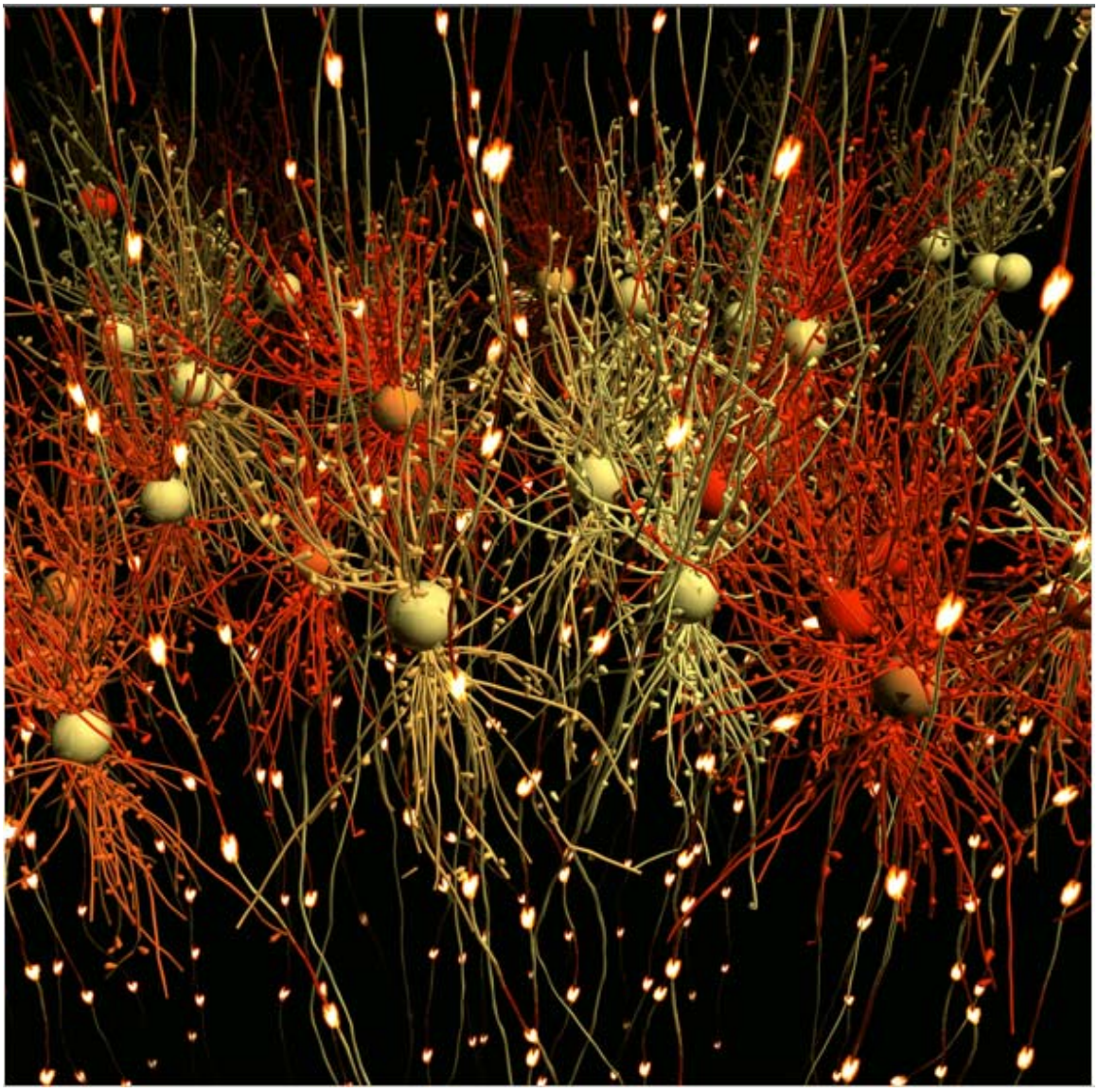
United States
National Science Foundation



# FY 2006

# PERFORMANCE AND ACCOUNTABILITY REPORT

**November 15, 2006**

## THE NSF STATUTORY MISSION

To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense; and for other purposes.

## THE NSF VISION

Enabling the Nation's future through discovery, learning and innovation.

NSF investments – in people, in their ideas, and in the tools they use – will catalyze the progress in science and engineering needed to establish world leadership and secure the Nation's security, prosperity, and well-being.

**About the cover:** Networks of neurons within the visual cortex of the brain. This still image is from animations developed by researchers at the Pittsburgh Supercomputing Center (PSC) for the planetarium show, "Gray Matters: The Brain Movie," at the Carnegie Science Center in Pittsburgh. Informal science education projects like planetarium shows expose science and engineering to countless numbers of all ages. "Gray Matters" was a collaboration among the Studio for Creative Inquiry at Carnegie Mellon University, the Center for the Neural Basis of Cognition and PSC. This work was supported in part by the National Science Foundation (NSF), who is a principal supporter of PSC. NSF supports a range of activities that expand our understanding of brain functions and foster connections between physical, computational, cognitive, and biological sciences and engineering. *Image courtesy of Greg Hood, John Burkhardt, and Greg Foss, PSC. For more information visit: www.nsf.gov/news/mmg/mmg_disp.cfm?med_id=51839&from=search_list.*

# NATIONAL SCIENCE FOUNDATION

## FY 2006 Performance and Accountability Report

www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0701

## III. Financials



## IV. Appendixes



*For more information about the National Science Foundation, visit NSF's website at www.nsf.gov.*

*For copies of this report please send your request to Accountability@nsf.gov.*

*We welcome suggestions on how to make this report more informative. Please provide your comments to John Lynskey, Deputy Director, Division of Financial Management, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230 (jlynskey@nsf.gov).*

# A MESSAGE FROM THE DIRECTOR

I am pleased to share with you the *Performance and Accountability Report (PAR)* of the U.S. National Science Foundation (NSF) for Fiscal Year (FY) 2006. This report presents the agency's financial condition and significant management and programmatic achievements of the past year. It meets the requirements of the Government Performance and Results Act and other management legislation, and most importantly, demonstrates NSF's commitment to be accountable for results measured against the goals established in our strategic plan. The financial and performance data we present are complete and reliable and conform to the Office of Management and Budget (OMB) guidance.

NSF is the federal government's only agency dedicated to the support of fundamental research across all fields of science and engineering and science and engineering education at all levels. For more than 50 years, NSF has been at the forefront of discovery—nearly 200 Nobel Prize winners and thousands of other distinguished scientists and engineers have conducted their groundbreaking research with funding from NSF. NSF's work has a profound and far-reaching impact—from protecting the environment, improving human health, growing our standard of living, and sustaining the nation's competitiveness in a global economy to supporting our nation's ability to secure the homeland. Moreover, NSF's investments are critical to producing the future generation of world-class scientists and engineers who will develop the ideas and research tools that will address the challenges of today and the future.

In FY 2006, NSF received over 42,000 proposals and made 10,450 new awards to 1,700 colleges, universities and other research enterprises throughout the country. The discoveries resulting from NSF investments are both exciting and transformative. Included in this report are research results reported by NSF grantees in FY 2006, from all fields of science and engineering research and education and from individual researchers to multinational collaborations at major facilities that involve researchers from several disciplines. NSF's establishment of a foreign office in Beijing, China, last spring will enable more effective participation in the international arena and education initiatives that will help build greater capacity for productive multinational collaboration.

In FY 2006, NSF-supported researchers conducting on-site studies across the southeastern United States were able to determine how and why numerous levees failed, thus providing information to enable engineers to improve their plans for repairs. NSF-supported researchers at New York University's Courant Institute of Mathematical Sciences developed a new algorithm that makes it much easier to detect certain cancer genes. These are only two examples of the many discoveries reported by NSF-supported researchers last year that have important implications for years to come. This report includes many other research highlights reported in FY 2006 by NSF-supported researchers; additional discoveries can be found on NSF's website at www.nsf.gov/discoveries.

Underlying NSF's programmatic achievements is our commitment to results-oriented management practices and sound financial management. Some achievements of note include the following:

- NSF received its ninth consecutive unqualified "clean" opinion from an independent audit of our financial statements, with no material weaknesses reported. NSF is in substantial compliance with the requirements of the Federal Managers' Financial Integrity Act of 1982, although we are reporting a qualified management assurance over internal control due to the scope limitation of the internal review over financial reporting.

- NSF is among a handful of agencies that have maintained "Green" successful ratings in four or more of the President's Management Agenda initiatives.

- All NSF programs evaluated to date by OMB's Program Assessment Rating Tool (PART) are among the 15 percent government-wide that have received the highest "Effective" rating.

- NSF made headlines by winning a Webby Award in a competition that Time Magazine calls the "online Oscars." Our website was named the "People's Choice" among the best government websites. NSF's *FY 2005 Performance Highlights* report received a League of American Communications Professionals (LACP) Honors Award at the 2005 Vision Awards. NSF also had the distinction of being the only federal government agency to be recognized for five years of distinction in its annual reports. These awards speak to NSF's continuing commitment to be informative and accountable to our stakeholders, customers, and the public with respect to our pursuit of scientific excellence and sound stewardship of the public's resources.

I hope you enjoy reviewing this report, and I also invite to you visit NSF's website to learn more about our achievements of the past year and about the exciting discoveries that are emerging every day.

Arden L. Bement, Jr.
Director

November 14, 2006

# MANAGEMENT'S DISCUSSION AND ANALYSIS

## AGENCY PROFILE

### Mission and Vision

The National Science Foundation (NSF) is the steward of the nation's science and engineering enterprise. As an independent agency created by Congress in 1950, its mission is to promote and advance scientific progress in the United States by supporting all fields of fundamental science and engineering. Unlike other research agencies that focus on specific missions such as defense or health, NSF is the only federal agency responsible for the overall health of science and engineering across all disciplines. Its unique vision is articulated in the fiscal year (FY) 2003–2008 Strategic Plan, which guided FY 2006 activities, and in the FY 2006–2011 Strategic Plan, which was delivered to Congress on September 29, 2006, and will guide the agency in the future:[1] "Enabling the Nation's Future Through Discovery, Learning and Innovation: NSF investments—in people, in their ideas, and in the tools they use—will catalyze the strong progress in science and engineering needed to establish world leadership and secure the nation's security, prosperity, and well-being."

### The Public Benefits of a Strong Science and Technology Enterprise

U.S. investments in science and technology have long driven economic growth and improved the quality of life for successive generations. Science and technology have generated new knowledge and industries, created new jobs, provided new sources of energy, developed new modes of communication and transportation, and improved medical care. This process of scientific discovery and innovation has been critical to increasing the nation's productivity and sustaining economic growth. Today, more nations follow our lead in investing in science and technology, so the United States, in keeping with the President's American Competitiveness Initiative, must maintain its leadership in scientific discovery and new technologies in order to remain globally competitive.

NSF plays a critical role in fostering research of the highest quality—research that will generate important discoveries and new technology. As the FY 2006 research highlights on the following page and throughout this report clearly demonstrate, this work has a positive impact on the nation. For example, NSF supported research efforts in the physical sciences, social and economic sciences and engineering research related to the catastrophic flooding in the southeastern United States, including one study that determined how and why numerous levees failed. The results will allow engineers to improve their plans for repairs. Also, NSF-supported researchers devised an ultra-tiny electrical valve (or diode) that is composed of only a single molecule and is a thousand times smaller than current valves. This research could lead to a whole new era of miniaturization in electronic components.

Despite its small size, NSF has had an extraordinary impact on the nation's scientific knowledge and capacity. NSF has funded the groundbreaking research of 174 Nobel Prize winners and thousands of other distinguished scientists and engineers.[2] The remarkable progress in science and engineering that has defined the United States since World War II reflects the strength of our basic research enterprise. Moreover, not since World War II have advances at the frontiers of knowledge been more critical for national security. Advanced capability in materials science research, sensors and sensor network

[1] NSF's current Strategic Plan, *Investing in America's Future: Strategic Plan FY 2006–2010*, is available at www.nsf.gov/pubs/2006/nsf0648/NSF-06-48.pdf. The FY 2003–2008 Strategic Plan is available at www.nsf.gov/pubs/2004/nsf04201/FY2003-2008.pdf.

[2] See www.nsf.gov/news/news_summ.jsp?cntn_id=108098&org=NSF&from=news for a list of the Nobel laureates who have received NSF support.

architecture, genomics, cyber-security, and data mining, as well as knowledge of human and social dynamics, have a direct impact on present and future homeland security systems and capacity.

## FY 2006 Research Highlights

The following are some results reported by NSF-supported researchers in FY 2006:

- Conducted extensive on-site research in and around New Orleans following Hurricane Katrina, and published an analysis explaining how and why numerous levees failed, allowing engineers to improve plans for repairs
- Observed the astronomical results of a two-galaxy smashup and announced the first "direct detection" of the mysterious, invisible "dark matter" that is a major component of the universe but neither emits nor reflects light
- Provided novel telecommunications and computerized early-warning systems that gave critical information to separate teams fighting a dangerous outbreak of wildfires in California
- Issued advance warning of the increased risk of a potentially lethal microbe called Hantavirus that has plagued the Four Corners area of the southwest United States
- Launched a major, multiyear program to record and study dozens of dying languages – those spoken by only a few people and doomed to disappear completely soon – so that knowledge will not be lost to humanity
- Compiled a forecast indicating that the next 11-year sunspot cycle, with its associated "solar storms" that can damage key communications satellites and cause widespread blackouts in power grids, will be at least 30 percent stronger than the last
- Showed that there is a direct link between the number of species in an ecosystem and its ability to survive environmental and other threats
- Uncovered a new method of detecting and identifying cancer genes by mathematically analyzing the output of "gene chips," and tested the method successfully in lung cancer cases
- Undertook a wholesale reevaluation of high-school advanced placement courses in math and science, which are now in drastic need of updating to give students the information and insight they will need in college
- Discovered and characterized a "super glue" produced by bacteria that is completely waterproof and three to five times stronger than any commercial adhesive available – capable of withstanding a pull of five tons per square inch
- Unearthed a remarkable fossil – unlike anything else ever discovered in the region – that is the oldest example of a creature that inhabited the evolutionary gap between fish and land animals
- Devised an ultra-tiny electrical valve (or diode) that is made of only a single molecule – a thousand times smaller than its current counterparts – thus raising the possibility of an entirely new era of miniaturization in electronic components
- Determined that infants less than one year old have an innate sense of numbers, which they are able to employ many months before they are even able to talk – much less do arithmetic.
- Produced the first computer simulation of the workings of every atom in a virus, the first time any complete life form has been mapped in its entirety
- Sent a new, high-altitude research plane, built to fly miles above commercial jets, on its first successful science missions to examine the contents and activity of atmosphere at new heights
- Constructed a new generation of two-legged robots that can walk like human being

For more information on the research results described here, see www.nsf.gov/discoveries/.

## NSF Leadership in U.S. Academic Basic Research

*Figure 1* Federal Support for Research and Development

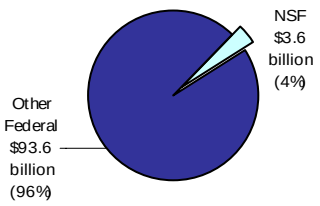
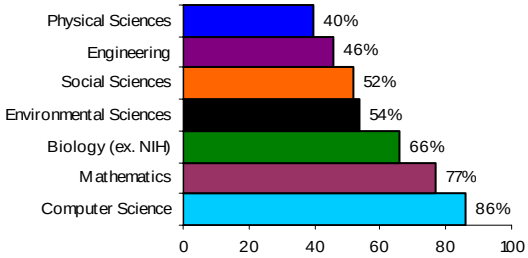



*Figure 2.* NSF Support as a Percent of Total Federal Support of Academic Basic Research in Selected Fields

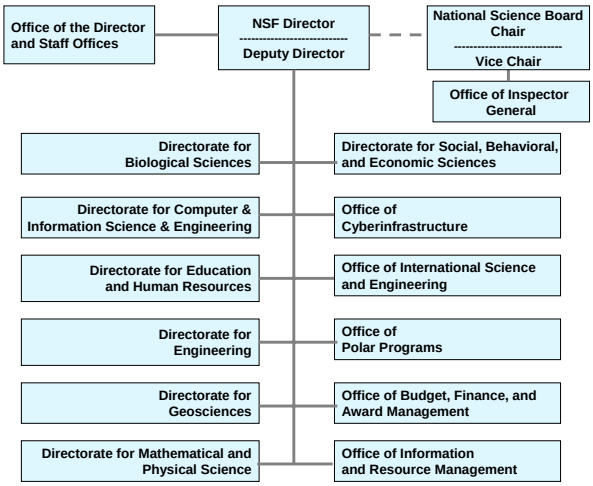



The support of academic research is critical to sustaining future generations of world-class scientists and engineers who will develop the ideas and research tools needed to address the challenges we face now and in the future. Although NSF represents only 4 percent of the total federal research and development (R&D) budget, it is the second largest funding source for R&D at colleges and universities. In fact, NSF is the primary source of federal academic support for basic research in many fields, including computer science, environmental sciences, mathematics, social sciences, and nonmedical biology (see Figures 1 and 2).[3] Although NSF does not directly fund medical research, its support benefits medical science and related industries, leading to advances in diagnosis, regenerative medicine, drug delivery, and pharmaceutical design and processing. NSF-supported fundamental research in physics, mathematics, and high-flux magnets led to the development of magnetic resonance imaging, which is widely used in medicine today.

## Organizational Structure

NSF is funded primarily by congressional appropriations and is headed by a Director who is appointed by the President and confirmed by the Senate. NSF has seven directorates and three program offices organized by disciplinary area and programmatic activity, in addition to two management offices that are responsible for business and operations (see Figure 3). A description of each directorate and office can be found in Appendix 1. A 24-member National Science Board (NSB), also appointed by the President with the consent of the Senate, meets about six times a year to establish overall policy. NSB serves the President and Congress by acting as an independent advisory body on policies related to the U.S. science and engineering enterprise.

*Figure 3.*
National Science Foundation Organization



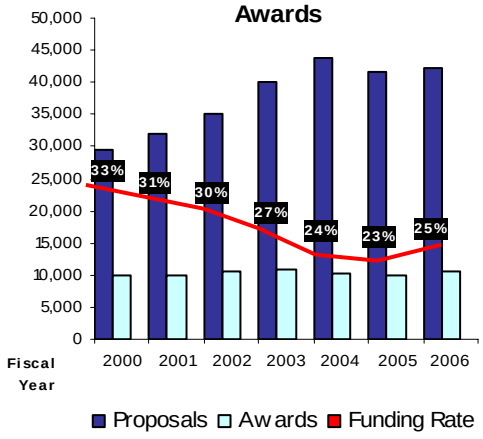

[3] Source for Figures 1 and 2: NSF/SRS/R&D Statistics Program, *Survey of Federal Funds for Research and Development: FY 2002–2004.*

The NSF workforce includes about 1,400 full-time staff; roughly 85 percent are permanent employees and the rest are "rotators." To complement the permanent workforce, NSF regularly recruits visiting scientists, engineers, and educators who are leaders in their fields. These rotators usually spend one to three years with the agency. Recruiting active researchers and educators to fill rotating assignments infuses new talent and expertise into NSF and is integral to the mission of supporting the entire spectrum of science and engineering research and education and advancing the frontiers of discovery and learning.[4] NSF currently has about 180 rotators, as well as contractors engaged in commercial administrative activities.

## How NSF Works

NSF directly supports scientists, engineers, and educators through their home institutions (usually colleges and universities). With the exception of polar operations, NSF does not maintain its own facilities or laboratories. In FY 2006, NSF received 42,377 proposals, a 1.6 percent increase over the previous year. A total of 10,450 new awards were funded to more than 1,700 colleges, universities, and other public institutions throughout the country (see Figure 4). Nearly 90 percent of NSF funding was allocated through a merit-based competitive process that is recognized throughout the government as the gold standard for the responsible use of public funds.[5] Each year, 42,000 members of the science and engineering community serve as panelists and proposal reviewers under the merit review process.

***Figure 4.***
**Number of NSF Proposals and Awards**




In FY 2006, NSF awards directly involved an estimated 170,000 people, including senior researchers, postdoctoral associates, teachers, and students from kindergarten through graduate school. NSF's investment portfolio is a rich mix of programs and partnerships that reach broad and diverse segments of the science and engineering research and education community, as well as the general public. The following are examples of projects funded by NSF in FY 2006; to see others, visit the NSF website at www.nsf.gov.

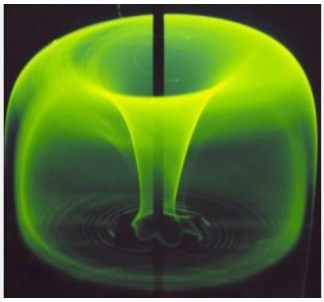
▶ Sequencing the maize (corn) genome has been considered a daunting task because of its size and complexity. With two smaller plant genomes—rice and the model laboratory plant *Arabidopsis*—now complete, a team of university and private research scientists is analyzing the 2.5 billion bases of the maize genetic code. This team has been awarded a total of $32 million from NSF, the Department of Agriculture, and the Department of Energy (DOE) to sequence the maize genome. The award is another step in using genomics to transform the plant sciences and help researchers increase yields, reduce inputs, and develop more disease-resistant varieties, as well as improve the growth and development of other related grass crops such as wheat and barley. This project will provide an essential

[4] Temporary appointments are made under the Intergovernmental Personnel Act (IPA), funded through program accounts, or under the Visiting Scientists, Engineers, and Educators (VSEE) Program, funded through administrative accounts. Appointments are counted as federal full-time-equivalent staff. In October 2006, NSF staff included 135 IPAs and 42 VSEEs.

[5] For additional information about NSF's merit review process, see *Report to the National Science Board on NSF's Merit Review Process, FY 2005*, at www.nsf.gov/publications/pub_summ.jsp?ods_key=nsb0621.

overview of the structure and function of genes that define the corn plant, which ranks among the world's major grain crops and dominates U.S. agriculture. Corn is not only grown for food and feed, but it is also the source of a variety of processed foods: Literally thousands of products in the typical supermarket contain corn. In addition, it is an important raw material for many industrial products including rubber, plastics, fuel, and clothing.

▶ NSF awarded $75.3 million for five new Engineering Research Centers (ERCs) that will develop cross-disciplinary programs to advance technologies to address major societal problems and provide the basis for new industries. Scientists and engineers from a variety of disciplines collaborate on broad-based high-risk engineering research, developing fundamental knowledge and test beds for emerging technologies. The ERCs also provide rich educational and research environments for preparing new generations of engineering leaders. The five centers will pursue breakthroughs in synthetic biology, fluid power, air monitoring, drug manufacturing, and technologies for older adults and people with disabilities. In the image at left, a fluorescent dye injected into a tank of stirred liquid creates a pattern that resembles a green apple. The demonstration, conducted by Rutgers researchers from the NSF Engineering Research Center for Structured Organic Composites, shows how liquids mix in a typical pharmaceutical manufacturing operation. This research will help enhance drug quality while reducing the cost of developing and manufacturing new drugs. *(Image courtesy of M. M. Alvarez, T. Shinbrot, and F. J. Muzzio, Rutgers University, Engineering Research Center for Structured Organic Composites)*



▶ NSF awarded nearly $12 million to the California Institute of Technology (Caltech) for the development of software to analyze neutron-scattering experiments. Neutron scattering looks at the position and motion of the atoms that make up materials, molecules, and condensed matter at various temperatures and pressures to analyze their stability. This work could affect the design of new materials for a huge variety of applications in transportation, construction, electronics, and space exploration. According to project leader Brent Fultz, Professor of Material Science and Applied Physics at Caltech, the research will eventually show how new materials can be optimized for mechanical strength, electrical conductivity, energy storage, and resistance to corrosion. Using data from facilities such as DOE's new Spallation Neutron Source (SNS) in Oak Ridge, Tennessee, this project will integrate new materials theory with high-performance computing. The image at right shows Rick Martineau of Los Alamos National Laboratory conducting a final inspection of an SNS component before it is shipped. *(Image courtesy of Leroy N. Sanchez, Los Alamos National Laboratory)*

▶ NSF awarded a $1.8 million grant to the College Board to redesign Advanced Placement (AP) courses in biology, chemistry, physics, and environmental science. Studies have shown that U.S. high school students continue to fall farther behind other nations in their ability to apply scientific concepts and skills, and the percentage of U.S. undergraduates earning degrees in science and engineering is far below that of other competitive nations. AP students are an important exception. Research indicates that U.S. students who take AP math and science courses have a higher level of proficiency than students from all other nations. AP students are also much more likely to major in science, technology, engineering, and mathematics (STEM) disciplines

than students who are first exposed to college-level math and science courses in college. Changes to the AP science program will reflect the latest research on how students learn. The redesign will emphasize depth of understanding so that students will be better equipped to navigate complex content and to transfer their knowledge during assessments. *(Image credit: AbelStock)*

## The President's Management Agenda

NSF's leadership and commitment to making government more effective are demonstrated by its ratings on the President's Management Agenda (PMA) scorecard (see Figure 5). In the fourth quarter of FY 2006, NSF was one of only five agencies to achieve "Green" status in four or more of the five primary initiatives. NSF also achieved "Green" status and progress ratings for the *Eliminating Improper Payments* initiative.[6]

***Figure 5.***
**President's Management Agenda Scorecard**

| | Baseline | Status | Progress |
|---|---|---|---|
| | Sept. 30, 2001 | Sept. 30, 2006 | |
| Strategic Management of Human Capital | R | G | G |
| Competitive Sourcing | R | R | R |
| Improving Financial Performance | G | G | G |
| Expanded E-Government | Y | G | G |
| Budget and Performance Integration | R | G | G |

Notes:

In FY 2006 Q4, NSF also received green status and progress ratings for the Eliminating Improper Payments initiative.

Green (G) indicates success; Yellow (Y), mixed results; and Red (R) unsatisfactory. Ratings are issued quarterly by OMB.

▶ NSF maintained its "Green" status in *Strategic Management of Human Capital* for the second consecutive year. Several key initiatives contributed to continued success in this area. The Administrative Function Study, which is addressing the changing nature of work in the program directorates, is in the early stages of implementation. Workforce and staff planning initiatives are helping to give leaders the tools they need to make better informed decisions on human capital, ultimately leading to a workforce that complements NSF's dynamic and unique staffing needs. In the Division of Human Resources Management (HRM), NSF is implementing a new integrated Service Team approach that focuses on partnering with program directorates to plan and anticipate human capital requirements. This approach will also emphasize coordination and communication within HRM and between HRM and NSF customers to improve responsiveness and reduce processing time. Further, a Learning Management System, called AcademyLearn, is being implemented to improve the coordination of training and development opportunities and to facilitate better connections between those opportunities and the needs of NSF organizations.

▶ NSF continues to be rated "Red" in *Competitive Sourcing.* In FY 2006, NSF completed its first public-private competition to strengthen technical and administrative support services within the Office of Budget, Finance, and Award Management. The competition was specifically tailored to address a concern identified in the *FY 2004 Financial Statement Audit Report*, which called for resources dedicated to improving post-award monitoring of grant, contract, and cooperative agreement activities. NSF continues to work with the Office of Management and Budget (OMB) to consider other potential opportunities for competitive sourcing.

[6] For more information on PMA and NSF's scorecard, see www.ExpectMore.gov, www.whitehouse.gov/results, and www.whitehouse.gov/results/agenda/scorecard.html.

▶ NSF has maintained its "Green" rating in *Improving Financial Performance* since 2001, when it was the only agency to receive a baseline "Green" rating. In FY 2006, NSF maintained consistently high scores on the Chief Financial Officers (CFO) Council Metric Tracking Scorecard and consistently earned "Green" ratings for the accuracy and timeliness of financial reporting on the Treasury Department's Financial Management Scorecard. In addition, NSF transformed its Cost and Performance Integration Work Plan into a "Next Steps Budget and Performance Integration (BPI) and Financial Performance Combined Work Plan." The centerpiece of this plan is the integration of the standards for BPI and Financial Performance, since these standards focus directly on information for agency reporting and decision making.

To improve the management and monitoring of travel funds, NSF implemented a new Guest Travel System that improves funds control, automates important reporting processes, and provides real-time information in specific areas. NSF also completed the initial development of a facilities tracking system that provides management and staff with improved real-time financial reporting capability, capturing specific facility data throughout the agency by life-cycle phase. This information will ultimately link directly to the related budget process.

NSF senior managers continue to meet at least quarterly to review integrated financial and performance information that covers all major areas of responsibility. The Enterprise Information System (EIS), the Financial Accounting System (FAS), and Report.web make financial, budgetary, awards, and performance data (including the Program Assessment Rating Tool, or PART) widely accessible in various formats to all NSF employees. Managers use this information to make decisions relating to budget priorities and business processes.

▶ NSF has successfully maintained its "Green" rating in *Expanded e-Government (e-Gov)* for five consecutive years. NSF is a federal leader in the use of information technology, actively promoting simpler, faster, more accurate, and less expensive electronic business solutions. Virtually all of NSF's business interactions with the external grantee community have been conducted electronically since 2000. The agency is actively engaged in supporting numerous e-Gov initiatives. NSF is a Grants.gov partner agency, co-chaired the Grants Management Line of Business (GMLoB) task force, and currently co-leads the GMLoB, which is using a consortium-based approach to develop service centers around functional and grant-type competencies. In FY 2006, OMB selected NSF as one of three initial consortia leaders. In FY 2006, NSF posted 100 percent of funding opportunities on Grants.gov Find and 75 percent of discretionary grant application packages on Grants.gov Apply. FastLane, NSF's flagship application, is an interactive real-time system that is used to conduct business with the grantee community over the Internet and interfaces with Grants.gov. Enhancements to the Electronic Jacket System (e-Jacket), a web-based application designed to process proposals electronically, provide more customer-friendly capabilities, enhanced accessibility, and a streamlined workflow, thereby resulting in significant efficiency and productivity savings.

Security of information technology (IT) systems remains a management priority of the highest importance. NSF has continued to make enhancements to an already strong security program by incorporating new guidance and best practices into its IT environment. All major NSF systems have current certification and accreditation. The IT environment is aggressively monitored, and an automated enterprise vulnerability management tool has been implemented to streamline compliance with security policies and reduce risk. Annual security awareness training is mandated and tracked for all users of NSF IT resources, and training is updated to reflect new privacy and security risks. The FY 2006 Federal Information Security Management process recognized NSF's established information security program and the proactive review of security controls and areas to improve. NSF uses a plan of action and milestones to monitor the implementation of enhancements to further strengthen the IT security program.

Recognizing that there are always risks, NSF continues to monitor and enhance its security program and integrates security into all of its business practices.

▶ NSF maintained its "Green" status for *Budget and Performance Integration.* This year's efforts have emphasized improvements to tracking the costs of large facility projects, upgrades to the EIS, and direct links between budget line items and the FAS. A major activity under this initiative is evaluating programs using PART. NSF is the only agency that has received the highest rating of "Effective" in all of its PART program evaluations from OMB. Of the nearly 800 federal programs that have been evaluated by PART, only 15 percent have been rated as effective. NSF's successful PART results reflect a diligent staff and a competitive awards process that helps ensure relevance, quality, and performance, which are key components of the Administration's R&D Criteria.

## Meeting Future Opportunities and Challenges

NSF is well positioned to maximize the opportunities and face the challenges of the future. The President's American Competitiveness Initiative (ACI) outlines a 10-year doubling of investments in NSF and other agencies that are the principal supporters of the physical sciences and engineering. To fulfill its ACI obligations, NSF will direct its funding toward generating fundamental discoveries that produce valuable and marketable technologies, providing world-class facilities and infrastructure that will transform research and enable discovery, and helping the nation's STEM workforce prepare for the 21st century while improving the quality of math and science education in U.S. schools. With a new strategic plan in place beginning in FY 2007, NSF will direct its efforts toward two new crosscutting objectives: "To Inspire and Transform" and "To Grow and Develop."

As it pursues these activities, NSF will seek partners and nurture cooperation among government, industry, and academia. With discoveries emerging in many countries, it is essential that U.S. scientists and engineers have the opportunity to interact with other top researchers, to lead major international collaborations, and to have access to the best research facilities throughout the world. With offices in Paris, Tokyo, and Beijing (the Beijing office was established earlier this year), NSF can more effectively participate in the international arena and facilitate education initiatives that will help build greater capacity for multinational collaboration. As the lead federal agency for the National Nanotechnology Initiative, NSF will continue to provide critical support for efforts in fundamental nanoscale science and engineering. As the lead federal agency for the International Polar Year project that runs from March 2007 to March 2009, NSF will head an interagency, international effort to understand the Earth's extreme latitudes at scales from the global to the molecular. Of highest priority is the support of frontier research that meets pressing national needs in security, energy, the environment, and health.

The successful achievement of NSF's strategic outcome goals in FY 2006 and in past years reflects a continuing commitment to excellent, results-oriented management and stewardship. The PMA scorecard and PART results, which are among the best in government, clearly demonstrate this commitment. NSF has an established record of success in leveraging its agile, motivated workforce, management processes, and technological resources to enhance productivity and effectiveness. The agency is also recognized within government for its financial management and electronic business acumen. Historically, about 95 percent of NSF's budget supports the conduct of research and education, with administrative overhead accounting for only about 5 percent.

The ongoing quest for organizational excellence will direct management's focus to a number of opportunities and challenges. The rise in multidisciplinary collaborative projects, international activities, and major research facility projects has increased the complexity of the workload, and although NSF's budget has increased 70 percent over the past 10 years, staffing has increased less than 10 percent. In

addition, meeting new external administrative, oversight, and accountability requirements is an additional burden on limited staffing and funding resources. This year's establishment of a new internal control process to meet OMB's revised A–123 guidance was a major undertaking that will continue for the next 2 years as NSF works toward achieving an unqualified management assurance. In addition to being one of the initial three consortia leaders in the GMLoB, NSF will remain actively engaged in supporting numerous other e-Gov activities, including e-Human Resources, the Integrated Acquisition Environment, e-Authentication, and the Lines of Business initiatives.

In FY 2002, NSF embarked on a Business Analysis study to address the fundamental challenges it faces as it becomes a fully integrated organization with increased capabilities for working both inside and across traditional disciplinary and organizational boundaries. The study was concluded in FY 2006. It identified desired outcomes that are influencing current operational strategies and supported several PMA initiatives. Specifically, it supported the update to NSF's 2003–2008 Strategic Plan; continued the implementation of a number of improvements in the Merit Review and Award Management and Oversight processes; completed the study phase of the Administrative Function Study and moved into the implementation phase; and continued designing the Target Enterprise Architecture, which, when implemented, will allow NSF to better monitor its IT investments and overall project and risk management. The Business Analysis team has prepared final reports that NSF can use to further implement study findings.

# MEASURING PERFORMANCE [7]

NSF's leadership in advancing the frontiers of science and engineering research and education is demonstrated, in part, through internal and external performance assessments. The results of our performance assessment process provide our stakeholders and the American taxpayer with vital information about the return on our investments. In FY 2006, performance assessment at NSF was guided by the Government Performance and Results Act of 1993 (GPRA),[8] OMB's Performance Assessment Rating Tool (PART),[9] and NSF's FY 2003–2008 Strategic Plan.[10]

## Assessing Long-Term Research

GPRA requires federal agencies to develop a strategic plan, establish annual performance goals, and report annually on the progress made toward achieving these goals. GPRA and PART pose a special challenge to agencies like NSF, which are involved in long-term science and education research. It is often not possible to link outcomes to annual investments because results in basic research and education can be unpredictable. Science and engineering research projects can generate discoveries in an unrelated area, and it can take years to recognize discoveries and their impact. Assessing the impact of advances in science and engineering is inherently retrospective and is best performed using the qualitative judgment of experts. The use of external experts to review results and outcomes is a common, longstanding practice in the academic research and education community. NSF's use of such panels, such as the Committees of Visitors (COVs) and Advisory Committees (ACs), pre-dates GPRA and has been recognized as a valid quality assessment by GAO and others.

NSF has used COVs and ACs for more than 20 years. These experts conduct independent assessments of the quality and integrity of our programs. On broader issues, NSF often uses external third parties such as the National Academies for outside review. We also convene external panels of experts for special studies. A schedule of NSF's program evaluations can be found in Appendix 4a and a list of the external evaluations completed in FY 2006 can be found in Appendix 4b.

OMB's approval of an alternative format for NSF performance assessment allowed us to develop a multilayer assessment approach, integrating quantitative metrics and qualitative reviews. The Advisory Committee for GPRA Performance Assessment (AC/GPA), composed of experts in various disciplines and fields of science, engineering, mathematics, and education, provides advice and recommendations to the NSF Director regarding NSF's performance under GPRA. As the reporting and determination of results for performance goals are inherently governmental functions, NSF makes the final determination on achievement using AC/GPA findings as one critical input.

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[7] This discussion presents highlights of NSF's FY 2006 GPRA performance goals, results, and pertinent issues. For a detailed discussion of each of NSF's FY 2006 GPRA performance goals and PART measures, see Chapter II.

[8] For more information about GPRA, visit www.whitehouse.gov/omb/mgmt-gpra/gplaw2m.html.

[9] For more information about PART, visit www.ExpectMore.gov.

[10] NSF's FY 2003–2008 Strategic Plan is available at www.nsf.gov/pubs/2004/nsf04201/FY2003-2008.pdf. NSF's current strategic plan, *Investing in America's Future: Strategic Plan FY 2006-2011*, is available at www.nsf.gov/pubs/2006/nsf0648/NSF-06-48.pdf.

This year, the AC/GPA met on June 22 and 23, 2006, to review a collection of over 900 outstanding accomplishments—or "highlights"—compiled by NSF program officers. In prior years, the AC/GPA, which includes experts in statistics and performance assessment, has had thorough discussions about the sampling technique used for compiling the highlights. The approach is a type of nonprobabilistic sampling, commonly referred to as "judgmental" or "purposeful" sampling, designed to identify notable examples and outcomes resulting from NSF's investments.

The aggregate of notable examples and outcomes collected can, by itself, demonstrate significant agency-wide achievement in the strategic outcome goals. It is possible, although unlikely, that the AC could incorrectly conclude that NSF failed to show significant achievement due to the limited set of highlights when, in fact, we actually achieved our goals. That is, the committee could conclude that NSF did not show sufficient achievement based on over 900 distinct accomplishments while, if time permitted, reviewing hundreds or thousands more would add enough data to show sufficient total results. The inverse, however, could not occur. If a subset of highlights were sufficient to show significant achievement, adding more results would not change that outcome. Therefore, the limitation imposed by using a "judgmental" sample is that there is a possibility, though small, that significant achievement *would not* be sufficiently demonstrated while a larger sample would show otherwise.

In addition, the AC/GPA had access to all award abstracts, investigator project reports, and three years of COV reports (COV reports are prepared every three years), to give a full picture of the NSF portfolio. Moreover, the process of assessment by NSF's external advisory committee is itself assessed by an independent, external management consulting firm. A more detailed discussion of the validation and verification of GPRA and PART data appear later in this chapter and in Chapter II.

## FY 2006 GPRA Goals and Results

NSF's FY 2003–2008 Strategic Plan outlines four overarching strategic outcome goals—*Ideas, Tools, People,* and *Organizational Excellence. Ideas, Tools,* and *People* are program-oriented goals focused on the long-term results of NSF's investments in science and engineering research and education. The *Organizational Excellence* goal is focused on administrative and management activities. In FY 2006, for the fifth consecutive year, NSF achieved all four strategic outcome goals. NSF also tracks 22 other annual performance goals that include performance measures from the PART evaluations and goals related to the effectiveness and efficiency of the agency's operations. In FY 2006, NSF achieved 15 of 22 (68 percent) annual performance goals. In the past five years, achievement of the annual performance goals has ranged from 63 percent in FY 2003 to 88 percent in FY 2004. Overall, NSF achieved 73 percent of its FY 2006 GPRA performance goals, down from the 86 percent achievement rate in FY 2005.

One of the most significant issues that has been raised in customer satisfaction surveys conducted by NSF is the amount of time it takes to process proposals. NSF's time-to-decision (dwell time) performance goal—to inform at least 70 percent of applicants about funding decisions within six months of receipt of a proposal—focuses on the efficiency of the agency's operations. In FY 2006, all six time-to-decision goals were met, including the agency-wide goal. In light of the increasing complexity and number of proposals received by NSF and the relative constancy of the number of staff handling the review of these proposals, this goal is an ambitious one for the agency, as it is increasingly difficult to maintain dwell time while performing quality merit review.

Among the annual performance goals achieved in FY 2006 were increasing the number of graduate students funded through NSF's three flagship graduate student programs and goals related to the Nanoscale Science and Engineering Program and to the Nanotechnology Network. Seven annual performance goals were not achieved in FY 2006: five addressed broadening participation in the science and engineering research community by underrepresented groups and by institutions from outside the top

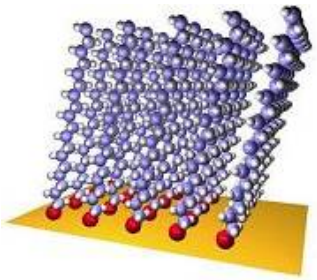
100 funded by NSF. The other two goals that were not achieved addressed the construction of large research facilities. For a more detailed discussion of each of NSF's FY 2006 GPRA performance goals, see Chapter II. Selected FY 2006 performance goals are presented in Figure 6 below.

***Figure 6.*** **Selected FY 2006 Performance Goals and Results**

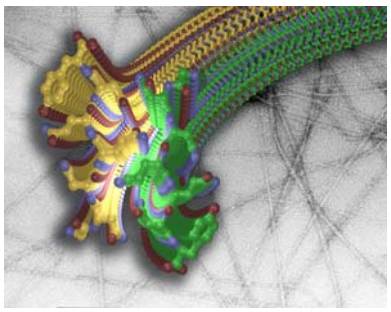
| Strategic Outcome Goals | Results |
|---|---|
| *IDEAS:* Advancing the frontiers of science and engineering ensures that America maintains its global leadership. Investments in Ideas build the intellectual capital and fundamental knowledge that drive technological innovation, spur economic growth, increase national security, and improve the quality of life for humankind around the globe. | ● FY 2002<br>● FY 2003<br>● FY 2004<br>● FY 2005<br>● FY 2006 |
| *TOOLS:* State-of-the-art tools and facilities are essential for researchers working at the frontier of science and engineering. Investments in Tools, including a wide range of instrumentation, multi-user facilities, distributed networks, and computational infrastructure, as well as the development of next-generation research and education tools, are critical for advancement at the frontier. | ● FY 2002<br>● FY 2003<br>● FY 2004<br>● FY 2005<br>● FY 2006 |
| *PEOPLE:* Leadership in today's knowledge economy requires world-class scientists and engineers and a workforce that is scientifically, technically, and mathematically strong. Investments in People aim to improve the quality and reach of science, engineering, and math education and enhance student achievement. | ● FY 2002<br>● FY 2003<br>● FY 2004<br>● FY 2005<br>● FY 2006 |
| *ORGANIZATIONAL EXCELLENCE:* NSF is committed to excellence and results-oriented management and stewardship. NSF strives to maintain an agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices. *(Note: This goal was established in FY 2004.)* | ● FY 2004<br>● FY 2005<br>● FY 2006 |
| **Annual Performance Goals** | **Results** |
| *TIME-TO-DECISION (Dwell Time):* Inform applicants about funding decisions within six months of receipt for 70 percent of proposals. One of the most significant issues raised in customer satisfaction surveys is the amount of time it takes NSF to process proposals. Considering the complexity and volume of proposals received by NSF and the relative constancy of the number of staff to handle the review and recommendation of proposals, this is an ambitious goal for NSF as a whole, as it is increasingly difficult to maintain dwell time while performing quality merit review. This measure is a proxy for efficiency. | ● FY 2002<br>● FY 2003<br>● FY 2004<br>● FY 2005<br>● FY 2006 |
| *GRADUATE FELLOWSHIPS—BROADENING PARTICIPATION:* Increase the number of applicants for the Graduate Research Fellowship Program from groups that are underrepresented in the science and engineering workforce. (*Note:* This goal was established in FY 2004.)<br>**Explanation of results**: Although the number of applicants from groups that are underrepresented in the science and engineering workforce did not increase from FY 2005 to FY 2006, the percentage of these applicants did increase. In FY 2005, NSF received 9,133 applications, of which 1,013, or 11.09 percent were from groups that are underrepresented in the science and engineering workforce. In FY 2006, the number of applicants was only 8,162, of which 929, or 11.38 percent, were from those groups. There was a surge of applicants following the increase of the stipend to $30,000 in FY 2004, which lowered the success rate. The FY 2006 data suggest a decline in the number of applicants that is consistent with the community's awareness of the reduced success rate for this program. These trends are mirrored in the underrepresented populations. NSF will continue to encourage proposals from these groups. | ● FY 2004<br>● FY 2005<br>■ FY 2006 |
| *KEY:* ● Goal was achieved. ■ Goal was not achieved. | |

## Recent Performance Highlights

The success and impact of NSF's programs in achieving important discoveries is illustrated in the following examples. Additional examples can be found in Chapter II and on NSF's website at www.nsf.gov/discoveries/.

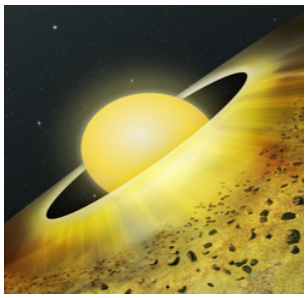


▶ **A Novel Approach to Storing Hydrogen:** Developing alternative fuels for transportation is key to achieving greater energy self-sufficiency in the United States. Hydrogen-fueled cars offer a potential option but there are major challenges in efficiently storing and distributing the fuel. Researchers at the University of Washington's Engineered Biomaterials Engineering Research Center have formed a start-up company that is tackling these issues. Asemblon, Inc., was initially created to produce and market a biomaterials-related invention that has applications in biotechnology, molecular electronics, and other areas. The firm discovered that this new type of material—composed of novel self-assembled monolayers—also has significant potential for hydrogen storage. It allows hydrogen to be chemically stored and released to generate energy when it is needed. Once hydrogen has been released, the material can be recycled and reused for hydrogen production. Asemblon has established a separate division aimed at optimizing hydrogen storage capacity and release, through its patented process, and ultimately marketing the products. The image above illustrates how self-assembling materials align to enable hydrogen storage. *(Image by Dan Graham, Asemblon, Inc.)*



The three-dimensional structure of an amyloid fibril protein has been determined. Amyloid fibrils are associated with diseases including Parkinson's and Alzheimer's. *Credit: Michael Sawaya, Rebecca Nelson, Melinda Balbirnie, and David Eisenberg, University of California, Los Angeles.*

▶ **Zipped Structure May Explain Protein Clumping in Brain Disorders:** After years of intense research, David Eisenberg and his team at the University of California, Los Angeles (UCLA), along with international colleagues, have discovered the three-dimensional structure of a miniscule—yet mighty—region of a protein that forms amyloid fibrils, deleterious rope-like structures in the brain. The researchers determined that a region of these fibril-forming proteins forms two sheets that "zip together." This coupling occurs along a self-guided track and squeezes out water molecules to form a dry, persistent structure that helps account for the tenacity of fibril buildups. This abnormally dry, zipped-up protein is completely insoluble. In people with Alzheimer's disease, for example, the buildup of fibrils in the brain is commonly referred to as plaque. Determining the molecular structure of fibrils, a feat that had eluded researchers for decades, will ultimately help medical researchers understand and devise treatments for the more than two dozen human diseases associated with fibrils, including Alzheimer's, Parkinson's, and Huntington's diseases, as well as so-called prion diseases like mad cow.

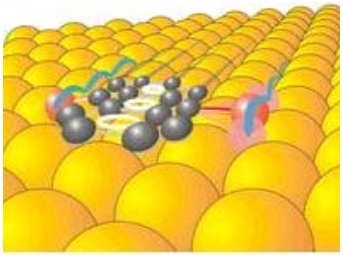


▶ **Astronomers See First Stages of Planet-Building around Nearby Star:** Future interstellar travelers might want to detour around the star system TW Hydrae to avoid a messy planetary construction site. Researchers at the Harvard-Smithsonian Center for Astrophysics have discovered that the gaseous disk surrounding TW Hydrae holds vast swaths of pebbles extending outward for at least one billion miles. These rocky chunks should continue to grow in size as they collide, combine, and eventually coalesce to form planets. The

researchers used NSF's Very Large Array to measure radio emissions from TW Hydrae. They detected radiation from a cold, extended dust disk suffused with centimeter-sized pebbles, something no one had seen before. Such pebbles, created as dust collects into larger and larger clumps, are a prerequisite for planet formation, a process that takes millions of years. The image above is an artist's conception of a dusty disk around the young star TW Hydrae. *(Image courtesy of Bill Saxton, NRAO/AUI/NSF.)*

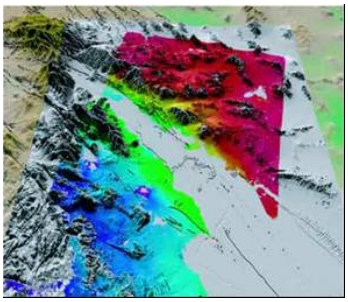
U.S. symposium participants. *Credit: Beverly Hartline.*

▶ **International Physics Young Ambassador Symposium:** More than 100 "physics young ambassadors" between the ages of 10 and 16 from 21 countries on five continents, winners of the International Physics Talent Search, met in Taipei, Taiwan, to share the physics experience. The International Physics Talent Search was part of the World Year of Physics 2005 (WYP2005), proclaimed to celebrate the centennial year of three of Einstein's major discoveries. Ending on New Year's Day 2006, the symposium was the final event of WYP2005. The Talent Search implemented its goal of promoting physics awareness by allowing girls and boys to earn points through physics—drawing posters to illustrate the laws of physics, discovering that household items can demonstrate physical principles, teaching classmates about physics, or performing laboratory experiments. At the symposium, the young ambassadors listened to and met with distinguished physicists, presented posters and talks on their work, and exchanged experiences with participants from other countries. The impact of the event on the participants was beyond measure, as attested to by the comments from parents who participated in the Symposium. Travel to Taipei for U.S. participants and for those from several less developed countries was supported by the Office of Multidisciplinary Activities and the Divisions of Physics and Materials Research in the Mathematical and Physical Sciences Directorate (which also supported the U.S. Physics Talent Search) and by the Office of International Science and Engineering.



Propelled by two sulfur (red) atoms as feet, DTA "walks" across the surface setting step in front of step and never veering off course. *Credit: Ludwig Bartelis, UC–Riverside.*

▶ **Walking Molecule Provides a Key to "Molecule Memory":** University of California Riverside professor Ludwig Bartels and his team have designed and simulated a molecule that can "walk" across a flat surface in a straight line. Indeed, 9,10-dithioanthracene (DTA), as the molecule is known, can walk for more than 10,000 steps on molecular appendages that act as feet. Such a DTA "nano-walker" could form the basis of a molecular memory 1,000 times more compact than current computer memory devices. That, in turn, could make it important to the nascent field of "molecular computing." The new concept of molecular propulsion may also have far reaching benefits for the development of surface nano-robots, with applications ranging from information storage to the control of surface chemical reactions. The molecule design and simulations were done using one of the TeraGrid's supercomputers located at the San Diego Supercomputing Center.

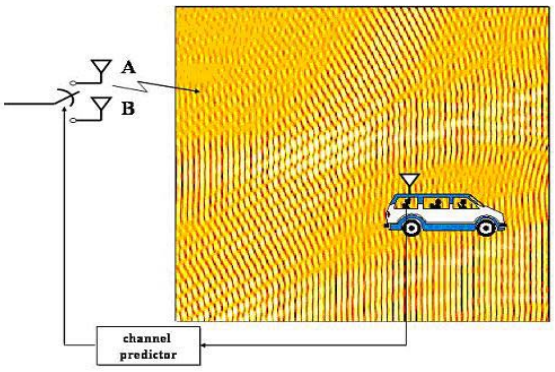


▶ **San Andreas Fault Set for the "Big One":** Yuri Fialko of the Scripps Institution of Oceanography at the University of California, San Diego, the recipient of a GEO CAREER award in 2004, has produced a new depiction of the earthquake potential of the San Andreas Fault's highly populated southern section. The new study indicates that the fault has been stressed to a level sufficient for an earthquake of magnitude 7 or greater and that the risk of a large earthquake in this region may be increasing faster than

researchers had believed. Fialko used remote sensing techniques like GPS and satellite radar data, geologic records, and seismic data to observe strain buildup along the southern part of the fault. He found evidence that the southern San Andreas has accumulated about six to eight meters of slip "deficit." If released at one time, this would result in a magnitude 8 earthquake, roughly the intensity of the 1906 San Francisco earthquake. Fialko also found that the two sides of the fault, the North American tectonic plate and the Pacific plate, exhibit different structural characteristics. The Pacific plate is more rigid than its neighbor. This research is important not only for long-term hazard planning in the densely populated region of Southern California, but also for providing new, precise analyses and methods to help earthquake scientists discover how faults operate. In the image above, surface deformation from radar interferograms across the Salton Sea shows movement of the San Andreas Fault. *(Image courtesy of Dr. Yuri Fialko.)*

▶ **U.S.-French Collaboration Sparks Multiple Successes:** International study programs can improve communications in more ways than one. Andy Klein is a case in point. As a graduate student at Cornell, an NSF grant enabled him to participate in a collaboration between Cornell University and two French institutions: the French National Institute for Telecommunications and Supélec. There Klein was immersed in cutting-edge research on some of the most difficult problems in wireless communications—extending range and reliability. In particular, he worked on ways to counteract the "multipath" distortion that results when electromagnetic waves reflect off different surfaces. That phenomenon is perhaps most familiar as the cause of "ghost" images on TV sets with antennas. Klein and colleagues published jointly submitted papers, and Klein soon earned his doctorate. The work will allow portable, personal communication devices to communicate successfully in a wider range of environments and permit longer battery life. The experience produced ideas that Klein used in his thesis. But it also created another kind of communication: "The nontechnical aspects of the collaboration were perhaps even more rewarding," Klein says, "since I was presented with a fresh perspective on how research can be conducted, from funding issues to topic selection. This alternate perspective gave me a reference point through which to better judge aspects of the American research system—a system for which I now have even more appreciation." In the photo above, Andy Klein works with Pierre Duhamel of Supélec in Paris. Andy has recently taken a postdoctoral position at Supélec. *(Photo courtesy of Andy Klein.)*

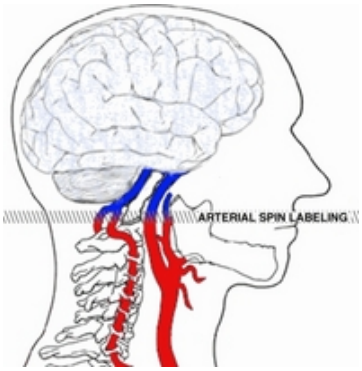
▶ **New Tools Improve Quality of Service for Wireless Customers:** Researchers have developed a suite of adaptive tools that can improve both the capacity and quality of wireless communication service. Channels change rapidly in mobile radio communications; most transmitters and receivers today are not optimized for the channel conditions they encounter from instant to instant. Accordingly, the devices fail to exploit the full potential of the wireless channel. The new adaptive tools predict information about a fading wireless channel—information that allows more efficient use of power and frequency. By collaborating with an industry partner, the researchers were able to validate the tools using realistic modeling and field measurements. In 2005, more than one billion consumers worldwide owned and used wireless




New wireless communication tools will improve the quality of service for consumers. *Credit: Alexandra Duel Hallen.*

telephones—the majority of them being in North America, Western Europe, and the Asia-Pacific region. The tremendous growth in demand for wireless communication capacity has created a need for new transmission and receiving methods to enhance quality of service for users.

**▶ A New Method for Measuring Effects of Stress on the Brain:**
John Detre and his colleagues at the University of Pennsylvania are developing and testing improved functional magnetic resonance imaging (fMRI) methods for visualizing human brain function. As in conventional fMRI studies, these methods estimate the amount of neural activity at any given point in the brain by measuring how fast the blood is flowing there—quantities that turn out to be closely linked. But unlike conventional studies, which measure the blood flow by indirect means, Detre and his coworkers are measuring blood flow directly with a technique called continuous arterial spin labeling (CASL). In effect, they magnetically "tag" the water molecules in blood on its way to the brain. As a demonstration, the researchers used CASL on individuals subjected to mental stress in the form of a demanding mental arithmetic task. They detected an increase in blood flow in the right prefrontal cortex, which is where such tasks are carried out. Moreover, they found that the change continued even after the task was completed, suggesting that the effects of a transient mental stressor are more persistent than commonly thought. Improvements in perfusion MRI for measuring changes in brain function could yield sensitivity superior to conventional fMRI methods for measuring prolonged cognitive or emotional states such as those imposed by mental stress.




The continuous arterial spin labeling (CASL) method is very similar to positron emission tomography (PET) scanning but does not require injections or radioactivity. To measure blood flow in the brain, the technique uses a functional magnetic imaging (fMRI) magnet to "tag" water molecules in the patient's blood, which then serve as a natural contrast agent. *Credit: University of Pennsylvania School of Medicine.*

**▶ The Importance of Fungi-Plant Symbiosis:** A new technique that was originally developed to understand Arctic mushrooms has begun to shed light on ecosystems around the world—and could be applied to improve farming practices. The research began with the well-known symbiosis between mushrooms and other soil fungi, and certain plants. When nitrogen is scarce, the fungi will transport the vital nutrient from the soil to the plant roots and receive plant sugars in return. The challenge for scientists is to measure this process. To meet this challenge, John E. Hobbie and Erik A. Hobbie, working at the NSF-funded Arctic Long Term Ecosystem Research site at Toolik Lake, Alaska, developed a new method based on the measurement of nitrogen isotopes. Using it, they found that between 61 and 86 percent of the nitrogen in the plants is provided by the fungi, and between 8 and 17 percent of the plants' photosynthetic carbon is provided to the fungi for growth and respiration. Because this kind of fungi-plant relationship is quite widespread in nature—and because nitrogen scarcity is quite common—this approach should help interpret ecological observations at many other research sites, and could even have application to agriculture. Shown in the photo above left are K–12 educator Tracy Alley and researchers working on a study plot at the Toolik Field Station LTER in Alaska, with the camp and the Brooks Range in the background. *(Photo courtesy of Tracy Alley.)*

▶ **Native American Students Work to Improve Community Environment:** Oglala Lakota College (OLC), on South Dakota's Pine Ridge Reservation, is using NSF funding to improve its curriculum in science, technology, engineering, and mathematics education, with an emphasis on environmental sciences and related analytical fields. The project's impact on the enrollment of American Indian students has been significant, particularly in information technology, where student enrollment has quadrupled in the past four years. The project has had a similar impact on academic achievement. In Calculus I, for example, the rate of successful completion has grown from 21 percent before the project started to approximately 70 percent in recent years. Currently, 14 American Indian students are involved in undergraduate research projects. The program's graduates, highly skilled scientists and technicians, work in their communities, contributing to the economic growth of the reservation. The college's Lakota Center for Science and Technology, developed through support from NSF's Tribal Colleges and Universities Program (TCUP) and other sources, received EPA certification and is now employing OLC graduates to perform water quality analyses for the reservation's water and sewer agencies. The TCUP project is also engaged in preparing the next generation of K–12 teachers for reservation schools, as well as working with current K–12 teachers to improve their knowledge and skills in areas such as robotics. The robotics project will be implemented in about six area schools this academic year. Shown in the photo on the upper left are students in the Oglala Lakota College robotics project. *(Photo Credit: Mike Fredenberg.)*

## PART Evaluations

In 2002, OMB developed the PART, a systematic method for assessing the performance of program activities across the federal government. Each year, about 20 percent of an agency's programs must undergo PART review. For the 2006 budget year, three NSF programs were assessed: Polar Tools, Facilities, and Logistics; Research Institutions; and Research Collaborations. For the 2007 budget year, two programs were assessed: Fundamental Science and Engineering and Federally Funded R&D Centers. All received the highest "Effective" rating. Of the nearly 800 programs that have been evaluated government-wide by PART, only 15 percent have been rated as effective. Moreover, all of NSF's priority areas and programs under the FY 2003–FY 2008 Strategic Plan that have undergone PART evaluation have been rated as effective. These outstanding results reflect the fact that NSF's competitive awards process helps ensure quality, relevance, and performance, which are key components of the Administration's R&D Criteria.

The improvement plans for NSF's FY 2006 PART evaluations include ensuring increased timeliness of yearly project reports from investigators and assessing potential improvements to the merit review process. In the past year, NSF has made changes to its FastLane project reports tracking system to provide notification to all investigators that annual reports are due 90 days in advance of the 12-month anniversary date or expiration date of the award. NSF has also convened focus groups and gathered recommendations on improvements to the merit review system.[11]

[11] For more information about NSF's PART programs and related improvement plans, see Chapter II and www.whitehouse.gov/omb/expectmore/index.html.

## Data Verification and Validation

For the seventh consecutive year, NSF engaged an independent, external firm, IBM Global Business Services (IBM), to assess the validity of the data and reported results of the agency's GPRA performance goals and to verify the reliability of the methods used to collect, process, maintain, and report data for these performance measurement goals. The verification and validation review was based on guidance from GAO's *Guide to Assessing Agency Annual Performance Plans (GAO/GGD-10.1.20)*. IBM documented the process used to collect, process, maintain, and report on data for nine quantitative goals that were being reviewed for the first time and documented any changes to processes and data for those goals undergoing an updated review. IBM assessed the accuracy of NSF's performance data and reported outcomes of performance goals and indicators as well as reviewed system controls to confirm that quality input results in quality output.

Since achievement of NSF's long-term strategic outcome goals is assessed by an external panel of experts, IBM was engaged to assess and observe the AC/GPA process to verify and validate that the process is sufficiently reliable to yield a valid conclusion on NSF's achievement for these nonquantitative goals. To provide a thorough and complete assessment, NSF provided IBM staff with unrestricted access to the AC/GPA meetings, performance information, NSF staff, and committee members. IBM's final report included the following[12]:

> *At the end of FY 2006, we were able to verify the reliability of the AC/GPA process and performance data. Further, based on the strength of these processes, we validate the reasonableness of the AC/GPA's conclusion that NSF had demonstrated significant achievement in all the indicators for the Strategic Outcome Goals of Ideas, Tools, and People and the Merit Review indicator for the Organizational Excellence Goal.*
>
> *Of the 22 other GPRA and PART performance goals we reviewed, we were able to verify the reliability of the processes and validate the accuracy or reasonableness of the results for 21 goals. We were able to partially verify the reliability of the process that NSF uses for the reporting of the remaining PART goal. For the majority of the reviewed goals, we can verify that NSF relies on sound business processes, system and application controls, and manual checks of system queries to produce valid and accurate results.*
>
> *Based on this comprehensive review, IBM has confidence in the systems, policies, and procedures used by NSF to generate the described performance measures. We strongly believe that NSF continues to take concerted steps to improve the quality of their systems and data on a yearly basis.*

## Integration of Budget, Performance, and Cost

NSF's FY 2003–2008 Strategic Plan established a framework that aligned and integrated NSF's performance goals with programmatic activities and budget.[13] As shown on the Strategic Goal Structure chart (Figure 7), all programmatic activities are aligned to an "investment category" and one of the four strategic goals—*Ideas*, *Tools*, *People*, and *Organizational Excellence*. Budgetary resources, obligations, and expenditures can be tracked and the full programmatic costs can be identified. (See the following discussion on *Organizational Excellence*, which explains the allocation of overhead to develop the full

[12] *IBM: NSF Government Performance and Results Act (GPRA) and Program Assessment Rating Tool (PART) Performance Measurement Validation and Verification, FY 2006 Final Report*, October 23, 2006, pages 1 and 2.

[13] NSF's FY 2005 and FY 2006 Budget Requests are available at www.nsf.gov/about/budget/.

cost of programs.) For the past two years, NSF has received a successful "Green" rating for ongoing efforts in the PMA Budget and Performance Integration initiative.

NSF's Statement of Net Cost[14] reports the full cost of each of the strategic goals of *Ideas*, *Tools*, and *People* and the 10 primary programmatic activities (the investment categories) that are associated with these three strategic goals. These investment categories, along with NSF's priority areas,[15] are the primary programs that have undergone OMB PART review.

Figure 8 shows NSF's FY 2006 obligations for the four strategic outcome goals: $2.83 billion for *Ideas;* $1.47 billion for *Tools;* $1.04 billion for *People;* and $314 million for *Organizational Excellence.* NSF's *Organizational Excellence* goal focuses on administration and management; its portfolio supports operational costs such as staff compensation and benefits, administrative travel, training, rent, IT business systems, the OIG and the NSB. In the Statement of Net Cost, these *Organizational Excellence* operational costs have been allocated to the 10 investment categories aligned to *Ideas*, *Tools*, and *People* in order to identify the full cost of NSF's primary programs. Figure 9 shows the FY 2006 obligations for *Ideas*, *Tools*, and *People* with *Organizational Excellence* allocated to the 10 investment categories by congressional appropriation.

*Figure 7.*

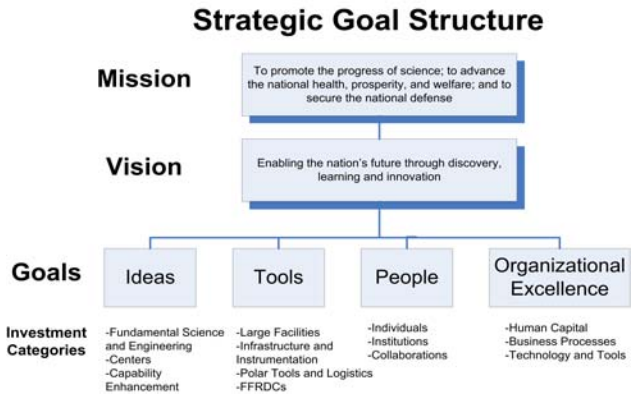



*Figure 8.*


*See Figure 10, second note.

It is important to note that this view of how NSF deploys its budget does not reflect the fact that NSF investments often serve multiple purposes. For example, research projects in programs categorized under *Ideas* commonly provide funds that involve graduate students. They contribute, therefore, to the *People* strategic outcome goal as well. These indirect investments are important to the attainment of the NSF's goals, and Program Officers are expected to take such potential contributions into account when making awards. The synergy attained across the four strategic goals attests to the real strength of the NSF process.

[14] For more information about the Statement of Net Cost, see Financial Statement Note 14.

[15] NSF's FY 2006 priority areas are Biocomplexity in the Environment, Nanoscale Science and Engineering, Mathematical Sciences, and Human and Social Dynamics.

*Figure 9.*

## FY 2006 Support of NSF's Strategic Outcome Goals and Investment Categories By Appropriation

(Obligations in Millions of Dollars)

| | R&RA* | EHR* | MREFC* | S&E* | NSB* | OIG* | **TOTAL** |
|---|---|---|---|---|---|---|---|
| IDEAS | | | | | | | |
| Fundamental Science & Engineering | 2,322.1 | 51.7 | 0.0 | 108.9 | 1.7 | 5.1 | 2,489.5 |
| Centers | 257.4 | 0.0 | 0.0 | 11.8 | 0.2 | 0.5 | 269.9 |
| Capability Enhancements | 107.5 | 116.1 | 0.0 | 10.3 | 0.2 | 0.5 | 234.5 |
| TOOLS | | | | | | | |
| Large Facilities | 339.7 | 0.0 | 220.7 | 25.8 | 0.4 | 1.2 | 587.8 |
| Infrastructure & Instrumentation | 405.6 | 15.0 | 0.0 | 19.3 | 0.3 | 0.9 | 441.0 |
| Polar Tools, Facilities & Logistics | 302.4 | 0.0 | 13.1 | 14.5 | 0.2 | 0.7 | 330.8 |
| FFRDC's | 185.2 | 0.0 | 0.0 | 8.5 | 0.1 | 0.4 | 194.2 |
| PEOPLE | | | | | | | |
| Individuals | 365.3 | 172.8 | 0.0 | 24.7 | 0.4 | 1.1 | 564.4 |
| Institutions | 38.1 | 108.7 | 0.0 | 6.7 | 0.1 | 0.3 | 154.0 |
| Collaborations | 27.8 | 334.2 | 0.0 | 16.6 | 0.3 | 0.8 | 379.7 |
| **TOTAL** | $4,351.0 | $798.5 | $233.8 | $247.1 | $3.9 | $11.5 | $5,645.8 ** |

*Notes:*

* NSF has six congressional appropriations: Research & Related Activities (R&RA), Education and Human Resources (EHR), Major Research Equipment and Facilities Construction (MREFC), Salaries and Expenses (S&E), Office of Inspector General (OIG), and National Science Board (NSB).

** Base obligation of $5,645.8M plus Donation Account ($28.4M), H1-B Nonimmigrant Petitioner Receipts ($99.4M), Reimbursable Authority ($100.5M), and appropriation with expired obligation authority in FY 2006 ($3.9M) equals total obligations incurred as shown on the Statement of Budgetary Resources ($5,878.0M).

FFRDC: Federally Funded Research and Development Centers

Totals may not add due to rounding.

## MANAGEMENT ASSURANCES

The *Federal Managers' Financial Integrity Act of 1982* (FMFIA) is implemented by *the Office of Management and Budget (OMB) Circular A-123: Management's Responsibility for Internal Control* (A-123). A-123 was revised in December 2004 to update agency requirements related to the three objectives of internal control: compliance with laws and regulations, reliability of financial reporting and the efficiency and effectiveness of operations. Revisions included additional requirements for documenting the review and assessment of entity-wide controls and controls over financial reporting, including the documentation of decision making, of the major business processes and controls, and of the results of control reviews themselves. Guidance recommended convening a Senior Assessment Team (SAT) to implement the requirements and a Senior Management Council (SMC) to provide oversight to such implementation. Circular A-123 implemented a top down approach to achieve a well-integrated control framework across each agency, including financial controls as one subcomponent of entity-wide controls. A-123 Appendix A implemented an additional set of requirements, effective for FY 2006, to be applied to the review and assessment of financial controls. Efficiency and effectiveness of operations are considered throughout the review processes.

The National Science Foundation (NSF) designated the Accountability & Performance Integration Council (APIC) to serve as its SAT and the already standing Senior Management RoundTable (SMaRT) to serve as its SMC for A-123 purposes. APIC is chaired by the Chief Financial Officer and includes four Assistant Directors/Office Heads, the Chief Human Capital Officer, the Chief Information Officer, and the General Counsel. APIC reports to the Chief Operating Officer (COO). SMaRT includes all Assistant Directors and Office Heads and is chaired by the NSF Deputy Director (DD), who currently also serves as NSF's COO. Throughout the implementation process, APIC provided regular updates to the Office of Inspector General through the Audit Coordinating Committee and obtained feedback from the auditors of NSF's financial statements, as well.

FY 2006 was a period of major implementation related to A-123 revisions for all federal agencies, and for NSF a year of reinforcing and strengthening internal controls and noting opportunities for future improvements. FY 2007 is slated as a year for continuing implementation, including the development of ongoing A-123 education and control rationalization directed toward continual improvement of operations as guided by A-123 and A-123 Appendix A.

During FY 2006, APIC led the review of entity-wide controls according to requirements set in the A-123, including a review of management structures and policy in place to ensure compliance with major laws and regulations. Several areas for improvement included increased documentation and dissemination of agency-wide policies and procedures, including written delegations. Although these are well understood in practice, A-123 emphasizes the need for updating written guidance. APIC also conducted the review of controls over financial reporting according to requirements set forth in A-123 Appendix A, including consideration of additional laws and regulations affecting financial reporting. Senior management will continue to work on integrated workflow charting and control descriptions in order to incorporate material and non-material key business subprocesses into its control documentation. This will allow for more extensive, end-to-end, assessments of the efficiency and effectiveness of operations. Both of these reviews included consideration of efficiency and effectiveness of operations. The results of NSF's assessment of the adequacy of internal controls entity-wide, including financial controls, are reported here in the agency's *FY 2006 Performance and Accountability Report*, consistent with the provisions of the Reports Consolidation Act of 2000.

NSF adopted a scope limitation for the financial control review to allow NSF to better ensure implementation of all A-123 Appendix A requirements over a several year period. This was a strategic option offered by OMB to all agencies. Adopting this strategy precludes NSF from reaching a level of *full*

*assurance* regarding controls for FY 2006, but better ensures that NSF will have in place the internal control infrastructure necessary to reach and maintain a level of full assurance in the near future. Based on the reviews conducted throughout FY 2006, APIC and SMaRT, with concurrence of the COO/DD, recommended a statement of limited assurance to the NSF Director for FY 2006. The recommendation noted that management found no evidence of material weakness in either financial controls or entity-wide controls, and reflected the testing of all key controls for FY 2006. The recommendation also noted that NSF internal controls meet the provisions of FMFIA, as implemented by A-123, including compliance with *OMB Circular A-127: Financial Management Systems* and the following laws and regulations:

- National Science Foundation Act of 1950, as amended;
- Annual Appropriation Law;
- Government Performance and Results Act of 1993;
- Clinger-Cohen Act of 1996;
- Federal Information Security Management Act of 2002;
- Chief Financial Officers Act of 1990, as amended;
- Federal Financial Management Improvement Act of 1996;
- Improper Payments Act of 2002;
- Single Audit Act of 1984, as amended; and
- Inspector General Act of 1978, as amended.

In the FY 2006 Independent Auditors' Report, NSF received an unqualified opinion on its financial condition, with no material weaknesses. NSF's statement of assurances follows.

## NSF Statement of Management Assurances

The National Science Foundation is responsible for establishing and maintaining effective internal control and financial management systems that meet the objectives of the Federal Managers' Financial Integrity Act (FMFIA), and OMB Circular A-123, *Management's Responsibility for Internal Control.* These objectives are to ensure:

- Effective and efficient operations,
- Compliance with applicable laws and regulations, and
- Reliable financial reporting.

For Fiscal Year (FY) 2006, the National Science Foundation is providing a qualified statement of assurance that its internal controls and financial management systems meet the objectives of FMFIA. The qualification is due to a scope limitation related to its first-year implementation of Appendix A of OMB Circular A-123, as described in paragraph 3.

The National Science Foundation conducted its evaluation of internal control over the effectiveness and efficiency of operations and compliance with applicable laws and regulations in accordance with OMB Circular A-123. Based on the results of this evaluation, the National Science Foundation identified no material weaknesses under Section 2 of FMFIA and no system nonconformances under Section 4 of FMFIA. The National Science Foundation provides reasonable assurance that its internal controls over the effectiveness and efficiency of operations, and compliance with applicable laws and regulations, as of September 30, 2006, were operating effectively and no material weaknesses were found in the design or operation of these internal controls.

The National Science Foundation also conducted its assessment of internal control over financial reporting in accordance with the requirements of Appendix A of OMB Circular A-123. A limited number of processes that could potentially impact financial reporting were not included in the initial scope of the assessment. These excluded processes will be included during the FY 2007 and FY 2008 implementation of Appendix A. Other than the scope limitation covering those processes that were not tested, the National Science Foundation provides reasonable assurance that the internal controls over financial reporting as of June 30, 2006, were operating effectively and no material weaknesses were found in the design or operation of these internal controls.

Arden L. Bement, Jr.

November 8, 2006

# FINANCIAL DISCUSSION AND ANALYSIS

NSF is proud of its record of achievement in the federal financial management arena. It is our goal and commitment to provide excellence in financial management to our stakeholders with the focus on the highest quality of business services. We honor that commitment by preparing annual financial statements in accordance with United States general accepted accounting principles (GAAP) for federal government entities and subjecting the statements to an independent audit to ensure their integrity and reliability in assessing the performance. For FY 2006, NSF received an unqualified opinion that the financial statements were fairly stated in all material respects.

In the FY 2006 Auditor's Report, the two prior year reportable conditions were repeated: post-award oversight for high risk grants and cooperative agreements and, contract monitoring. With respect to post-award oversight, we have made significant progress in the last year. Significant time was invested in the design, planning and implementation of a desk review program. NSF will continue to conduct desk reviews to enhance post-award monitoring. With respect to the contract monitoring reportable condition, the quarterly expenditure reviews of our major contractors by management were completed but not in time for the auditors to fully assess the overall impact of the corrective actions. For further discussion, see Chapter III, Management's Response to the Independent Auditor's Report.

NSF's CFO Five-Year Financial Management Plan supports the President's Management Agenda (PMA) by establishing key components to accomplish our financial management strategic goals. These forward-focused components are: high quality accountability support for NSF's strategic goals; effective stewardship and accountability to maximize the public resources provided to NSF; quality business services to our external and internal customers; efficient delivery of operations, transactions and outreach through e-systems; new and improved business practices through the development of constructive partnerships; and proactive leadership in all endeavors.

While NSF has accomplished much under the current CFO Five-Year Management Plan, we are now focusing our efforts to meet the new financial management goals that are in the updated CFO Five-Year Management Plan that will be implemented in FY 2007. These new goals provide us with the framework to improve upon the record of achievement we have accomplished so far in the areas of financial management and reporting, financial systems, awards management, customer service and a productive workforce.

## Understanding the Financial Statements

NSF's FY 2006 financial statements and notes are presented in the format required for the current year by *OMB Circular No. A-136, Financial Reporting Requirements* dated July 24, 2006, which supersedes *OMB Bulletin No. 01-09, Form and Content of Agency Financial Statements,* dated September 25, 2001, and OMB memoranda, specifically *M-04-20, FY 2004 Performance and Accountability Reports and Reporting*, dated July 22, 2004. NSF's current year financial statements and notes are presented in a comparative format. The Stewardship Investment schedule presents information over the last five years. The following table (*Figure 10*) summarizes the significant changes in NSF's financial position during FY 2006.

*Figure 10.*

**Significant Changes in NSF's Financial Position in FY 2006**

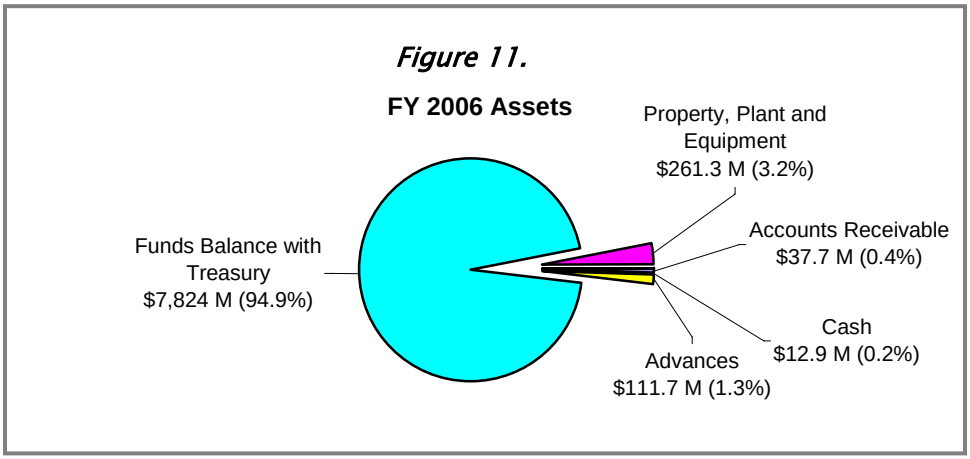
*(Dollars in Thousands)*

| Net Financial Condition | FY 2006 | FY 2005 | Increase/ (Decrease) | % Change |
|---|---|---|---|---|
| **Assets** | $8,247,611 | $8,075,059 | $172,552 | 2% |
| **Liabilities** | $441,720 | $377,543 | $64,177 | 17% |
| **Net Position** | $7,805,891 | $7,697,516 | $108,375 | 1% |
| **Net Cost** | $5,595,761 | $5,408,174 | $187,587 | 3% |

The following is a brief description of the nature of each required financial statement and its relevance. Certain significant balances or conditions are explained to help clarify their relationship to NSF operations.

**Balance Sheet**: The Balance Sheet presents the total amounts available for use by NSF (assets) against the amounts owed (liabilities) and amounts that comprise the difference (net position). Three line items consisting of *Fund Balance with Treasury; Property, Plant and Equipment;* and *Advances* represent 99 percent of NSF's current year assets (*Figure 11*). *Fund Balance With Treasury* is funding available through the Department of Treasury accounts from which NSF is authorized to make expenditures and pay amounts due. *Property, Plant and Equipment* comprises capitalized property located at NSF headquarters and NSF-owned property in New Zealand and Antarctica that supports the U.S. Antarctic Program (USAP). *Advances* are funds advanced to NSF grantees, contractors, and other government agencies.

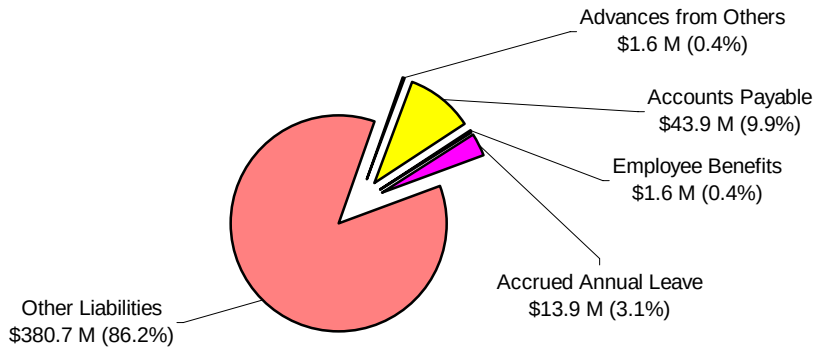
*Figure 11.*




Three line items, *Accounts Payable, Accrued Liabilities* (*Other Liabilities), and Accrued Annual Leave* represent 99 percent of NSF's current year liabilities (*Figure 12*). *Accounts Payable* includes liabilities to NSF vendors for unpaid goods and services received. *Accrued Liabilities* are amounts recorded for NSF's grants and contracts for which work has been completed and payment has not been made, as well as accrued payroll and benefits. *Accrued Annual Leave* represents annual leave earned by NSF employees but not yet taken.

*Figure 12.*

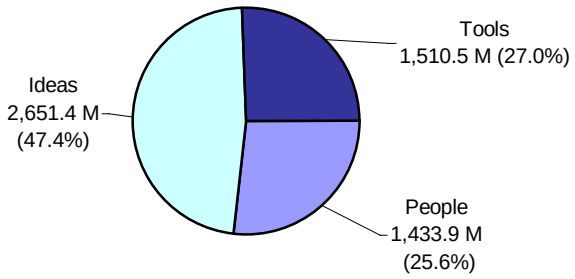
**FY 2006 Liabilities**




**Statement of Net Cost:** This statement presents the annual cost of operating NSF programs. Gross cost less any offsetting revenue for each NSF program is used to arrive at the net cost of specific program operations. *Intragovernmental Earned Revenues* are recognized when these related program or administrative expenses are incurred and deducted from the full cost of the programs to arrive at the net cost of operation.

*Figure 13.*

**FY 2006 Net Cost**




*Note: Included in Ideas, Tools, and People, is the approximately 6 percent of NSF's total funding that is devoted to Salaries & Expenses, the National Science Board and the Office of Inspector General for the administration and management costs addressed by NSF's Organizational Excellence strategic goal.*

Approximately 94 percent of all current year NSF costs incurred were directly related to the support of our *Ideas, Tools,* and *People* programs (*Figure 13*). Costs were incurred for indirect general operation activities (e.g., salaries, training, activities related to the advancement of NSF information systems technology, and activities of the NSB and the OIG). These costs were allocated to NSF's investment categories under *Ideas, Tools, and People*, and account for six percent of the total current year *Net Cost of Operations*. These administrative and management activities are the focus of our *Organizational Excellence* strategic goal.

**Statement of Changes in Net Position:** This statement presents the accounting items that caused the net position section of the Balance Sheet to change from the beginning to the end of the reporting period. NSF's Net Position increased to $7.8 billion in FY 2006—an increase of one percent—due to the increase in *Unexpended Appropriations and Cumulative Results of Operations. Unexpended Appropriations* is affected mainly by *Appropriations Received* and *Appropriations Used*, with minor impact from *Appropriation Transfers* from the U.S. Agency for International Development (USAID) and *Other Adjustments*, which include appropriation rescissions and cancellations. In FY 2006, NSF separated its Earmarked Funds portion of *Cumulative Results of Operations* based on new OMB A-136 guidance issued this fiscal year. See footnote 13 in Section III – Notes to the Principal Financial Statements for further details.

**Statement of Budgetary Resources:** This statement provides information on how budgetary resources were made available to NSF for the year and the status of those budgetary resources at year-end. For FY 2006, new *Budgetary Authority* for Research and Related Activities, Education and Human Resources, Major Research Equipment and Facilities Construction, the combined National Science Board, OIG and Salaries & Expenses were $4,331 million, $797 million, $191 million and $262 million, respectively. *Total Budgetary Resources* increased by 3.1 percent and *Net Outlays* increased by 2.6 percent in FY 2006. The *Net Outlays* reported on this statement reflects the actual cash disbursed for the year by Treasury for NSF obligations; it is reduced by the amount of Distributed Offsetting Receipts.

**Statement of Financing:** This statement illustrates the relationship between *Net Obligations* derived from NSF's budgetary accounts and the *Net Cost of Operations* reported on the *Statement Of Net Cost,* which is derived from NSF's proprietary accounts. The statement is structured to first identify total resources classified by obligations, and then other adjustments are made to those resources based on how additional items financed those resources or contributed to net cost. *Total Resources Used to Finance Activities* are only resources that have been obligated and are derived from information provided on the Statement of Budgetary Resources. *Total Resources Used to Finance Items Not Part of Net Cost of Operations* consists mainly of an adjustment to undelivered orders of the agency that are reflected in net obligations but not part of *Net Cost of Operations*. *Components Requiring or Generating Resources in Future Periods* adjusts for future funded expenses that are recognized in *Net Cost of Operations* but resources will not be provided until subsequent periods.

**Stewardship Investments:** Stewardship investments are NSF-funded investments that yield long-term benefits to the general public. NSF investments in research and education yield quantifiable outputs, including the number of awards made and the number of researchers, students, and teachers supported or involved in the pursuit of discoveries in science and engineering and in science and math education. Stewardship investments from FY 2005 to FY 2006 showed incremental increases in research activities in support of NSF's overall mission as reported in monetary investments. The decrease in the number of people directly involved in NSF-supported activities in FY 2006 primarily reflects the phase down of support for the Math and Science Partnership Program.

## Limitations of the Financial Statements

In accordance with the revised guidance *OMB Circular No. A-136, Financial Reporting Requirements*, we are disclosing the following limitations of NSF's FY 2006 financial statements, which are in Chapter III of this report. The financial statements have been prepared to report the financial position and results of operations of NSF, pursuant to the requirements of 31 U.S.C. 3515(b). While the statements have been prepared from NSF books and records in accordance with U.S. generally accepted accounting principles (GAAP) for federal entities and the format prescribed by OMB, the statements are in addition to the

financial reports used to monitor and control budgetary resources, which are prepared from the same books and records. The statements should be read with the realization that they are for a component of the U.S. government, a sovereign entity.

## Budgetary Integrity: NSF Resources and How They Are Used

NSF is funded primarily through six Congressional appropriations that totaled $5.6 billion in FY 2006.[16] Other FY 2006 revenue sources included $100.5 million in reimbursable authority, $8.0 million in appropriation transfers from other federal agencies, $105.3 million in H-1B collections and $31.4 million in donations to support NSF activities. As shown in the Statement of Net Cost, NSF made investments in fundamental research and education through ten investment categories linked to the agency's three mission-oriented strategic outcome goals of *Ideas, Tools, and People*.[17] These investment categories, together with NSF's priority areas, constitute the agency's PART programs. The investment categories are: Individuals; Institutions; Collaborations; Fundamental Science and Engineering; Centers; Capability Enhancement; Large Facilities; Infrastructure and Instrumentation; Polar Tools, Facilities, and Logistics; and Federally Funded Research and Development Centers. NSF provided support across the full range of science and engineering disciplines.

In FY 2006, four key multidisciplinary priority areas were funded: Biocomplexity in the Environment, Nanoscale Science and Engineering, Mathematical Sciences, and Human and Social Dynamics. Major investments were also made in Cyberinfrastructure and in the Networking and Information Technology R&D Program. NSF also supported education activities for students and teachers from pre-K through the post-doctoral level. Among major research facility and equipment projects supported were the Atacama Large Millimeter Array, which when completed will be the world's most sensitive, highest resolution, millimeter-wavelength telescope; EarthScope, a distributed geophysical instrument array that will enhance our understanding of the structure and dynamics of the North America continent; and the IceCube Neutrino Detector Observatory in Antarctica.

At the time of this report, NSF had not yet received its FY 2007 appropriations. However, our priorities for the coming year are clear. NSF looks toward contributing a major role in the Administration's American Competitiveness Initiative, which outlines a 10-year doubling of investments in NSF and other agencies that are principal supporters of the physical sciences and engineering. NSF's task in this ambitious undertaking is to kindle the leadership and excellence in fundamental research and education that keeps America at the leading edge of science, engineering and technology. NSF will focus on supporting frontier research, broadening participation in the science and engineering enterprise, providing world-class facilities and infrastructure, and bolstering NSF's K-12 education portfolio. NSF will also provide support in fundamental research for activities coordinated by the National Science and Technology Council (NSTC): the National Nanotechnology Initiative; the Climate Change Science Program; Networking and Information Technology R&D; and basic research related to homeland security.

[16] NSF's original appropriations were reduced by a government-wide one percent rescission, an across-the-board reduction required in Section 3801.(a) of H.R. 2863 and a 0.28 percent rescission, required in Section 638(a) of the Conference Report H.R. 109-272.

[17] See page I-19 for a discussion of NSF's fourth strategic goal of *Organizational Excellence*, which focuses on the agency's administrative and management activities.

## Improper Payments Information Act of 2002: Status

The Improper Payments Information Act (IPIA) of 2002 and the recently issued OMB Circular A-123 Appendix C guidance require agencies to review all programs and activities, identify those that are susceptible to significant erroneous payments, and determine an annual estimated amount of erroneous payments made in those programs.

NSF's FY 2004 initial response to the IPIA requirements focused on awards already identified as high-risk through our pre-existing Award Monitoring and Business Assistance Program. In FY 2005, we revamped our Improper Payments Plan and implemented a process to ensure improper payments testing for NSF's IPIA program portfolio. NSF contracted with McBride, Lock, and Associates, Certified Public Accountants, to conduct a statistical review of grant payment data related to two targeted appropriations (NSF's OMB-identified IPIA program) that represented more than 80 percent of NSF total funding. The baseline results and the very low improper payment rates reported in our FY 2004 and FY 2005 Performance and Accountability Report indicate a low risk program that is well below the IPIA $10 million and 2.5 percent total outlays thresholds.

Therefore, in accordance with OMB Memorandum 06-23, Circular A-123 Appendix C, Section K issued on August 10, 2006, NSF applied and received relief from the annual IPIA reporting requirement for this year. NSF will remain vigilant in our monitoring and continue efforts towards improving the payment process. In fact, NSF intends to continue other grant expenditure sampling for improper payment in support of the NSF grant monitoring program to ensure that it remains low risk.

## Financial System Strategy

The goal of NSF's financial management team has always been to provide the highest quality of business services to our customers, stakeholders, and staff through effective funds control, prompt and streamlined award processes, and reliable and timely financial data to support sound management decisions. NSF's Financial Accounting System (FAS) enables us to achieve these goals. FAS is an online, real-time system that provides the full spectrum of financial transaction functionality required by a grants-making agency. The system allows NSF to consistently meet financial reporting deadlines, helps ensure FFMIA and OMB A-127 compliance, and provides accurate, on-demand financial information to NSF staff.

FAS is extensively integrated with all of NSF's core business systems, including the Proposal and Reviewer System (PARS), the Awards System, Guest (panelists) Travel and Reimbursement System, and the FastLane System that supports grants management. FAS supports both the grant and core financial processes. It is used to monitor, control, and ensure the management and financial accountability of over 20,000 active awards with nearly 2,000 external grantee institutions. FAS distributes funds electronically to grantees in a seamless and highly controlled environment. Grantees can check available funds in real time on a daily basis. The extensive reporting capabilities built into the software include on-line lookups to verify funds, track commitments and obligations, and the ability to generate daily, weekly, monthly, and quarterly reports that provide up-to-date financial information about NSF operations for program and grantee decision support. All FAS-generated reports are posted electronically and are available to staff via Report.web which is a web-based application that streamlines information distribution. Information from FAS is captured and used in our Enterprise Information System reporting. FAS is custom software that was developed and is maintained by NSF to support our extensive grantmaking enterprise.

NSF's ability to meet interface and integration requirements of any government-wide initiative (e.g. e-Travel and e-Learning), to adopt new legislative, regulatory, and policy requirements as they are promulgated, and to implement required technical upgrades is resource dependent. Consistent with NSF's eGovernment Implementation Plan, FAS will remain in a steady-state phase in the FY 2005-FY 2010

timeframe. NSF will be approaching its future financial system requirements as an integral part of its grant process. The agency will conduct an integrated review of the Grants Management Line of Business (GMLoB) and the Financial Management Line of Business (FMLoB) solution in 2007. If the GMLoB/FMLoB Shared Service Provider (SSP) option is determined to be infeasible, NSF will analyze the FMLoB SSP option in 2008. NSF may conduct a Business Case Feasibility Study for the FMLoB solution in 2009. This plan allows NSF to take advantage of the results/findings of the GMLoB process in becoming a SSP to more fully define our financial requirements. NSF anticipates that if a conversion to a new financial management system is necessary, it will substantially impact NSF grantees beginning in 2010.

## Key Financial Metrics

The information in this section presents selected key financial measures of NSF core business of awarding grants and our progress in associated electronic processes. NSF has an established record of success in leveraging automation to increase efficiency and productivity. Since the inception of the Department of Treasury's Financial Management Service Scorecard in FY 2004, NSF has consistently received the highest "Green" ratings for accuracy and timeliness of our financial reporting in the quarterly ratings (Figure 14).

***Figure 14.***

**U.S. Department of Treasury Financial Management Scorecard**

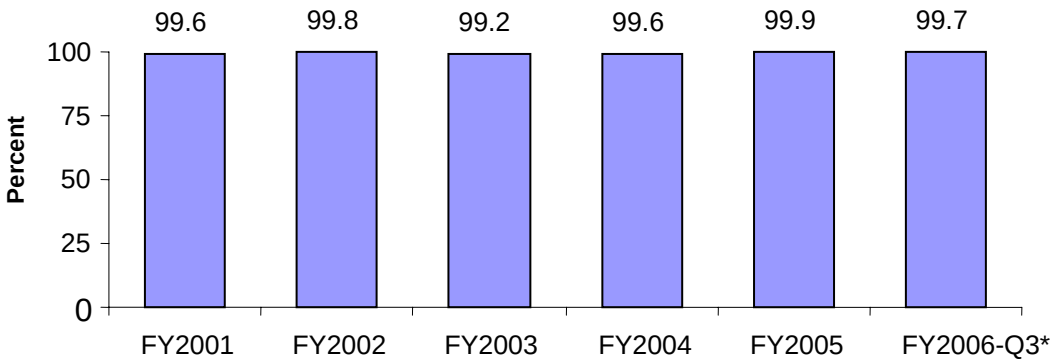
| Category | Standard | Results (as of 6/30/06)** |
|---|---|---|
| Accuracy of Reporting* | *Green*: If differences outstanding for less than 3 months.<br>*Yellow:* If differences are older than 3 months but less than 6 months.<br>*Red:* If differences are older than 6 months. | ● |
| Timeliness of Reporting* | *Green*: If original and supplemental reporting completed by the third workday.<br>*Yellow:* If original submitted by the 3rd workday and supplemental report submitted on the 4th workday.<br>*Red:* If original submitted after the 3rd workday and/or supplemental submitted after the 4th workday. | ● |
| Checks issued Comparison Reporting | *Green*: If differences outstanding for less than 3 months.<br>*Yellow:* If differences are older than 3 months but less than 6 months.<br>*Red:* If differences are older than 6 months.<br>*N/A:* If agency does not have disbursing authority. | N/A |

* FMS 224, SF1218/1221 and FMS 1219/1220.

** Most current data available.

*Figure 15.*

**Percent of Federal Cash Transaction Reports Received**

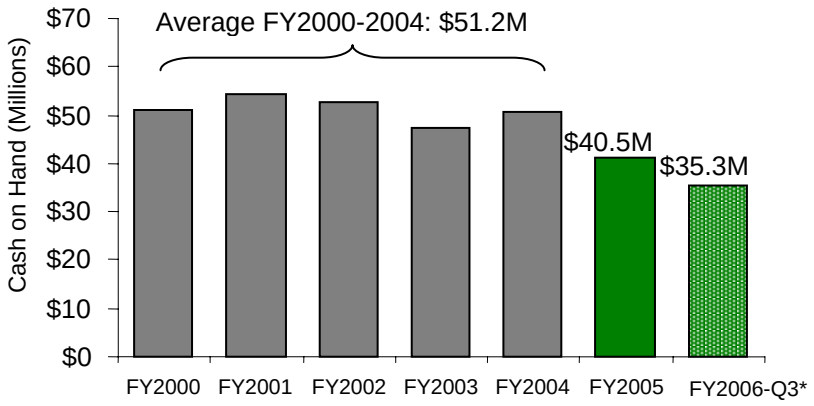



Note: Grantees are required to report the status of funds received from NSF on a quarterly basis through the submission of a Federal Cash Transaction Report (FCTR). The reports are prepared and submitted by the grantee electronically to NSF through the FastLane FCTR Function.
* Most current data available.

*Figure 15* focuses on the SF 272 Federal Cash Transaction Report (FCTR) process, a key part of NSF's core grant business. It shows the FCTR collection rate over the past five years including the continued increase of on-time submissions. In FY 1998, NSF developed FastLane, a secure, web-based application that enables grantees to electronically transmit FCTR reports. NSF routinely collects over 99.9 percent of all required FCTRs - a collection rate that significantly exceeds that of other federal agencies.

*Figure 16.*

**Quarterly Average Cash on Hand**




*Most current data available.

*Figure 16* shows the results of NSF's increased emphasis on enhanced FCTR monitoring activities implemented in January 2005. Unexpended federal cash held by grantees has dropped by an average of

approximately $10 million per quarter due to NSF monitoring activities, indicating improved cash management on the part of the NSF grantees.

***Figure 17.***

**CFO COUNCIL METRIC TRACKING SYSTEM**
**FINANCIAL MANAGEMENT INDICATORS**

| Indicator | Definition | Standard | Data through 6/30/06 |
|---|---|---|---|
| **1.** Fund Balance with Treasury (Net) | Identifies the difference between the fund balance reported in Treasury reports and the agency fund balance with Treasury recorded in its general ledger on a net basis. | *Green:* fully successful <= 2%<br>*Yellow:* minimally successful > 2% - <= 10%<br>*Red:* unsuccessful > 10% | GREEN 0.0% |
| **2.** Amount in Suspense (Absolute) Greater than 60 Days Old | The timeliness of clearing and reconciling suspense accounts. This metric is reported quarterly. | *Green:* fully successful <= 10%<br>*Yellow:* minimally successful > 10% - <= 20%<br>*Red:* unsuccessful > 20% | GREEN 0.0% |
| **3.** Delinquent Accounts Receivable from Public Over 180 days | The success in reducing or eliminating delinquent accounts receivable from the public. This metric is reported quarterly. | *Green:* fully successful <= 10%<br>*Yellow:* minimally successful > 10% - <= 20%<br>*Red:* unsuccessful > 20% | RED 37.9% |
| **4.** Electronic Payments | The number of electronic payments measures the extent to which vendors are paid electronically. | *Green:* fully successful >= 96%<br>*Yellow:* minimally successful >= 90% - < 96%<br>*Red:* unsuccessful > < 90% | GREEN 99.2% |
| **5a.** Percent Non-Credit Card Invoices Paid on Time | How many non credit card invoices are paid on time in accordance with the Prompt Payment Act (PPA). | *Green:* fully successful >= 98%<br>*Yellow:* minimally successful >= 97% - < 98%<br>*Red:* unsuccessful < 97% | GREEN 99.6% |
| **5b.** Interest Penalties Paid | The amount of interest penalties paid on late invoices relative to total dollars paid in accordance with the PPA. | *Green:* fully successful <= 0.02%<br>*Yellow:* minimally successful > 0.02% - <= 0.(<br>*Red:* unsuccessful > 0.03% | GREEN 0.0018% |
| **6a.** Travel Card Delinquency Rates Individually Billed Account (IBA) | The percent of travel card balances outstanding over 61 days for Individually Billed Accounts (IBA). | *Green:* fully successful <= 2%<br>*Yellow:* minimally successful > 2% - <= 4%<br>*Red:* unsuccessful > 4% | GREEN 0.8% |
| **6b.** Travel Card Delinquency Rates Centrally Billed Account (CBA) | The percent of travel card balances outstanding over 61 days for Centrally Billed Accounts (CBA). | *Green:* fully successful = 0%<br>*Yellow:* minimally successful > 0% - <= 1.5%<br>*Red:* unsuccessful > 1.5% | GREEN 0.0% |
| **6c.** Purchase Card Delinquency Rates | The percent of purchase card balances outstanding over 61 days. | *Green:* fully successful = 0%<br>*Yellow:* minimally successful > 0% - <= 1.5%<br>*Red:* unsuccessful > 1.5% | GREEN 0.0% |

*Figure 17* provides the CFO Metrics Tracking System (MTS) Scorecard for June 2006, the most recent data available. The MTS, sponsored by the CFO Council Committee on Performance Measurement, provides monthly details on core financial metrics across government. NSF received its first "Red" for Indicator 3, "Delinquent Accounts Receivable from Public over 180 Days," for the June reporting month. This indicator is based on the ratio of public receivables greater than 180 days to total receivables. This

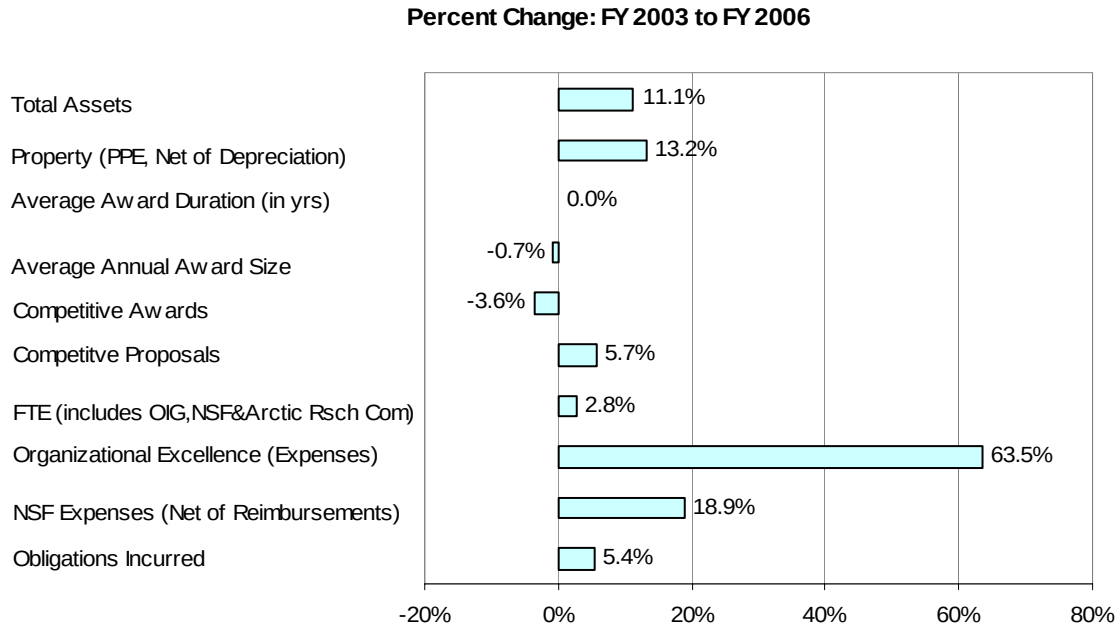
score was caused by a single delinquent debt out of the pool of NSF outstanding public receivables. NSF's receivables are generally one of the lowest total public receivables of all government agencies. This single delinquent debt has caused the MTS score for NSF to experience an anomaly from the normal scoring it receives. In fact, since MTS was launched in January 2005, NSF has had the most consistently high scores of any government agency. MTS scorecards and information are available at www.fido.gov/mts/cfo/public/200606/.

## *Figure 18.*
## Recent Trends

The following table summarizes several of NSF's key workload and financial indicators. Obligations are a direct result of each year's appropriation while expenses reflect multiple years of prior obligations. Of real significance is the increase since FY 2003 for Organizational Excellence. This increase reflects the higher onboard FTE as well as other investments designed to address the sustained high level of competitive proposals received and their increasing complexity.

*(Dollars in Millions)*

| | FY 2003 | FY 2004 | FY 2005 | FY 2006 | %Change FY 03-06 |
|---|---|---|---|---|---|
| Obligations Incurred | $5,578.64 | $5,870.72 | $5,653.90 | $5,878.01 | 5.4% |
| NSF Expenses (Net of Reimbursements) | $4,707.77 | $5,100.14 | $5,408.17 | $5,595.76 | 18.9% |
| Organizational Excellence (Expenses) | $196.36 | $268.30 | $292.43 | $321.09 | 63.5% |
| FTE (includes OIG) | 1,242 | 1,274 | 1,279 | 1,277 | 2.8% |
| Competitive Proposals | 40,075 | 43,851 | 41,760 | 42,377 | 5.7% |
| Competitive Awards | 10,844 | 10,380 | 9,794 | 10,450 | -3.6% |
| Average Annual Award Size | $135,609 | $139,637 | $143,669 | $134,595 | -0.7% |
| Average Award Duration (in yrs) | 2.9 | 2.9 | 2.9 | 2.9 | 0.0% |
| Property (PP&E, Net of Depreciation) | $230.78 | $240.44 | $257.56 | $261.35 | 13.2% |
| Total Assets | $7,424.92 | $7,929.03 | $8,075.06 | $8,247.61 | 11.1% |



## Future Business Trends and Events

NSF looks toward meeting all the opportunities and challenges that are presented in the federal environment. The future will require a continued focus on management excellence through increased attention to specific financial operations and strategic issues. For example, the PMA and other new administrative policy initiatives mandate that NSF, like other agencies, demonstrate consistent progress in improving financial management practices as well as adapt to changing management and policy initiatives. We are also committed to leveraging technology and human capital resources to provide an optimum environment for creative intelligence to be utilized to improve operations and services to stakeholders. In addition, we proactively address management challenges identified through internal review and oversight. In the following section, we describe some of the areas we will be focusing on in both the immediate future and the long term.

**OMB Circular A-123:** NSF underwent its first full implementation under the revised OMB Circular A-123, *Management's Responsibility for Internal Control in FY 2006*. We experienced a steep learning curve in implementing the OMB guidance this year but the agency has emerged with a greater depth and breadth of understanding of the importance of good internal controls at both the entity-wide level and at the financial reporting level. NSF realizes that the process of institutionalizing the OMB A-123 guidance involves detailed planning and execution in the review, documentation, and testing of the business process controls. NSF recognizes that complete institutionalization of the OMB A-123 process does not depend solely on the annual internal control review and test results but also on achieving an overall level of confidence and experience over time. Therefore, in FY 2006, NSF opted for a limited scope on the testing of internal controls over financial reporting for fiscal years 2006, 2007 and 2008. This will allow the agency time to build a level of confidence into the review process.

**E-Travel:** NSF is the lead agency in implementing EDS's FedTraveler, one of three government-wide approved e-Travel Presidential initiative systems. NSF is paving the way for other agencies to follow and has had to implement and improve a system in parallel. In FY 2006, NSF staff made significant efforts to overcome the obstacles and challenges of a system that was essentially not ready for the e-Travel initiative. As a result, the FedTraveler system has been substantially improved; however, it was not fully implemented due to some remaining system deficiencies and integration issues. NSF is currently addressing these issues aggressively with EDS and GSA as part of a corrective action plan. The FedTraveler system was selected to provide our travelers with an integrated web-based travel system; NSF is confident that with continued diligence and oversight, we will have an optimal and responsive E-Travel system that will meet the needs of this agency.

**Federal Financial Report (FFR):** As part of its implementation initiatives for the Federal Financial Assistance Management Improvement Act of 1999 (P.L. 106–107), OMB is consolidating and replacing existing grant recipient financial reporting forms with a single Federal Financial Report (FFR). The FFR will provide grantees with a financial reporting process that will be common to all federal agencies while simplifying reporting requirements, procedures and associated business processes. The FFR will utilize a standardized pool of data elements as defined by the Grants Policy Committee of the Federal Chief Financial Officers Council. NSF is developing a FFR for implementation as part of its FastLane Financial Functions. NSF's FFR will assist OMB in advancing Federal Grants Streamlining initiatives, reinforce NSF leadership within the federal grants management arena, and maintain the customized integration of business processes and systems inherent in NSF's end-to-end systems. NSF's FFR will replace the Federal Cash Transaction Report (FCTR) currently being used by all NSF grant recipients, beginning in July 2007.

**Financial Service Offerings of the NSF GMLoB**: NSF has built a highly integrated financial and grants management process that has the flexibility to provide services to other agencies. As such, NSF is becoming a shared service provider within the Grants Management Line of Business (GMLoB) in a fee-for-service environment to other federal research agencies. Potential financial service offerings include grant payments, grantee financial reporting, and centralized grant accounting. These offerings will complement and extend the shared services to be offered for pre and post award grant management services. NSF financial services have the technical capability and management acumen, combined with proven business processes, which will provide a benefit to the federal research community.

**Government-wide Accounting Standardization**: There are several government-wide accounting (GWA) initiatives in the federal government, e.g., the GWA Modernization Project and the "Tie-point" Project that will help move the federal government towards government-wide accounting standardization. The goals of these initiatives are to provide reliable, timely and useful information, and to promote a better understanding of the federal accounting and reporting process across the federal government. The Department of the Treasury, in its effort to improve the integrity and consistency of government-wide financial data, is leading the "Tie-point" project through the use of U.S. Standard General Ledger "tie-points". These tie-points will help NSF to further improve our own tie-points that we are using in our current reconciliation process prior to OMB and Treasury reporting. NSF is currently participating and assisting in the project with Treasury and other agencies.

NSF is also involved in a government-wide accounting standardization effort that is spearheaded by the Financial Systems Integration Office under the Financial Lines of Business (FMLoB). The goal of this project is to develop a common government accounting code (CGAC) structure. It includes establishing an applicable set of definitions that all new agency financial management systems must adhere to. Since NSF is moving forward as a Shared Service Provider under the Grants Management Lines of Business (GMLoB), we are studying the feasibility of integrating both GMLoB and FMLoB, and working cooperatively with these two lines of business to develop the touch points. Developments in the CGAC and touch points projects will have an impact on the approach that NSF will take in the future.

# DETAILED PERFORMANCE INFORMATION

## SUMMARY OF RESULTS

Performance assessment is fundamental to the mission of NSF, permeating all agency processes. FY 2006 performance assessment at NSF was guided by the Government Performance and Results Act of 1993 (GPRA),[1] OMB's Program Assessment Rating Tool (PART),[2] and by NSF's *FY 2003–2008 Strategic Plan*.[3]

A summary discussion of NSF's performance results and assessment activities as well as a discussion of the integration of budget, performance, and cost is provided in Management's Discussion and Analysis, beginning on page I-10. This chapter provides detailed information on NSF's FY 2006 performance assessment activities and the results of the agency's FY 2006 GPRA performance goals. Following this Summary of Results are discussions of NSF's performance assessment and evaluation process, NSF's validation and verification (V&V) process, and detailed discussions on each of NSF's FY 2006 GPRA performance goals.

NSF's performance goals fall into two broad categories: long-term "Strategic Outcome Goals" and "Annual Performance Goals." Historically NSF has relied upon external committees of experts (see pages II-6 to II-8) to evaluate the results of its long-term investments. This is appropriate given the broad scope of science, engineering, and education research supported by NSF, and the extensive use of competitive merit review for selecting new awards. Evaluation of annual performance goals is related to internal practices, processes, and operations that support the mission.

> **Strategic Outcome Goals:** NSF's *FY 2003-2008 Strategic Plan* provides the programmatic framework that translates into the agency's four strategic outcome goals: *Ideas, Tools, People,* and *Organizational Excellence*. *Ideas, Tools,* and *People* focus on the long-term results of NSF's grants and programs. These goals represent the outcomes from NSF investments in science and engineering research and education. The strategic outcome goal of *Organizational Excellence* focuses on the administrative and management activities of the agency, and ensures that NSF is a capable and responsive organization that supports the accomplishment of the three other strategic outcome goals.
>
> To assess NSF's long-term strategic outcome goals, NSF established an Advisory Committee for GPRA Performance Assessment (AC/GPA), comprised of experts in fields of science, engineering, and education to provide advice and recommendations to the Director regarding NSF's performance. The Committee meets annually to assess results and to comment on the quality and relevance of NSF's research and education award portfolio and on its high risk/transformative awards. Performance indicators are used to assess annual progress toward attainment of each of the long-term outcome goals. For each outcome goal, NSF judges itself successful when, in the aggregate, results reported demonstrate significant achievement for the majority of associated indicators. In FY 2006, the AC/GPA determined that NSF demonstrated

[1] For more information about GPRA, visit www.whitehouse.gov/omb/mgmt-gpra/gprptm.html.

[2] For more information about the Program Assessment Rating Tool (PART), visit www.whitehouse.gov/omb/expectmore/index.html.

[3] *NSF's FY 2003–2008 Strategic Plan* is available at www.nsf.gov/pubs/2004/nsf04201/FY2003-2008.pdf.

significant achievement in all performance indicators related to the four strategic outcome goals. The AC/GPA determined that quality and relevance were demonstrated for the achievement in all the performance indicators associated with *Ideas*, *Tools*, and *People*. In addition, using input from the Advisory Committee for Business and Operations, the AC/GPA determined that quality was demonstrated for *Organizational Excellence*.

**Annual Performance Goals:** NSF has integrated its GPRA and PART reporting. Our annual performance goals consist of performance measures associated with NSF's PART programs and an agency-wide efficiency goal related to time-to-decision on funding recommendations. The FY 2006 annual performance goals consist of nine new goals and 13 goals reported in previous years. The nine new goals are associated with the following PART programs: Polar Research Support, Tools, and Logistics; the Biocomplexity in the Environment priority area; and the Institutions and Collaborations programs under the *People* strategic outcome goal.

## FY 2006 Results

*NSF was successful for all four of its long-term strategic outcome goals: Ideas, Tools, People, and Organizational Excellence*. The external Advisory Committee for GPRA Performance Assessment (AC/GPA) determined that NSF demonstrated significant achievement in all performance indicators related to these goals. The AC/GPA also determined that the Research & Development criteria of "Quality" and "Relevance" were demonstrated for the *Ideas*, *Tools*, and *People* goals, and that "Quality" had been demonstrated for *Organizational Excellence*. The Committee's report may be found at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06206. The FY 2006 AC/GPA evaluation process was also validated by an independent external verification and validation (V&V) review.[4]

In FY 2006, NSF was successful for 15 of its 22 annual performance goals (68 percent). We were successful in the goals relating to time-to-decision; increasing the number of graduate students funded through NSF's three flagship graduate student programs; increasing the number of applicants from minority serving institutions for the CAREER program for junior faculty; the six goals related to the Nanoscale Science and Engineering Program; the facilities operations goal; and the Polar research support goal. NSF was not successful in achieving goals related to increasing the number of applications to the Graduate Research Fellowship Program from groups that are underrepresented in the science and engineering workforce; increasing the percentages of proposals from academic institutions not in the top 100 of NSF funding recipients for the Research Institutions and Research Collaborations programs; increasing the percentages of proposals to the Biocomplexity in the Environment Program with at least one female or one minority investigator; the facilities construction goal; and the Polar research facilities goal.

## FY 2002–2006 Results

Overall, in FY 2006, NSF achieved 19 of 26 performance goals (73 percent), including all four strategic outcome goals. A detailed explanation of each of NSF's FY 2006 performance goals is provided later in this chapter. A summary of the results of NSF's GPRA performance goals from FY 2002 through FY 2006 is shown in the chart below. NSF has successfully achieved all its strategic outcome goals in the last five years. With respect to our annual performance goals, NSF achievement has ranged from a low of 63 percent in FY 2003 to a high of 88 percent in FY 2004.

[4] For further information about the independent verification and validation review, see Appendix 4c.

| FY 2002 – FY 2006 Performance Results<br>Number and Percent of Goals Achieved | | | | | |
|---|---|---|---|---|---|
| | FY 2002 | FY 2003 | FY 2004 | FY 2005 | **FY 2006** |
| Strategic Outcome Goals | 4 of 4 (100%) | 4 of 4 (100%) | 4 of 4 (100%) | 4 of 4 (100%) | **4 of 4 (100%)** |
| Annual Performance Goals | 14 of 19 (74%) | 10 of 16 (63%) | 23 of 26 (88%) | 14 of 17 (82%) | **15 of 22 (68%)** |
| Total | 18 of 23 (78%) | 14 of 20 (70%) | 27 of 30 (90%) | 18 of 21 (86%) | **19 of 26 (73%)** |

## Recent Performance Highlights

The results of many NSF-supported projects appear long after the initial investment. The discoveries highlighted here and throughout this report are the outcome of long-term support of research and education projects that emerged and were reported in FY 2006. Additional examples may be found in NSF's website at www.nsf.gov/discoveries/.

► **Solar Vehicles for Environmental Monitoring:** The RiverNet Project is designing sensor networks and systems to monitor complex or geographically large regions. One such development is the Solar Autonomous Underwater Vehicle (SAUV). The SAUV can submerge for up to 12 hours and dive to 500 meters. It features a unique solar panel that allows the vehicle to be deployed for weeks at a time; an on-board computer system to enable real-time mission adaptations; and networked communications to support multi-vehicle cooperation.

The new solar-powered autonomous underwater vehicle (SAUV-II) will be used for a variety of environmental monitoring tasks. *Credit: Arthur C. Sanderson and D. Richard Blidberg.*

The SAUV can be used in a variety of environmental monitoring tasks, including the detection and monitoring of hazardous events such as red tides and contaminant spills, or in assessing the impact of natural events such as earthquakes and volcanoes. A team of SAUV vehicles will be used for long-term observation of coastal and harbor regions in order to detect threats or introduction of hazardous substances. The SAUVs may also serve as an integral part of logistics for large-scale military operations with several vehicles facilitating land, sea, and air coordination.

► **Finding and Keeping Kids in the Earth Science Pipeline from 6th Grade to Post-college**: Researcher Alan Smith and his team at Cal State-San Bernadino have completed an ambitious project to recruit and retain underrepresented ethnic groups in the earth sciences from sixth grade to post-college. In an initial survey asking minority children why they were not majoring in geology, the top reasons were lack of exposure to the geosciences and lack of knowledge about geoscience careers. Armed with these results, the team conducted 169 outreach sessions over a three-year period that involved more than 12,000 contact hours with 5,700 students. Most students were middle or high school students, and three-quarters were from underrepresented groups in the geosciences (52 percent were Hispanic, 13 percent African American, 5 percent Native American, and 4 percent Pacific Islander).

Group activities included hikes to the San Andreas Fault and hands-on exercises related to plate tectonics and earthquakes. Hands-on activities were modified to enhance students' familiarity with the scientific method. Students began by making observations from and asking questions about maps of the Earth. One of the observations they often noted was that the coastlines of Africa and South America look like they would fit together. They also noticed the mid-ocean ridges and trenches on the sea floor. A computer animation of world seismicity was shown so that students could make observations about where earthquakes occur. Another activity was a bi-annual Global Positioning System (GPS) campaign. This campaign allowed students to work with scientists and use state-of-the-art GPS receivers to precisely determine the location of benchmarks on both sides of the San Andreas and San Jacinto faults. From these measurements, the students determined the bending of the tectonic plates that will eventually lead to slip along these faults as major earthquakes. Students worked with scientists to interpret the GPS data in terms of how fast the faults were slipping. Results were presented at meetings of the American Geophysical Union and the Southern California Earthquake Center. The data were also shared with the Southern California Earthquake Data Center (www.scecdc.scec.org) for use by other scientists around the country and world.

College-student outreach assistant working with middle schoolers to draw plate boundaries on a map showing earthquake locations. *Credit: Sally McGill.*

► **Collapsing Ice Shelf Reveals Seafloor Life:** Researchers have discovered an entirely unexpected ecosystem in the lightless depths just off the coast of the Antarctic Peninsula. When the Larsen Ice Shelf collapsed there in 2002, it suddenly revealed the seabed beneath, giving NSF-supported scientists a chance to survey the contents. They found marine life forms, such as thick bacterial mats, that were able to subsist without sunlight – which had been blocked by the ice above – and therefore without photosynthesis.

View of remnant tabular iceberg (from Larsen B) in front of the new fjord coast of Oscar II Land (photo taken February, 2005). *Credit*: *David Tewksbury.*

Such communities, called "chemotrophic" because their members obtain energy from oxidation of chemical compounds rather than deriving it from sunshine, had previously been seen only at warm volcanic locations and hydrothermal vent areas on the sea floor. Eugene Domack of Hamilton College and colleagues described their findings in publications during 2005. The scientists speculate that the bacteria may feed on seepage of methane gas from the seabed. The research also serves to further understanding of how ice shelves collapse and insight into potential sea level change associated with global warming.

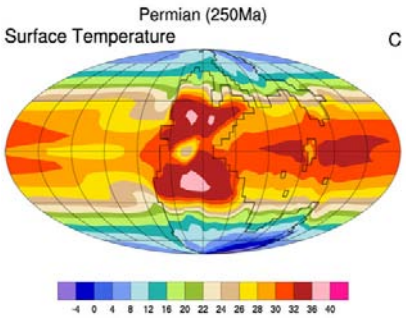
► **High School Students Compete in Protein Modeling:** In 2005, for the first time, the Wisconsin Science Olympiad included a competition in protein modeling. The competitors used tools and data from the Protein Data Bank, an international repository for protein information, to develop physical models of two proteins and answer questions about each protein's structure, function, and importance. Teams were scored on the accuracy of their models and their answers.

The event was conceived and organized by Gary Graper, a retired Madison West High School biology teacher, and the Center for BioMolecular Modeling at the Milwaukee School of Engineering.

Wisconsin Science Olympiad contestants used the Protein Data Bank and modeling kits to examine the relationship between protein structure and function. *Credit: RCSB Protein Data Bank.*

Funding came in part from NSF's Course, Curriculum, and Laboratory Improvement program. The protein modeling competition was one of over 30 individual and team events for the Wisconsin Division C High School 2005 regional and state Science Olympiad competitions. One of the central goals of the Science Olympiad is to "create a passion for learning science..." The success of the protein modeling event led to its proposal for inclusion in other state Science Olympiads in 2006 and in the national competition in 2007. As a result, students across the country will experience, as did the nine teams of Wisconsin students, the excitement of scientific discovery.

► **Climate Models Give Clue to Greatest Mass Extinction in Earth's History:** Scientists at the National Center for Atmospheric Research have used a computer model to simulate the Earth's climate at the time of the Permian Extinction, when 90 to 95 percent of all marine species and 70 percent of terrestrial species became extinct. The researchers used the Community Climate System Model, which integrates changes in atmospheric temperatures with ocean temperatures and currents. The work supports the theory that an abrupt and dramatic rise in atmospheric carbon dioxide triggered the extinction 251 million years ago.




Annual mean surface temperature (in degrees Celsius) simulated for the latest Permian from the Community Climate System Model, version 3. *Credit: National Center for Atmospheric Research.*

This large pulse of carbon dioxide seems to have come from an equally large burst of volcanic activity that played out over the relatively short span of some 700,000 years. According to the model, the resulting rise in carbon dioxide levels raised the temperature of the atmosphere, which in turn raised the temperature of the oceans' surface waters. Once this warming of the oceans reached a depth of 4,000 meters, it interfered with the seas' normal circulation process and kept oxygen from moving into the deep ocean. This lack of oxygen then killed the marine organisms that normally would have removed carbon dioxide from the atmosphere. The result: an even faster rise in carbon dioxide levels, thereby increasing the temperatures on land and in the ocean even further.

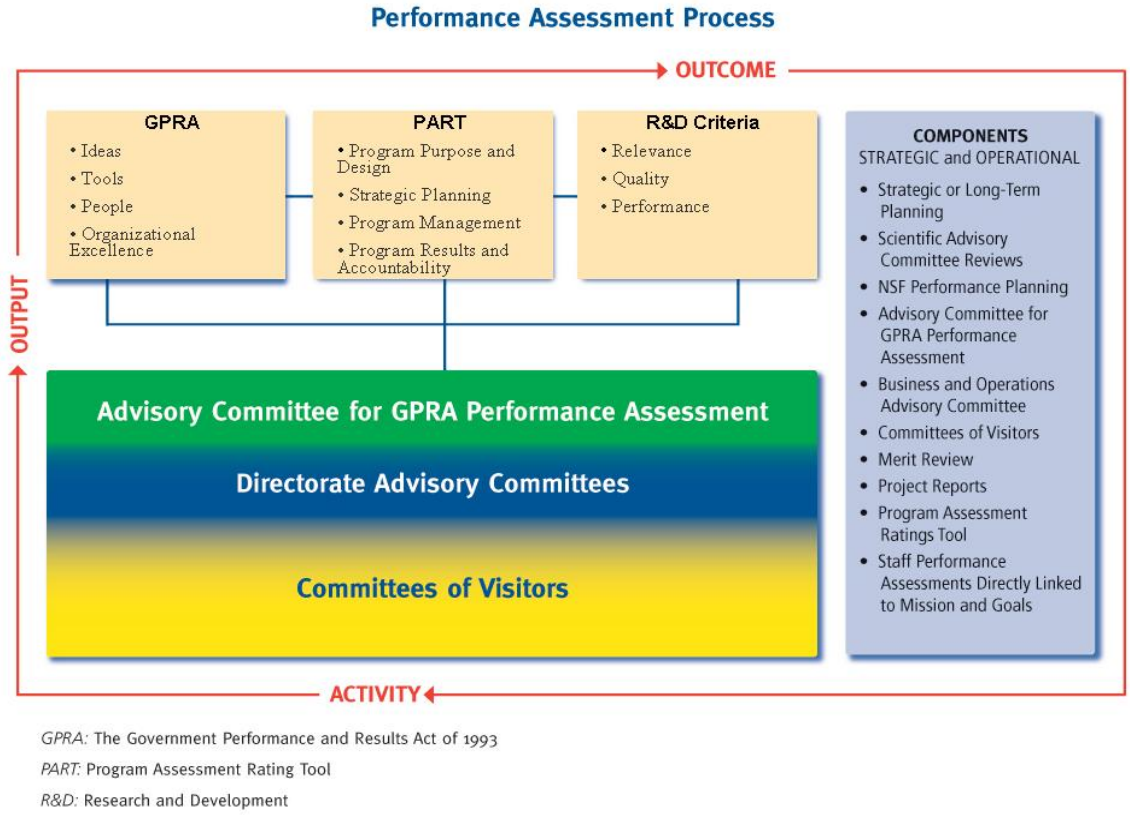
► **Engaging U.S. Undergraduate Engineers through Nanotech Research in Japan:** As part of the Rice University NanoJapan Program, a group of sixteen freshman and sophomore engineering majors is spending the summer conducting nanotechnology research in the best laboratories in Japan. By involving students in cutting-edge research projects early in their studies, NanoJapan aims to increase the number of U.S. students who choose to pursue graduate study in a nanotech-related field, while also cultivating a globally aware science and engineering workforce. The U.S. and Japan account for 57 percent of worldwide nanotechnology R&D spending, with Japan leading the way. Continued U.S. leadership in frontier nanoscale science, will require young American scientists and engineers to network with their Japanese peers. Students spend ten weeks in Japan participating in intensive Japanese language and intercultural skills training and hands-on research at a prestigious Japanese university, corporate or national laboratory. Students then build on their overseas experience with research presentations at a special one-week technology symposium in Texas. The NanoJapan Program is part of an innovative Partnership for International Research and Education award to Rice University. Eighty students will participate in the NanoJapan Program from 2006-2010.

NanoJapan participant loads a sample into a CVD chamber at the University of Tokyo. *Credit: Dvir Kafri.*

# NSF'S PERFORMANCE ASSESSMENT AND EVALUATION PROCESS

NSF has integrated the GPRA and PART processes with its long-standing external expert evaluation process through Advisory Committees (ACs) and Committees of Visitors (COVs). NSF relies on the judgment of these external experts to maintain high standards of program management, provide advice for continuous improvement of performance, and ensure openness to the research and education community served by NSF. With respect to broader issues, NSF often uses external third parties such as the National Academy of Sciences for outside review. NSF also convenes external panels of experts for special studies. A schedule of NSF's program evaluations can be found in Appendix 4a. A list of the external evaluations conducted in FY 2006 is provided in Appendix 4b.

NSF's performance assessment process is illustrated in the chart below. An explanation of the components of this performance assessment process follows.




*GPRA:* The Government Performance and Results Act of 1993

*PART:* Program Assessment Rating Tool

*R&D:* Research and Development

## Committees of Visitors (COVs)

NSF's Committees of Visitors (COV) provide program assessments that are used both in program management and in annual GPRA reporting. Each COV typically consists of 5 to 20 external experts who review one or more programs over a two to three day period. These experts are selected to ensure independence, programmatic coverage, and balanced representation. They typically represent academia, industry, government, and the public sector. Approximately one-third of NSF activities are assessed each year. All COVs are asked to complete a report template with questions addressing how programs contribute to NSF's goals. Questions to COVs include: (A) the integrity and efficiency of the *processes* involved in proposal review, and (B) the results, including the quality, of NSF's investments.

In evaluating the results of those investments, COVs are asked to comment on program activities as they relate to NSF's strategic outcome goals, justify their assessment, and provide supporting examples or statements. COVs are subcommittees of NSF directorate advisory committees. Each COV prepares a report and the division or program that is being reviewed must prepare a response. COV reports, along with the NSF responses to their recommendations, are submitted to the parent advisory committee and to the Director of NSF. All COV reports and NSF responses are public documents posted on NSF's website.

## Advisory Committees

Each directorate and office has an Advisory Committee that meets twice a year to provide guidance on priorities, address program effectiveness, and review Committee of Visitor COV) reports and NSF programs' responses to COV recommendations. Advisory Committees are chartered and hence subject to Federal Advisory Committee Act rules. Each division or cross-disciplinary program has a Committee of Visitors that meets once every three years to review and assess program priorities, program management, and award accomplishments or outcomes.

## Advisory Committee for GPRA Performance Assessment

The Advisory Committee for GPRA Performance Assessment (AC/GPA) was established in June 2002 to provide advice and recommendations to the NSF Director regarding NSF's performance under GPRA. NSF is the only federal government agency that invites an external advisory committee to perform an analysis of its entire portfolio as part of the agency GPRA assessment process. The Committee, which is composed of scientists, engineers, and educators, reviews NSF's broad portfolio to determine NSF's annual progress towards meeting its strategic outcome goals. The AC/GPA's assessment of whether NSF has demonstrated significant achievement is based on the collective experience and expertise of the Committee following the review of approximately 900 outstanding accomplishments – "highlights" complied by NSF program officers and an array of COV reports and other data. After its meetings, the AC/GPA provides NSF with an evaluation of NSF performance with respect to the indicators associated with each strategic outcome goal. NSF's annual independent verification and validation report includes a review of the AC/GPA evaluation process.

## The Advisory Committee for Business and Operations

The Advisory Committee for Business and Operations provides advice to the Director of the Office of Budget, Finance, and Award Management and to the Director of the Office of Information and Resource Management on issues related to the oversight, integrity, development, and enhancement for improved performance of NSF's business operations. These operations are critical for assuring that the agency effectively implements its research and education mission. Emphasis is placed on how NSF can most effectively meet its strategic goals and other statutory accountability requirements related to its business operations, including financial and administrative operations, award management, business policies and procedures, human resource development, and information and communications systems.

## Project-level Assessment During Merit Review

While Advisory Committees and Committees of Visitors assess NSF programs at the portfolio level, assessment at the project or award level is conducted in two different ways. First, when submitting a proposal, applicants provide information on the results of previous NSF support. Such information is available to external experts who review the proposals based on NSF's merit review criteria. Program officers also review this information and take it into account when making recommendations on awards or declinations. Second, awardees are required to submit annual progress reports during the course of their awards. Such information is required before funds are released each year for continuing grants.

The merit review process involves several steps. When a proposal arrives at NSF, a program officer or team of program officers reviews the proposal and assigns it to at least three experts from outside NSF. Reviews are generally conducted by mail, in an advisory panel, or combination of mail and advisory panel. Reviewers and panelists use two general criteria: intellectual merit and broader impacts. The division leadership oversees the review process. Following merit review, the program officer makes a recommendation to award or decline the proposal, taking into account external reviews, panel discussion, and other factors such as portfolio balance and the availability of funding. Higher-level review of program officers' decisions is conducted. If an award is recommended, grants officers perform an administrative review. Large awards are also subject to further review at a higher level, by the Director's Review Board and the National Science Board.

## PART Assessments

In 2002, OMB developed the Program Assessment Rating Tool (PART) as a systematic method for assessing the performance of program activities across the federal government. A PART review focuses on program purpose and design, strategic planning, program management, and program results and accountability. Each year, 20 percent of an agency's programs must undergo PART review. To date, all NSF's priority areas and programs under the current strategic plan that have undergone PART evaluations have received the highest rating of "Effective." The following chart shows the PART programs that have been evaluated; the ratings of the programs that were evaluated in the summer of 2006 will be available with the release of NSF's FY 2008 Budget Request to Congress in February 2007.

| **NSF PART Evaluations**<br>Investment Category/Priority Area | Budget Year | Result |
|---|---|---|
| Ideas | | |
| Fundamental Science and Engineering | FY 2007 | Effective |
| Federally Funded Research and Development Centers | FY 2007 | Effective |
| Tools | | |
| Facilities | FY 2005 | Effective |
| Polar Tools, Facilities, and Logistics | FY 2006 | Effective |
| People | | |
| Individuals | FY 2005 | Effective |
| Institutions | FY 2006 | Effective |
| Collaborations | FY 2006 | Effective |
| Priority Areas | | |
| Information Technology Research | FY 2005 | Effective |
| Nanoscale Science and Engineering | FY 2005 | Effective |
| Biocomplexity in the Environment | FY 2006 | Effective |
| For more information visit: www.whitehouse.gov/omb/expectmore | | |

## Types and Sources of Performance Data and Information

Most of the data that underlie achievement assessments for the strategic outcome goals (with the exception of the *Organizational Excellence* goal) originate outside the agency and are submitted to NSF through the Project Reporting System, which includes annual and final project reports for all awards. Through this system, performance information/data such as the following are available to program staff, third party evaluators, and other external committees:

- Information on *Ideas:* Published and disseminated results, including journal publications, books, software, audio or video products created; contributions within and across disciplines; organizations of participants and collaborators (including collaborations with industry); contributions to other disciplines, infrastructure, and beyond science and engineering; use beyond the research group of specific products, instruments, and equipment resulting from NSF awards; and role of NSF-sponsored activities in stimulating innovation and policy development.
- Information on *Tools: P*ublished and disseminated results; new tools and technologies, multidisciplinary databases; software, newly-developed instrumentation, and other inventions; data, samples, specimens, germ lines, and related products of awards placed in shared repositories; facilities construction and upgrade costs and schedules; and operating efficiency of shared-use facilities.
- Information on *People: S*tudent, teacher and faculty participants in NSF activities; demographics of participants; descriptions of student involvement; education and outreach activities under grants; demographics of science and engineering students and workforce; numbers and quality of educational models, products and practices used/developed; number and quality of teachers trained; and student outcomes including enrollments in mathematics and science courses, retention, achievement, and science and mathematics degrees received.
- Information on *Organizational Excellence:* Information provided by NSF on diversity initiatives, diversity statistics, the NSF Academy and the government-wide eTraining Initiative; information on performance management system improvements, employee recognition activities, innovative capital studies within NSF, the development and implementation of a human capital management plan, and eGovernment human resource initiatives; information on technology enabled business processes, government-wide grants management initiatives, the ePayroll initiative, compliance with the FY 2003 Federal Information Security Management Act (FISMA) Compliance, Greater IT Security Awareness Training Throughout Foundation, and activities associated with GPRA performance assessment.

Most of the data supporting quantitative goals can be found in NSF's central systems. These central systems include the Enterprise Information System; FastLane, with its Project Reporting System and its Facilities Performance Reporting System; the Online Document System; the Proposal and Reviewer System; the Awards System; the Electronic Jacket; and the Financial Accounting System. These systems are subject to regular checks for accuracy and reliability.

## Data/Information Limitations

With respect to the *Ideas, Tools*, and *People* strategic outcome goals, the AC/GPA is provided with access to recent Committee of Visitor reports and program assessments conducted by external programmatic expert panels, principal investigator project reports, award abstracts. Because it is impractical for an external committee to review the contributions to the associated performance goals by each of the 22,000 active awards, NSF program officers provided the Committee with nearly 900 summaries of notable results relevant to the performance indicators. Collections obtained from expert sampling of outstanding accomplishments ("highlights") from awards, together with COV reports and project reports, formed the primary basis for determining, through the recommendations of the external Advisory Committee for GPRA Performance Assessment, whether or not NSF demonstrated significant achievement in its strategic outcome goals for *Ideas*, *Tools*, and *People*. The approach to highlights

collection is a type of non-probabilistic sampling, commonly referred to as "judgmental" or "purposeful" sampling, which is best designed to identify notable examples and outcomes resulting from NSF's investments. It is the aggregate of collections of notable examples and outcomes that can, on their own, demonstrate significant agency-wide achievement in the strategic outcome goals. Nevertheless, the combination of COV reports, project reports, award abstracts, and notable accomplishments covers the entire NSF portfolio.

## DATA VERIFICATION AND VALIDATION PROCESS

As in prior years, NSF used an independent, external consultant to conduct a verification and validation (V&V) review of all performance information and data reported in the FY 2006 PAR. IBM Global Business Services (IBM) conducted the V&V review based on guidelines issued by the Government Accountability Office.[5] GAO requires federal agencies to provide confidence that the policies and procedures underlying performance reporting are complete, accurate, and consistent. IBM assessed the validity of the data and reported results as well as verified the reliability of the methods used to collect, process, maintain and report data. IBM also reviewed NSF's information systems based on GAO standards for application controls. For the strategic outcome goals, IBM reviewed the processes NSF used to obtain external assessment of its goals.

In their October 2006 Report, IBM states:

> The National Science Foundation (NSF or the Foundation), as a federal agency, is subject to the performance reporting requirements of the Government Performance and Results Act (GPRA). In addition, NSF measures its programmatic performance using the Office of Management and Budget's Program Assessment Rating Tool (PART). These performance reporting requirements hold Federal agencies accountable for providing detailed information on their progress in meeting performance objectives. Accordingly, NSF measures itself against a series of GPRA and PART goals to help the agency achieve its mission and objectives.
>
> Government Accountability Office (GAO) auditing standards require Federal agencies to provide confidence that the policies and procedures underlying performance reporting are complete, accurate, and consistent. As such, NSF asked IBM Global Business Services to assess the validity of the data and reported results of its performance goals and to verify the reliability of the methods used to collect, process, maintain and report data for these performance measurement goals and objectives.[6] In this report, we detail the results of our review of NSF's GPRA and PART processes and results for FY 2006. We conducted a preliminary review after the third quarter and the formal review after the end of the fiscal year.
>
> NSF measures its annual performance against the four Strategic Outcome Goals of Ideas, Tools, People, and Organizational Excellence and 22 other performance goals. As of the end of FY 2006, we were able to verify the reliability of the processes and validate the accuracy of all four Strategic Outcome Goals as well as 21 of the 22 annual performance goals. Although we were able to only partially verify the reliability of the process for the remaining goal, we believe that NSF's reported outcome for this goal is consistent with the data collected.

[5] *GAO Guide to Assessing Agency Annual Performance Plans* (GAO/GGD-10.1.20)

[6] GAO defines "verification" as a means to check or test performance data in order to reduce the risk of using data that contains significant errors. GAO defines "validation" as a way to test data to ensure that no error creates significant bias.

Based on this comprehensive review, IBM has confidence in the systems, policies, and procedures used by NSF to generate the described performance measures. We strongly believe that NSF continues to take concerted steps to improve the quality of their systems and data on a yearly basis.

The executive summary of the IBM V&V Report may be found in Appendix 4c of this report.

# STRATEGIC OUTCOME GOALS

The NSF Strategic Plan for FY 2003–FY 2008 established a programmatic framework for four long term strategic outcome goals: *Ideas*, *Tools*, *People*, and *Organizational Excellence*. The first three goals represent the outcomes from NSF investments in science and engineering research and education. The fourth goal focuses on the administrative and management activities of the agency, and ensures that NSF is a capable and responsive organization that supports the accomplishments of the other three strategic outcome goals.

To accomplish the NSF mission to promote the progress of science and engineering, NSF invests in the most capable people, supporting their creative ideas, and providing them with cutting-edge research and education tools. Within NSF, the agency strives to maintain a diverse, agile, results-oriented cadre of NSF knowledge workers and leadership in state-of-the-art business processes, tools, and technologies.

NSF's strategic outcome goals are defined as follows:

- *Ideas* – Discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.
- *Tools* – Broadly accessible, state-of-the-art science and engineering facilities, tools, and other infrastructure that enable discovery, learning, and innovation.
- *People* – A diverse, competitive, and globally-engaged U.S. workforce of scientists, engineers, technologists, and well prepared citizens.
- *Organizational Excellence* – An agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices.

In FY 2006, the Advisory Committee for GPRA Performance Assessment (AC/GPA) determined that NSF demonstrated significant achievement in all performance indicators related to the four strategic outcome goals. The AC/GPA also determined that the Research & Development criteria of "Quality" and "Relevance" were demonstrated for the *Ideas*, *Tools*, and *People* goals, and that "Quality" had been demonstrated for *Organizational Excellence*. The AC/GPA evaluation process was validated by an independent external Verification and Validation review.[7] The AC/GPA report may be found at www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06206.

A summary of the strategic outcome goal results from FY 2002 through FY2006 is presented below.

**FY 2002 – FY 2006 Strategic Outcome Goal Results**
Number and Percent of Goals Achieved

| | FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 |
|---|---|---|---|---|---|
| Strategic Outcome Goals | 4 of 4 (100%) | 4 of 4 (100%) | 4 of 4 (100%) | 4 of 4 (100%) | 4 of 4 (100%) |

[7] For further information about the independent external verification and validation review, see Appendix 4c.

## Strategic Outcome Goal 1

***IDEAS: Discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.***

| FY 2002–FY 2006 Performance Results | | | | |
|---|---|---|---|---|
| FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 |
| G | G | G | G | G |
| ***Green (G) indicates success*** | | | | |

| Indicators | Results |
|---|---|
| NSF's performance is successful when, *in the aggregate*, results reported in the period FY 2006 demonstrate significant achievement in the majority of the relevant indicators:<br>▸ (Contributions) Enable people who work at the forefront of discovery to make important and significant contributions to science and engineering knowledge.<br>▸ (Collaborations) Encourage collaborative research and education efforts across organizations, disciplines, sectors, and international boundaries.<br>▸ (Connections) Foster connections between discoveries and their use in the service of society.<br>▸ (Underrepresented Individuals and Institutions) Increase opportunities for underrepresented individuals and institutions to conduct high quality, competitive research and education activities.<br>▸ (Identifying New Opportunities) Provide leadership in identifying and developing new research and education opportunities within and across S&E fields.<br>▸ (Cross-disciplinary) Accelerate progress in selected S&E areas of high priority by creating new integrative and cross-disciplinary knowledge and tools, and by providing people with new skills and perspectives.<br>▸ (Identifying New Opportunities) Support innovative research on learning and teaching that provides a scientific basis for improving science, technology, engineering, and mathematics education at all levels. | NSF has demonstrated significant achievement in all indicators. |

Investments in *Ideas* support cutting-edge research that yield new and important discoveries and promote the development of new knowledge and techniques within and across traditional boundaries. These investments enable NSF to meet its mission of promoting the progress of science while at the same time helping to maintain the nation's capacity to excel in science and engineering, particularly in academic institutions. The results of NSF-funded research projects provide a rich foundation for broad and useful applications of knowledge and the development of new technologies. Support in this area also promotes the education and training of the next generation of scientists and engineers by providing them with an opportunity to participate in discovery-oriented projects.

FY 2006 Result: NSF achieved this goal. NSF is the only agency to invite an external advisory committee, the Advisory Committee for GPRA Performance Assessment (AC/GPA), to review its entire portfolio as part of the agency GPRA assessment process. The AC/GPA determined that NSF has demonstrated significant achievement for each of the performance indicators associated with this goal.

Implications for the FY 2007 Performance Plan: This goal has been updated in NSF's new Strategic Plan for FY 2006-FY 2011.

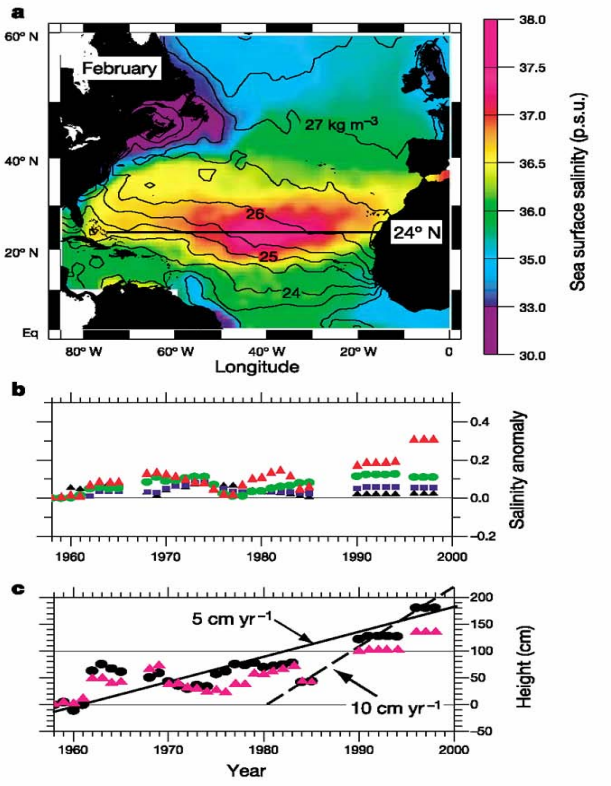
## Comments from the Advisory Committee for GPRA Performance Assessment (AC/GPA):

The following statements are excerpted from the FY 2006 AC/GPA Report that may be found at www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06206. This report contains additional comments and examples in support of significant achievement for each indicator.

> The NSF portfolio is deep and rich in ideas. From novel discoveries in the basic sciences and engineering to educational advancements across the STEM disciplines, NSF has demonstrated continued commitment to its basic goals of pursuing the highest quality research, in novel and transformative ways, while broadening the participation in science and engineering of people from all parts of society. The breadth and depth of research topics supported by the NSF spans a vast array from cutting edge climate research in remote regions of our planet to fundamental discoveries in the engineering of nanoscale materials and biologicals. It is clear that programs throughout NSF are supporting high quality research at a variety of institutions, from a diverse group of investigators, and of a potentially transformative nature in a significant number of cases.
>
> The reach of NSF cuts across all disciplines, all educational sectors, and extends significantly across international boundaries as evidenced by the large-scale interdisciplinary and internationally focused projects that have been funded. The global impact of NSF's reach is readily apparent from the portfolio of funded projects reviewed by the advisory committee.
>
> The relevance of NSF-sponsored research to societal needs is dramatic and direct as evidenced by the research on such topics as identifying terrorism targets; producing more energy-efficient, environmentally sound materials; and assessing and reducing costs associated with structures built to withstand earthquakes. The impact of these research projects will be local, national, and potentially global from the various types of research projects that are underway.
>
> There is good evidence that many sectors of NSF can demonstrate progress toward broadening participation. There is also evidence that some directorates are not demonstrating clear commitment to this goal in ways that can be tangibly measured. We urge that more uniformity be applied across directorates with regard to reporting on this goal.
>
> NSF appears to be leading the effort to identify and develop new research and educational opportunities that cut across various science and engineering fields. Examples of large-scale, cross-cutting projects indicate a high level of commitment by NSF to novel, sometimes high-risk, research and dissemination efforts. New tools, new perspectives and integration across the disciplines have been demonstrated in a variety of projects from information technology to biotechnology. Combinations of approaches from the different disciplines are providing novel opportunities to solve large-scale problems.
>
> And finally, the impact of projects designed to improve STEM education at all levels is manifested in a variety of projects that take full advantage of the scientific method as a means of engaging students at all levels in the excitement of scientific inquiry. Making science and mathematics accessible and interesting to students of all ages is a goal of a number of projects sponsored by NSF. Indeed this will position NSF well for responding to the National Academies report *Rising Above the Gathering Storm*, and we look forward to even more creative programming efforts on the part of NSF with regard to STEM education. In particular, efforts to address similar challenges in engineering education need to be enhanced significantly. We believe the NSF has the opportunity to be a significant driver in the improvement and enhancement of STEM education generally and engineering education most particularly.

Recent Performance Highlights: The following are some results reported in FY 2006 by the science and engineering research and education community supported by NSF. These examples demonstrate NSF leadership in emerging science and engineering research frontiers and how new discoveries can benefit society and improve the quality of life for all citizens. Additional results may be found at www.nsf.gov/discoveries/.

► **Saltier Tropical Oceans and Fresher Ocean Waters Near the Poles Show Further Signs of Global Climate Change's Impacts:** Tropical ocean waters have become dramatically saltier over the past 40 years, while oceans closer to Earth's poles have become fresher, according to a recent study led by Ruth Curry of the Woods Hole Oceanographic Institution and funded by NSF. Curry and her colleagues reached this conclusion by comparing recent and historical records of salinity over the entire Atlantic Ocean. They found that tropical and subtropical regions of the Atlantic have become markedly saltier since 1861, when record-keeping began, while the waters in high latitudes of the North and South Atlantic have generally become fresher.

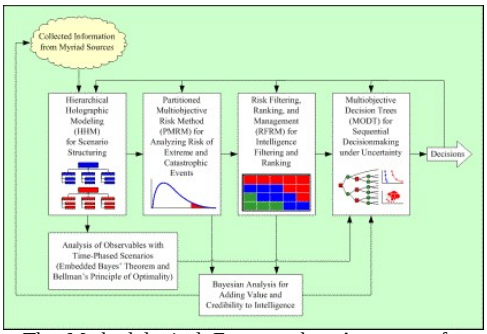



Map of the Nordic Seas with ocean circulation. Surface currents are shown as solid pathways; deep currents are dashed; water temperature is colored. *Credit: Ruth Curry/WHOI.*

This is presumably the result of increased evaporation from the ocean as Earth's temperature goes up. The scientists estimated that evaporation rates over the tropical Atlantic have increased by five percent to ten percent over the past four decades. Moreover, they found that the salinity trends have accelerated since 1990, a period that encompasses ten of the warmest years on record.

The findings are particularly significant as pressure on freshwater resources has become critical in many areas of the world. An acceleration of the changes could affect the distribution, severity, and frequency of droughts, floods, and storms. It could also fuel global warming by rapidly adding more water vapor, itself a heat-trapping greenhouse gas, to the atmosphere. And it could continue to freshen North Atlantic Ocean waters to a point that could disrupt ocean circulation, heavily dependent on gradients in salinity, and trigger further worldwide climate changes.

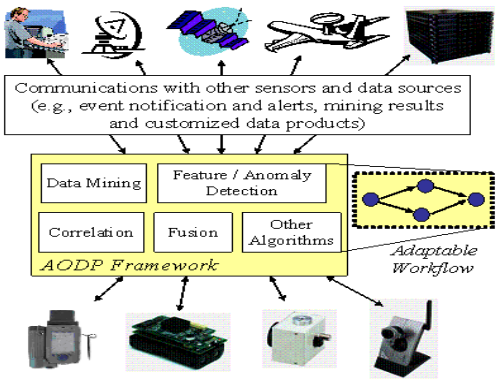
► **A Scenario-based Method for Identifying Terrorism Targets:** Yacov Haimes and his colleagues at the University of Virginia have developed a scenario-based "game" for identifying and prioritizing security vulnerabilities related to critical infrastructure. The game is built around an interactive, multidimensional analysis method called the hierarchical holographic method (HHM) developed by the same team. The team has refined and extended this innovative risk-assessment methodology by working on real terrorism-assessment problems. By combining research and development with application studies, the risk assessment method is




The Methodological Framework: A process for scenario-based tracking used to identify and prioritize security vulnerabilities of critical infrastructure. *Credit: Yacov Haimes, University of Virginia.*

simultaneously tested, improved, and used to help solve a pressing national problem.

Working with the Virginia Department of Transportation, the researchers have used the game to identify security vulnerabilities around a gubernatorial inauguration. And working with the Department of Homeland Security, they have used it to aid decision analysis associated with the department's color alert system. They have also analyzed risks to U.S. Army critical infrastructure to help prioritize protection of critical army assets.

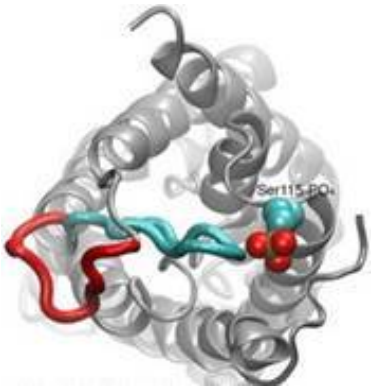



The AODP tool provides a framework to link components of a sensor network for on-board real-time data analysis and mining, event detection and autonomous behavior. *Credit: Information Technology and Systems Center, University of Alabama in Huntsville, 2004.*

► **Smart Sensors React Cooperatively:** The Adaptive On-Board Data Processing (AODP) research team is developing a unique approach for processing, integrating, and mining data acquired by a sensor network. The software will be used to detect complex phenomena based on information from multiple sensors deployed in settings that range from outer space to the ground.

Ideally, multiple processes in a sensor network should act independently, yet be able to coordinate and integrate their findings and results. For example, if one sensor detects a feature or an anomaly, it should automatically alert other sensors to increase their monitoring of a specific area. Final outcomes of the AODP research will include a method to enable sensor networks that are autonomous, intelligent, and applicable to a wide range of environments; data analysis and mining components that can be used in intelligent sensor networks; a processing system capable of adaptable workflow execution within the sensor network; and creation of a sensor network testbed for continued research and development.

► **Gating Mechanism in Plant Water Channels Visualized:** Scientists now know the three-dimensional structure of a plant aquaporin – a specialized protein that creates a "water channel" to regulate the flow of water in and out of the plant's cells. The collaborative effort involved experts in protein structure and computer modeling. Together, the team was able to gain a detailed understanding of the structure and function of the gating mechanism used by spinach aquaporins.



Scientists determined the three-dimensional structure of plant aquaporins – specialized proteins that regulate the flow of water in and out of the plant's cells. *Credit: Klaus Schulten, University of Illinois at Urbana-Champaign.*

Although aquaporins are present in all life forms, land plants use them to control the flow of water through their water channels. In effect, the plants use them as gates that open and close in response to drought, flooding, and biochemical signals like pH. Without these gates for example, the flower in the office window would not survive the weekend without watering. Knowing how the molecular gates function will help scientists determine how the closed structure might be stabilized or destabilized, thereby leading to new strategies to help plants conserve water in drought conditions, or alternatively, stop them from taking up too much water when fields are flooded.

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## Strategic Outcome Goal 2

***TOOLS: Broadly accessible, state-of-the-art, science and engineering facilities, tools, and other infrastructure that enable discovery, learning, and innovation.***

| FY 2002–FY 2006 Performance Results | | | | |
|---|---|---|---|---|
| FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 |
| G | G | G | G | G |
| ***Green (G) indicates success*** | | | | |

| Indicators | Results |
|---|---|
| NSF's performance is successful when, *in the aggregate*, results reported in the period FY 2006 demonstrate significant achievement in the majority of the relevant indicators:<br>▸ (Expand Access) Expand opportunities for U.S. researchers, educators, and students at all levels to access state-of the-art S&E facilities, tools, databases, and other infrastructure.<br>▸ (Next Generation Facilities and Platforms) Provide leadership in the development, construction, and operation of major, next-generation facilities and other large research and education platforms.<br>▸ (Cyberinfrastructure) Develop and deploy an advanced cyberinfrastructure to enable all fields of science and engineering to fully utilize state-of-the-art computation.<br>▸ (Data Collection/Analysis) Provide for the collection and analysis of the scientific and technical resources of the U.S. and other nations to inform policy formulation and resource allocation.<br>▸ (Instrument technology) Support research that advances instrument technology and leads to the development of next-generation research and education tools. | NSF has demonstrated significant achievement in all indicators. |

As the issues researchers face increasingly involve phenomena at or beyond the limits of our measurement capabilities, their study requires the use of new generations of powerful tools. NSF investments provide state-of-the-art tools for research and education, such as distributed instrumentation networks and arrays, multi-user facilities, digital libraries, accelerators, telescopes, research vessels, aircraft, and earthquake simulators. In addition, funding devoted to the *Tools* strategic outcome area provides resources needed to support large surveys and databases as well as computational and computing infrastructures for all fields of science, engineering, and education.

NSF provides support for large multi-user facilities that meet the need for state-of-the-art, world-class research platforms vital to new discoveries and the progress of research. NSF support may include construction, upgrades, operations, maintenance, and personnel needed to assist scientists and engineers in the conduct of research at such facilities. NSF consults with other agencies and international partners to avoid duplication and optimize capabilities for American researchers.

All of these investments enable NSF to meet its mission of promoting the progress of science, while responding specifically to direction in the NSF Act of 1950 to foster and support the development and use of computer and other scientific and engineering methods and technologies, primarily for research and education in the sciences and engineering.

FY 2006 Result: NSF achieved this goal. NSF is the only agency to invite an external advisory committee, the Advisory Committee for GPRA Performance Assessment (AC/GPA), to review its entire

portfolio as part of the agency GPRA assessment process. The AC/GPA determined that NSF has demonstrated significant achievement for each of the performance indicators associated with this goal.

Implications for the FY 2007 Performance Plan: This goal has been updated in NSF's new Strategic Plan for FY 2006-FY 2011.

Comments from the Advisory Committee for GPRA Performance Assessment (AC/GPA): The following statements are excerpted from the FY 2006 AC/GPA Report that may be found at www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06206. This report contains additional comments and examples in support of significant achievement for each indicator.

> To accomplish NSF's mission, NSF must not only invest in people and ideas, but it must also invest in the necessary TOOLS to support those people and ideas – so that the overall job can be accomplished both efficiently and effectively. The Committee's assessment for the TOOLS strategic outcome goal is that NSF has attained significant achievement in all indicators. The Committee also concluded that the projects contained in the TOOLS portfolio exhibited both high quality and high relevance.
>
> Based upon the Committee's findings, and as supported by the "nuggets" from various new and ongoing research projects and review of the many documents and resources made available to the Committee during the term of its review of NSF performance, the TOOLS subgroup has unanimously concluded that NSF has demonstrated both relevance and quality. The R&D programs under the TOOLS performance indicator are important investments and appropriate and deemed to be of very high quality. Based on evidence provided directly to the Committee, it was not possible to independently gauge overall "performance" because we were only provided with a sample of the best nuggets, not a representative sample of all work performed. However, our review of the COV reports, which did evaluate representative samples of all projects, indicates that performance was also excellent across the board. Our concerns in the indicator related to next generation facilities and platforms are discussed more fully below.
>
> The current NSF strategic plan for FY 2005 (2003 – 2008) dated September 30, 2003, is in place and includes a "GPRA Goal Structure" aimed at balancing expenditures for IDEAS, TOOLS, PEOPLE, and ORGANIZATIONAL EXCELLENCE. The amount budgeted for TOOLS, when compared to the needs for the other performance indicators set forth in the strategic plan, was 25% of the total NSF budget. During 2005, of the total NSF budget, which amounted to $5.4 billion, TOOLS equaled $1.375 billion. Thus, if expenditures can be used as a rough measure of performance, assuming expenditures were appropriately controlled, and we are confident they were, TOOLS expenditures met the performance goal in terms of allocation of resources. Alignment between strategic plan goal structure and FY 2005 expenditures was therefore achieved from a budget and expenditure standpoint.

In its recommendations to NSF, the AC/GPA suggested that NSF encourage more innovative, high risk or "bold" research, in addition to basic research, to balance the agency portfolio and enhance national competitiveness. Noting that it is important to balance innovation (converting knowledge into dollars) against basic research (converting dollars into knowledge), the Committee stated that "…the goal of supporting paradigm-shifting leading edge research, invention, and knowledge creation can remain a key part of the portfolio. However, the [Committee] recommends balancing the research portfolio to include more emphasis on innovation."

Recent Performance Highlights: The following are some results reported in FY 2006 by the science and engineering research and education community supported by NSF. These examples demonstrate NSF leadership in emerging science and engineering research frontiers and how new discoveries can benefit society and improve the quality of life for all citizens. Additional results may be found at www.nsf.gov/discoveries/.

NEES investigators at UCSD's Seven Story Test Model. *Credit: Prof. Jose Restrepo, Department of Structural Engineering, University of California at San Diego.*

► **Cost Effective and Earthquake Resistant:** By applying innovative, intelligent design strategies, structural engineers at the University of California, San Diego, have successfully shown that new light-weight construction techniques are as earthquake-resistant as bulkier, more expensive methods. By erecting a seven-story test building on a giant outdoor shake table – which is part of the NSF-supported Network for Earthquake Engineering Simulation (NEES) – the engineers duplicated the force of California's devastating 1994 Northridge Earthquake. Data from this test confirmed that novel designs and carefully placed reinforcements are just as effective at withstanding earthquake damage as the heavily reinforced, "hardened" buildings required by California building codes. Full-scale tests of such large buildings have previously not been possible because of weight, space, and technical limitations of smaller indoor shake tables. The NEES shake table at UCSD can actually support a building roughly 10 times heavier than the one tested in this study.

► **Gemini Telescopes Expand Their Capability:** The powerful suite of instruments within each of the Gemini telescopes now follow a queue system, making the structures the most flexibly scheduled ground-based telescopes ever.

Gemini South telescope at twilight. *Credit: Gemini Observatory.*

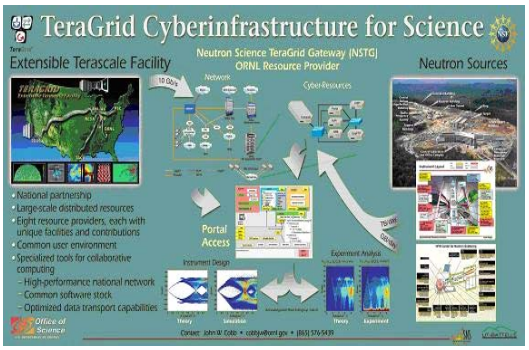
Each cluster of imaging and spectroscopic instruments permits Gemini scientists to observe over a remarkably broad spectrum, from the optical through the near-infrared and into the mid-infrared regions of the electromagnetic spectrum. Because of its technique of queue observing, Gemini can use any of these instruments at any point during a night, allowing observers to fine-tune their efforts to the nightly weather and sky conditions. Switching between instruments takes no longer than moving to a new target. This unique and powerful multi-instrument queue brings a new level of efficiency to Gemini operations.

► **Center for Remote Sensing of Ice Sheets:** A group of NSF-supported researchers at the Center for Remote Sensing of Ice Sheets (CReSIS) are developing new sensors, platforms, and cyberinfrastructure tools that will lead to a better understanding of Antarctic and Greenland ice sheets and how they contribute to sea level change. Because of the immense size and complexity of these ice sheets, data from satellite and airborne platforms, combined with ground-based measurements and observations, are needed to accurately assess them. One of the new radar-based sensors can produce a high-resolution map of layers within the ice, and has produced the first image of 3-km thick ice. The technological innovations will provide long-term benefits to the polar community and also have wide applications outside of the polar community.

Collecting data in Greenland. *Credit: CReSIS, University of Kansas.*

The tools being developed under CReSIS will lead to a better understanding of polar ice sheets and how they contribute to sea level change. Because of the immense size and complexity of these ice sheets, data from satellite and airborne platforms, combined with ground-based, in-situ measurements and observations, are needed to accurately assess their mass balance state. Technological innovations are being made in three areas, including sensors, platforms, and cyberinfrastructure. The next generation of researchers should reflect the diversity of our society. To this end, the Center is working closely with two minority-serving institutions, Haskell Indian Nations University in Lawrence, Kansas, and Elizabeth City State University in Elizabeth City, North Carolina. The Center is conducting extensive outreach and education programs to attract minority students to careers in science and technology.

► **Neutron Science Gateway:** Researchers at the Department of Energy's Oak Ridge National Laboratory and at NSF's TeraGrid project have developed the Neutron Science TeraGrid Gateway (NSTG), a Web-based "science community portal." Many such community portals have emerged in recent years as scientists have struggled to coordinate widely scattered teams working on massive experimental data sets. The idea is to provide a single point of access to all the data, as well as to the many types of data-analysis and simulation tools developed by the community as a whole.




Neutron Science Gateway. *Credit: John W. Cobb, ORNL.*

In the case of the NSTG portal, the data are currently coming from the High Flux Isotope Reactor at Oak Ridge, where scientists from around the United States are using neutron scattering to explore basic issues in chemistry, materials, nanotechnology, biosciences, and earth science. But eventually – and this has been the NSTG's primary purpose all along – the data will be coming from the DOE's much more powerful Spallation Neutron Source (SNS), now nearing completion in Oak Ridge. Scientists have already used the analysis and simulation tools available in NSTG to refine the design of an instrument planned for deployment on the SNS: a high resolution Chopper Spectrometer called Sequoia.

## Strategic Outcome Goal 3

***PEOPLE:* A diverse, competitive, and globally-engaged U.S. workforce of scientists, engineers, technologists, and well-prepared citizens.**

| FY 2002–FY 2006 Performance Results | | | | |
|---|---|---|---|---|
| FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 |
| G | G | G | G | G |
| ***Green (G) indicates success*** | | | | |

| Indicators | Results |
|---|---|
| NSF's performance is successful when, *in the aggregate*, results reported in the period FY 2006 demonstrate significant achievement in the majority of the relevant indicators:<br>▸ (Greater Diversity) Promote greater diversity in the science and engineering workforce through increased participation of underrepresented groups and institutions in all NSF programs and activities.<br>▸ (Global S&E Workforce) Support programs that attract and prepare U.S. students to be highly qualified members of the global S&E workforce, including providing opportunities for international study, collaborations and partnerships.<br>▸ (Continuous Learning) Develop the Nation's capability to provide K-12 and higher education faculty with opportunities for continuous learning and career development in science, technology, engineering, and mathematics.<br>▸ (Public Understanding of Science) Promote public understanding and appreciation of science, technology, engineering, and mathematics, and build bridges between formal and informal science education. | NSF has demonstrated significant achievement in all indicators. |

Leadership in today's knowledge economy requires world-class scientists and engineers and a national workforce that is scientifically, technically, and mathematically strong. Investments in *People* aim to improve the quality and reach of science, engineering, and mathematics education and enhance student achievement. Each year, NSF supports almost 200,000 people – teachers, students, and researchers at every educational level and across all disciplines in science and engineering. Embedded in all NSF programs are efforts to build a more inclusive, knowledgeable, and globally engaged workforce that fully reflects the strength of the nation's diverse population. Because science and engineering increasingly address global questions of significant societal importance, today's research requires globally-engaged investigators working collaboratively across agencies and international organizations to apply the results of research to long-standing global challenges.

FY 2006 Result: NSF achieved this goal. NSF is the only agency to invite an external advisory committee, the Advisory Committee for GPRA Performance Assessment (AC/GPA), to review its entire portfolio as part of the agency GPRA assessment process. The AC/GPA determined that NSF has demonstrated significant achievement for each of the performance indicators associated with this goal.

Implications for the FY 2007 Performance Plan: This goal has been updated in NSF's new Strategic Plan for FY 2006-FY 2011.

Comments from the Advisory Committee for GPRA Performance Assessment (AC/GPA): The following statements are excerpted from the FY 2006 AC/GPA Report that may be found at

www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06206. This report contains additional comments and examples in support of significant achievement for each indicator.

The NSF People Strategic Outcome Goal, which is to create "a diverse, competitive and globally-engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens," is central to ensuring that our nation continues to enjoy the high quality of life and security that this and previous generations worked so hard to create.

The Committee found significant achievement for each indicator established for the assessment. Based on the review of project accomplishments (nuggets), COV reports, and other relevant materials, the quality of projects and programs was determined to be high and relevant to the People Strategic Outcome Goal. Many of the projects reviewed have high relevance to the development of a strong workforce and to public understanding of science. Projects contributing to the People goal were found to include goals and accomplishments considered to be bold and at the frontiers of science, engineering, and education.

The Committee is concerned that focused investment in people occurs primarily in EHR. Our preliminary analysis indicates that programs in the science and engineering directorates specifically targeted at creating a diverse competitive and globally-engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens ranges from ~ two to 14% of the total budget. We would recommend that every directorate explore the potential for additional opportunities to contribute to NSF's workforce-for-the-21st-century goals.

Looking to the future, the Committee expressed concern about the direction of the workforce development that must be the cornerstone of the growth of science within the nation. NSF has been admirable in establishing a culture within which a growing number of underrepresented groups are included in the future of science. There is concern, however, that this inclusion often is limited to the first layer of response, namely, the mere number of people from these groups. As the need for a well developed workforce increases, greater efforts must be made to ensure true inclusion of all people and institutions. Partnerships with minority-serving institutions must be infrastructure and science partnerships, not solely external student research opportunities. Student training must be the right balance between rigor and exposure. Funding must have the appearance of a true meritocracy, where the ideas are more important than the institution in which one resides. Innovative science teaching models must not only be discussed and developed, but also implemented. The mission of NSF clearly establishes the goals of a diverse workforce in science. While we applaud NSF commitment to this goal and are very pleased in the programs established, we look forward in anticipation to the innovative and proactive solutions for which NSF is known, so that in the near future the need for specific diverse workforce programs will be eliminated.

We are heartened that NSF continues to recognize the importance of strengthening the STEM workforce by striving to attract more US citizens into STEM fields. Many youngsters have the impression, however, that they can earn better salaries in other fields, such as medicine, law, or business. We suggest that NSF collaborate with experts in marketing to mount or support more-aggressive campaigns that demonstrate not only the excitement of these careers but also the opportunity to earn lucrative salaries and advance into other careers as well.

In this context, we recommend strongly that NSF intensify efforts to identify, nurture, and develop the next generation of leaders of the STEM workforce, those who will provide the vision and set the agenda for the nation's future scientific, technological, and hence economic leadership, and the benefits to humankind that these will afford. Without leadership, the enterprise cannot go forward.

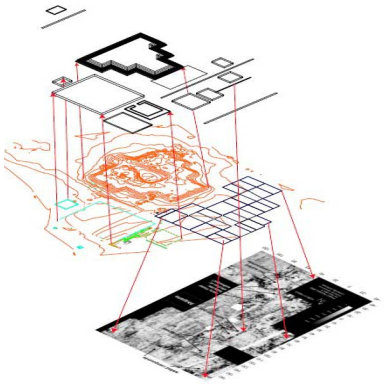
Recent Performance Highlights: The following are some results reported in FY 2006 by the science and engineering research and education community supported by NSF. These examples demonstrate NSF leadership in emerging science and engineering research frontiers and how new discoveries can benefit society and improve the quality of life for all citizens. Additional results may be found at www.nsf.gov/discoveries/.

► **Using "Squishy Materials" to Teach Physics:** Is peanut butter a liquid or a solid? At times it seems like a solid: a glob of peanut butter will hold its shape over a period of time. Over a longer time, however, it will flow like a liquid. Materials that behave in this manner are called complex fluids. Some of them change from solid-like to liquid-like, and vice versa, in response to changes in pressure. Many household items are examples, such as creams, shampoo, toothpaste, and ketchup. At Emory University, researchers study the physics of complex fluids to better understand their behavior. The group is interested in learning how a material's microscopic structure relates to its macroscopic behavior, such as determining how easy is it for a material to spread, flow, or compress – especially in confined spaces.

Postdoctoral fellow Dr. Denis Semwogerere shows a microscopic view of a squishy material. *Credit: Dr. Eric Weeks, Emory University.*

The Emory researchers have used activities involving "squishy materials" to interest schoolchildren in science. The laboratory has hosted groups from kindergarten through 8th grade, and children have the opportunity to study properties of these materials through age-appropriate hands-on activities. The excitement of doing physics research is conveyed to the children during these visits. The laboratory also has a popular website that contains extensive information on using complex fluids to teach freshman students (no matter which major they are pursuing) about current physics research while providing researchers particle tracking software and associated tutorials.

► **Computing and Mapping Archaeological Structures in Three Dimensions:** In a development that could change the way archaeologists conduct excavations, a multidisciplinary team of computer scientists and applied mathematicians has given them the ability to preview sites where the structures of interest are still underground. By precisely mapping the electric and magnetic fields at ground level on the site, and by simultaneously probing into the earth with a downward-looking radar system known as "Georadar," the researchers were able to precisely locate buried architectural and related features. The resulting data were used to produce subterranean atlases that cover several square kilometers in Tiwanaku, Bolivia, and Machu Picchu, Peru. Each atlas serves as an indication of where to dig and as a repository for comparing structures and studying differences in historical periods.



Computer scientists have produced detailed underground atlases of archaeologically significant sites. *Credit: University of Pennsylvania and University of Arkansas, 2005.*

A team of undergraduate students was also active in the project. Students from the University of Pennsylvania, the University of Arkansas, and Denver University spent two months at the research sites.

► **Marine Advanced Technology Education Center Organizes Remotely Operated Vehicle Competition for Students:** In June 2005, students from around the United States gathered at the NASA Johnson Space Center's Neutral Buoyancy Lab for the fourth annual international Student Remotely Operated Vehicle (ROV) competition.

The competition is coordinated every year by the Marine Advanced Technology Education (MATE) Center at Monterey Peninsular College in Monterey, Calif., and the Marine Technology Society's ROV Committee. MATE is an NSF-funded Advanced Technological Education Center of Excellence.


The Polar Submersibles ROV team gets wet in a practice session in Fairbanks, Alaska. *Credit: Patrick Endres.*

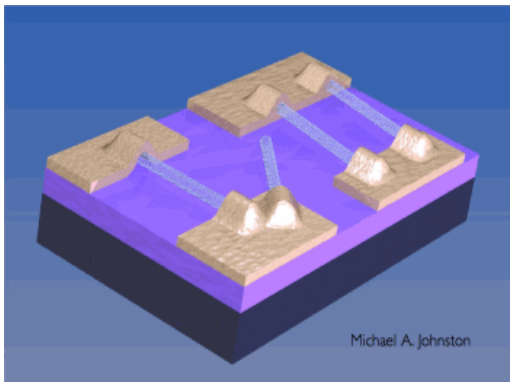
More than 2,000 students, from middle schoolers to college seniors, have participated in the competition since it began in 2001. Currently more than 60 organizations and 70 industry professionals support the events by contributing funds, facilities, equipment, building materials, and time and technical expertise as team mentors, judges, and technical advisors. The MATE center is partnering with the National Office for Integrated and Sustained Ocean Observations and the Ocean Research Interactive Observatory Networks (ORION) Program to challenge teams to develop ROVs to support ocean-observing systems in the 2006 competition.

► **Silicon Chips With Nanotube "Sprinkles" Show Promise for Electronics:** University of Pennsylvania's Danvers Johnston, a student in NSF-supported Integrative Graduate Education and Research Traineeship program, and his advisor, physicist Charlie Johnson, have developed a new method of depositing carbon nanotubes on the surface a silicon chip – a technique that could help pave the way toward high-quality nanoelectronic devices.

First, the scientists suspend the raw nanotube material in water, explains Johnston. And then, he says, "We dip the chips into nanotubes, much like dipping an ice cream cone in candy." Tests on the chip show the nanotubes that cling to its surface retain their unique electronic properties.

Even though commercial use of carbon nanotubes in electronics is probably a decade away, the technique opens the door for other solution-based methods that could one day be used to sort the nanotubes and select those that exhibit desired properties.

Illustration of an electronic circuit produced by Johnston *et al's* method. Carbon nanotubes connect gold contact pads across a silicon surface. *Credit: Yury Gogotsi and Dawn Bonnell.*



## Strategic Outcome Goal 4

***ORGANIATIONAL EXCELLENCE:** An agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices.*

| FY 2002–FY 2006 Performance Results | | | | |
|---|---|---|---|---|
| FY 2002 | FY 2003 | FY 2004 | FY 2005 | FY 2006 |
| G | G | G | G | G |
| ***Green (G) indicates success*** | | | | |

| Indicators | Results |
|---|---|
| NSF's performance is successful when, *in the aggregate*, results reported in the period FY 2006 demonstrate significant achievement in the majority of the relevant indicators:<br>▸ Human Capital Management--develop a diverse, capable, motivated staff that operates with efficiency and integrity.<br>▸ Technology-enabled Business Process--utilize and sustain broad access to new and emerging technologies for business application.<br>▸ Performance Assessment--develop and use performance assessment tools and measures to provide an environment of continuous improvement in NSF's intellectual investments as well as its management effectiveness.<br>▸ Merit Review--operate a credible, efficient merit review system. | NSF has demonstrated significant achievement in all indicators. |

Excellence in managing NSF's activities is critical to achievement of NSF's mission-oriented outcome goals. Long-term investment categories include *human capital*, which produces a diverse, agile, results-oriented cadre of knowledge workers committed to enabling the agency's mission and to constantly expanding their abilities to shape the agency's future; *business processes*, which produce effective, efficient, strategically-aligned business processes that integrate and capitalize on the agency's human capital and technology resources; and *technologies and tools*, which produce flexible, reliable, state-of-the-art business tools and technologies designed to support the agency's mission, business processes, and customers.

FY 2006 Result: NSF achieved this goal. External experts provided examples of significant achievement during FY 2006. See the comments by the AC/GPA and the examples they selected as indicative of achievement of this goal.

Implications for the FY 2007 Performance Plan: This goal has been updated in NSF's new Strategic Plan for FY 2006-FY 2011.

Comments from the Advisory Committee for GPRA Performance Assessment (AC/GPA): The following statements on *the Organizational Excellence* goal, which take into account the findings of the Advisory Committee for Business and Operations (AC/B&O), are excerpted from the FY 2006 AC/GPA Report. This report contains additional comments and examples in support of significant achievement for each indicator; see www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf06206.

> The OE strategic outcome goal was added to the NSF Strategic Plan for FY 2003-2008 and helped to recognize the linkages between excellence in advancing science and excellence in organizational development. NSF's merit review process is the keystone for award selection,

through which NSF achieves its goals. All proposals for research and education projects are evaluated using two criteria: the intellectual merit of the proposed activity and its broader impacts. Specifically addressed in these criteria are the creativity and originality of the idea, the development of human resources, and the potential impact on the research and education infrastructure. Ensuring a credible, efficient system requires constant attention and openness to change.

The Advisory Committee for Business and Operations (AC/B&O) provides an assessment of the first three OE indicators (Human Capital, Technology-enabled Business Processes, and Performance Assessment), and the AC/GPA conducts an assessment of the Merit Review indicator. To perform this latter assessment, the 2006 AC/GPA used data and information from the:

- 2005 Committee of Visitors reports addressing Merit Review and Organizational Excellence
- 2005 Report to the National Science Board on the National Science Foundation's Merit Review Process (NSB-06-21)
- 2005 Report of the National Science Board on the National Science Foundation's Merit Review System (NSB-05-119)
- 2006 AC/B&O Assessment

Overall Findings: In conjunction with the findings of the AC/B&O and our own review of the Merit Review indicator, the OE subgroup concludes that the NSF has demonstrated significant achievement and quality in all four indicators of *Organizational Excellence*.

Overview (including highlights taken from the Report to the NSB on the NSF Merit Review Process): The merit review system is highly effective, trusted, and respected by participants within the science community. The process is thorough and has well-designed contingencies for handling non-procedural issues and allows for continuous improvement. This is indeed an impressive accomplishment given the heterogeneity of the NSF portfolio (single investigator grants, center grants, facilities/research infrastructure grants) and the diversity of peer review mechanisms (mail review only, panel review only, combination of mail and panel review, combination of mail and site visit review, inter-division and directorate review, etc.). It is even more impressive given that proposal pressure has increased by 38% from 2001 to 2004 (in 2005 a slight decrease in proposal number occurred) leading to a declining success rate (33 % in 2000 to 23% in 2005). Despite severe budget constraints over the past five years, NSF has maintained an excellent and diverse program balance including single investigator grants, multi-investigator grants, center grants, and facilities grants and grants that promote high risk/high payoff "potentially transformative" grants. This success of this last category reflects the high quality of scientific knowledge and judgment of program managers and the Directorate/Division leaders. Statistically, there is no evidence of demographic bias in the award of grants during the period 2000-2005, which is an important result. The falling success rate is of concern, although the rate of decline is less for new awards (8%) than for those who have had prior awards (12%). Another important point is the percentages of standard grants and center/facilities/other grants have not changed significantly (2%) over the past five years. It is difficult to measure efficiency given that expected outcomes are generalized in solicitations, reports, and strategic goals.

The AC/GPA recommendations on *Organizational Excellence* focus on improving the reviewer management system, particularly with regard to reviewer and program officer training; the merit review

criteria, particularly explaining more clearly the broader impacts criterion; reducing program officer workload; and program officer training in general.

Recent Performance Highlights: The following are some of the results and achievements reported in FY 2006, which demonstrate NSF leadership in continuous improvement in the area of *Organizational Excellence*.

In the 2006 NSF Report to Employees, the Director and Deputy Director noted that NSF is recognized throughout the federal government as a leader for implementing outstanding results-oriented management practices and establishing collaborative partnerships with the scientific and federal communities. Among the accomplishments cited in this report are:

- NSF continues to maintain "Green" ratings for excellent management practices. NSF has sustained a "Green" rating for financial performance and eGov on the President's Management Agenda (PMA) scorecard for over four years. In FY 2006, NSF was only one of three federal agencies to achieve four or more "Green" ratings in the five primary PMA initiatives. NSF has also achieved "Green" ratings for its two PMA programmatic initiatives of Eliminating Improper Payments and R&D Investment Criteria.

- NSF received its eighth consecutive unqualified "clean" audit opinion.

- In both the Department of Treasury's Financial Management Service Scorecard and the CFO Council Metric Tracking System which tracks core financial metrics, NSF continued to have the most consistently high scores among all federal agencies.

- NSF is the only agency to receive the highest rating of "Effective" in all of its Program Assessment Rating Tool (PART) program evaluations from OMB.

- NSF received an "A" grade in the House Committee on Government Reforms study of 24 agencies' security practices.

- After NSF co-chaired the Grants Management Line of business (GMLoB) task force, OMB selected NSF as one of the initial three consortia leads.

- NSF's was awarded a Webby Award in a competition that Time Magazine calls the "online Oscars." NSF's website was named the "People's Choice" among the best government websites.

- NSF's *FY 2005 Performance Highlights* report received a League of American Communications Professionals (LACP) Honors Award at the 2005 Vision Awards. In a field of almost 2,000 entrants, NSF placed in the top 15 percent, and had the distinction of being the only federal government agency to be recognized for five years of distinction in its annual reports.

- NSF implemented AcademyLearn, a web-based learning management system to increase workforce productivity and aid in agency operations. AcademyLearn gives all employees access to approximately 2,000 professional and personal development online courses and provides proprietary e-business online tutorials.

## ANNUAL PERFORMANCE GOALS

NSF has integrated its GPRA reporting with the Program Assessment Rating Tool (PART) evaluation process designed by the Office of Management and Budget (OMB). NSF's annual performance goals consist of the performance measures associated with NSF's PART programs and an agency-wide efficiency goal related to time-to-decision on funding recommendations. The FY 2006 annual performance goals consist of nine new goals and 13 goals reported in previous years. Those nine new goals are associated the following PART programs: Polar Research Support, Tools, and Logistics; the Institutions and Collaborations programs under the *People* strategic outcome goal; and Biocomplexity in the Environment.

The PART process has become a central component of NSF's performance framework. The PART examines program performance through a series of questions on program purpose and design, strategic planning, program management, and program results/accountability. After a program has been evaluated, follow-up actions or improvement plans are established, and the agency reports on its progress under those plans. NSF's PART evaluations were conducted on the investment categories identified in the FY 2003 – FY 2008 Strategic Plan.

To date, of the nearly 800 PART programs that have been evaluated across federal agencies, only 15 percent received the highest rating of "Effective." All 10 NSF programs have received the highest rating of "Effective." Summaries, detailed assessments, and improvement plans of NSF's PART programs may be found at www.whitehouse.gov/omb/expectmore/index.html.

The improvement plans associated with NSF's PART programs focus on performance goals and reporting, the merit review process, and yearly project reports by principal investigators. In the past year, NSF has made changes to its FastLane project reports tracking system to provide notification to all investigators that annual reports are due 90 days in advance of the 12-month anniversary date or expiration date of the award. NSF has also convened focus groups and gathered recommendations on improvements to the merit review system.

In FY 2006, NSF achieved 68 percent or 15 of its 22 annual performance goals. All time-to-decision goals were met, including the Foundation-wide goal and those for Individual Researcher, Research Institutions, and Research Collaborations under the *People* goal; and the two priority areas of Nanoscale Science and Engineering and Biocomplexity in the Environment (BE). NSF met two important *People* goals: increasing the number of graduate students supported in the Foundation's three flagship programs—Graduate Research Fellowships (GRF), Integrative Graduate Education and Research Traineeships (IGERT), and the Graduate Teaching Fellows in K-12 Education (GK-12) Program; and increasing the number of applications from investigators at minority serving institutions for the Faculty Early Career Development (CAREER) Awards program. In addition, NSF met the facilities operations goal, as well as the Polar research support goal.

NSF did not meet three of its goals under *People*: increasing the number of applicants for the GRF Program from groups that are underrepresented in the science and engineering workforce, and increasing the number of proposals from academic institutions not in the top 100 of NSF funding recipients for the Research Institutions and Research Collaborations programs. NSF did not meet its goals for increasing the percentage of proposals from female and minority investigators in the BE Program. In addition, NSF did not meet the goal for facilities construction, acquisition, and upgrade, and the goal for Polar research facilities cost and schedule variance.

With reference to goals not met, it is important to point out the following:

- For the Graduate Fellowships Broadening Participation goal, although the number of applicants from groups that are underrepresented in the science and engineering workforce did not increase, the percentage of applicants from those groups did increase in FY 2006.

- For the goals relating to increasing the percentage of proposals to the Research Institutions and Research Collaborations programs from academic institutions not in the top 100 of NSF funding recipients, the goal is ambitious, given the conflicting demand to decrease the number of program solicitations for research opportunities in an attempt to improve the NSF-wide funding rate for proposals. In addition, there is a lag time between taking action to increase broadening participation, for example through outreach, and receiving proposals at NSF.

- For the BE goals related to proposals from female and minority investigators, there are special circumstances. For example, since only two of the five BE programs (in the engineering and geosciences areas) requested proposals during FY 2006, the drop in percentage of proposals from female and minority investigators was not unexpected.

- For the facilities construction goal, only 3 of the 11 projects did not meet the goal, due primarily to changes in scope and schedules and unplanned costs. Action on these issues will be taken during future rebaselining of project performance measurements.

- For the Polar research facilities goal, the South Pole Station Modernization (SPSM) is reporting against cost and schedule baselines that will be revised when NSF receives its FY 2007 appropriation. The McMurdo Power Plant will also be rebaselined in the coming months. Once rebaselined, the cost and schedule performance for these projects will improve, resulting in lower variances than those reported for FY 2006.

NSF plans to address these factors and will continue to report progress in achieving the goals in the future. With regard to the PART programs, NSF's improvement plans are updated twice yearly in the spring and fall. As noted on the previous page, these PART improvement plans are available at www.whitehouse.gov/omb/expectmore/index.html.

A summary of FY 2006 results is presented in the following chart.

**FY 2002 – FY 2006 Performance Results**
Number and Percent of Goals Achieved

| | FY 2002 | FY 2003 | FY 2004 | FY 2005 | **FY 2006** |
|---|---|---|---|---|---|
| Annual performance goals | 14 of 19 (74%) | 10 of 16 (63%) | 23 of 26 (88%) | 14 of 17 (82%) | **15 of 22 (68%)** |

A detailed explanation of the FY 2006 result for each annual performance goal follows, with information on the PART Program to which it is related if appropriate, the specific measure and its purpose, and the implications for NSF's FY 2007 performance plan. If the goal was not achieved, an explanation is provided, along with statements about actions being taken to eliminate or reduce shortfalls in the future.

| Results of FY 2006 Annual Performance Goals:<br>15 of 22 Goals (68%) Were Achieved | |
|---|---|
| ● | 1. Time-to-Decision |
| ■ | 2. Facilities Construction, Acquisition, and Upgrades |
| ● | 3. Facilities Operation and Management |
| ● | 4. Polar Research Support |
| ■ | 5. Polar Research Facilities |
| ■ | 6. Graduate Fellowships: Broadening Participation |
| ● | 7. CAREER Awards: Broadening Participation |
| ● | 8. U.S. Students Receiving Fellowships |
| ● | 9. Individual Researchers: Time-to-Decision |
| ■ | 10. Research Institutions: Proposals From Outside the Top 100 Institutions NSF Funds |
| ● | 11. Research Institutions: Time-to-Decision |
| ■ | 12. Research Collaborations: Proposals From Outside the Top 100 Institutions NSF Funds |
| ● | 13. Research Collaborations: Time-to-Decision |
| ● | 14. Nanotechnology Network Users |
| ● | 15. Nanotechnology Network Nodes |
| ● | 16. Nanoscale Science and Engineering: Time-to-Decision |
| ● | 17. Nanoscale Science & Engineering: Proposals with Female Investigators |
| ● | 18. Nanoscale Science & Engineering: Proposals with Minority Investigators |
| ● | 19. Nanoscale Science & Engineering: Proposals with Multiple Investigators |
| ■ | 20. Biocomplexity in the Environment: Proposals with Female Investigators |
| ■ | 21. Biocomplexity in the Environment: Proposals with Minority Investigators |
| ● | 22. Biocomplexity in the Environment: Time-to-Decision |
| Key: | |
| ● | Achieved goal |
| ■ | Did not achieve goal |

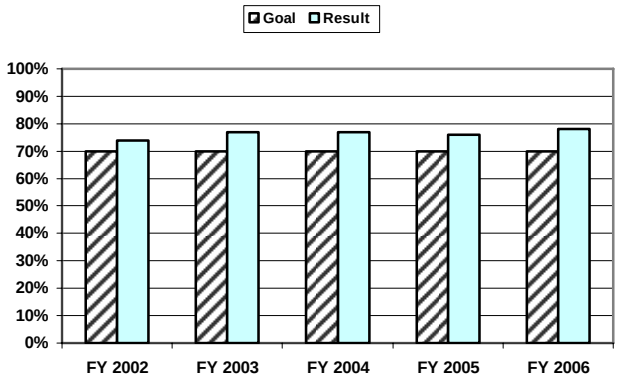
## ANNUAL PERFORMANCE GOAL1: TIME-TO-DECISION (DWELL TIME)

**Measure:** For 70 percent of proposals, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or receipt date, whichever is later.

**Purpose:** To make proposal decisions available in a timely manner in order that investigators may more effectively plan activities.

**FY 2006 Result:** NSF achieved this goal. Considering the complexity and numbers of proposals received by NSF and the relative constancy of the number of staff to handle the review and recommendation of proposals, this is an ambitious goal for NSF as a whole, as it is increasingly difficult to maintain dwell time while performing quality merit review. This measure is a proxy for efficiency.

| | Goal | Result |
|---|---|---|
| FY 2002 | 70% | 74% |
| FY 2003 | 70% | 77% |
| FY 2004 | 70% | 77% |
| FY 2005 | 70% | 76% |
| FY 2006 | 70% | 78% |




**Implications For The FY 2007 Performance Plan:**
This goal will be continued in FY 2007.

## ANNUAL PERFORMANCE GOAL 2:
## FACILITIES CONSTRUCTION, ACQUISITION, AND UPGRADES

**PART Program:** Construction and Operations of Research Facilities
**PART ID:** 10001145

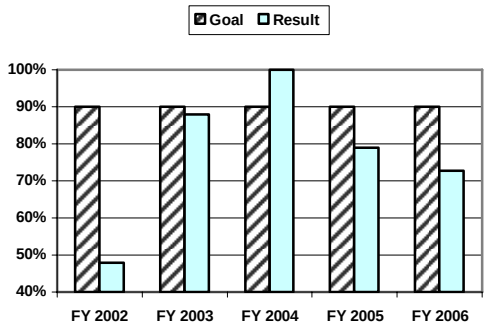
**Measure:** Percent of Construction, Acquisition, and Upgrade Projects with Negative Cost and Schedule Variances of Less Than 10 percent of the Approved Project Plan.

**Purpose:** To keep construction, acquisition, and upgrade project on time and within budget.

This measure reflects investments in the construction, acquisition, and upgrade of NSF-funded facilities. Investments in development and construction of state-of-the-art facilities and platforms are implemented consistently with planned cost and schedule. In FY 2002, NSF undertook a comprehensive internal review of the facilities goals. In FY 2003, NSF improved the construction goals by combining cost and schedule performance into a single goal. The revised goal assesses performance based on Earned Value Management, a widely accepted project management tool for measuring progress that recognizes that cost or schedule data alone can lead to distorted perceptions of performance. Beginning in FY 2004, Polar facilities were included in a separate Program Assessment Rating Tool (PART) evaluation and are not included under this goal for Facilities.

**FY 2006 Result:** NSF did not achieve this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | 90% | 48% |
| FY 2003 | 90% | 88% |
| FY 2004 | 90% | 100% |
| FY 2005 | 90% | 79% |
| FY 2006 | 90% | 73% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

**Why We Did Not Meet This Goal:** Three of the 11 construction projects did not meet this goal. One of the projects did not meet the *cost* goal due to scope and schedule changes and unplanned costs. Two of the projects did not meet the *schedule* goal: one due to errors in time distribution on the project, and the other principally due to deferral of some equipment purchases, in order to manage risk, until firm pricing for all project activities could be established. NSF will continue to work with project managers to help avoid obstacles to successful performance by requiring all projects funded by the Major Research Equipment and Facilities Construction appropriation to provide quarterly financial reports comparing budgeted expenditures to actual expenditures.

## ANNUAL PERFORMANCE GOAL 3:
## FACILITIES OPERATION AND MANAGEMENT

**PART Program:** Construction and Operations of Research Facilities
**PART ID:** 10001145

**Measure:** Percent of Operational Facilities that keep Scheduled Operating Time Lost to Less than 10 percent.

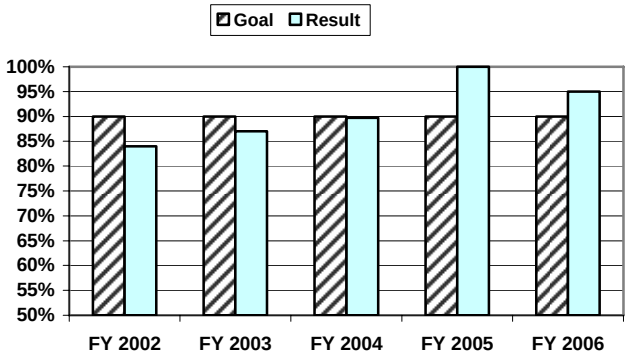
**Purpose:** To minimize lost operating time at NSF-funded facilities.

This measure reflects investments in the operation of state-of-the-art facilities and platforms. A modern and effective research infrastructure is critical to maintaining U.S. leadership in science and engineering. The future success of entire fields of research depends upon their access to new generations of powerful research tools. Increasingly, these tools are large and complex, and have a significant information technology component.

To provide the flexibility necessary for NSF to report realistic goals for operational large facilities, the level of success is maintained at 90 percent of those facilities. Beginning in FY 2005, the threshold for reporting was raised to $8 million per year, to provide consistent definitions of "large facilities." After several years of tracking this goal, it appears that facility managers are improving their ability to estimate and perhaps mitigate against unscheduled downtime.

**FY 2006 Result:** NSF achieved this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | 90% | 84% |
| FY 2003 | 90% | 87% |
| FY 2004 | 90% | 90% |
| FY 2005 | 90% | 100% |
| FY 2006 | 90% | 95% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 4:
## POLAR RESEARCH SUPPORT

**PART Program:** Polar Research Tools, Facilities and Logistics
**PART ID:** 10002326

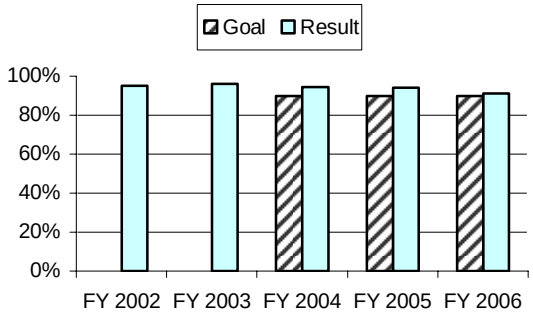
**Measure:** Percent of person (or project) days planned for Antarctic research for which the program is able to provide the necessary research support. (NEW GOAL FOR FY 2006)

**Purpose:** To maximize PI research time while on location in Antarctica.

This measure accounts for the number of days that the investigator was able to conduct research at the South Pole Station because the necessary research support was provided. It excludes research conducted off site in preparation for deployment to the Pole and lost time due to circumstances beyond the program's control (e.g. severe weather). Research support for the 181 current projects includes lab operation; facilities engineering, maintenance, and construction; communications operations; remote field camp support; cargo and passenger transportation; and housing management and janitorial services. This measure is a proxy for efficiency and compares results to original estimates.

**FY 2006 Result:** NSF achieved this goal. Research support data is compiled by the primary support contractor, Raytheon Polar Services Company (RPSC), based on post-trip surveys completed by investigators. In FY 2006, since only 52 principal investigators, or 29 percent, submitted surveys, RPSC extrapolated across the total project population to report results.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 95% |
| FY 2003 | N/A | 96% |
| FY 2004 | 90% | 94% |
| FY 2005 | 90% | 94% |
| FY 2006 | 90% | 91% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 5: POLAR RESEARCH FACILITIES

**PART Program:** Polar Research Tools, Facilities and Logistics
**PART ID:** 10002326

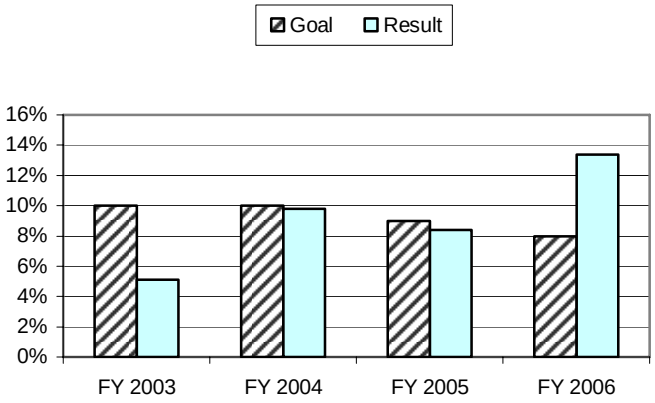
**Measure:** Percent of construction cost and schedule variances of major projects as monitored by Earned Value Management for Polar Facilities. (NEW GOAL FOR FY 2006)

**Purpose:** To keep polar construction projects on time and within budget.

This is a measure against planned cost and schedule for construction projects with a total project cost of at least $5 million. The result is an average of cost and schedule variances.

**FY 2006 Result:** NSF did not achieve this goal.

| | Goal | Result |
|---|---|---|
| FY 2003 | 10% | 5% |
| FY 2004 | 10% | 10% |
| FY 2005 | 9% | 8% |
| FY 2006 | 8% | 13% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

**Why We Did Not Meet This Goal:** Two of the three Polar facilities projects did not meet this goal. One was due to reporting against an outdated cost and schedule baseline that will be revised when NSF receives its FY 2007 appropriation. The other was due to unplanned work (redesign of footing installation, reworking of the foundation, and resetting of the generators due to unforeseen site conditions) that caused cost increases and schedule delays. Once re-baselined, the cost and schedule performance for these projects will improve, resulting in lower variances than those reported for FY 2006.

## ANNUAL PERFORMANCE GOAL 6:
## GRADUATE FELLOWSHIPS: BROADENING PARTICIPATION

**PART Program:** Support for Individual Researchers
**PART ID:** 10001148

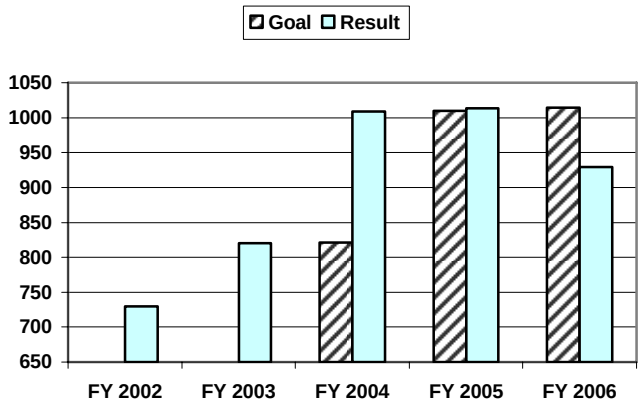
**Measure:** Number of applicants for the Graduate Research Fellowships Program (GRFP) from groups that are underrepresented in the science and engineering workforce.

**Purpose:** To increase the number of minority and/or underrepresented applicants submitting GRF proposals and to broaden participation in NSF STEM programs.

Graduate Research Fellowships are NSF's flagship investment in graduate education and training, and outreach efforts to increase the number of applicants from groups that are underrepresented in the science and engineering workforce are an ongoing priority within the Foundation. As with all demographic goals, the data come from voluntary self-reporting. Therefore, the number of applicants from underrepresented groups may actually be higher.

**FY 2006 Result:** NSF did not achieve this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 730 |
| FY 2003 | N/A | 820 |
| FY 2004 | 821 | 1009 |
| FY 2005 | 1010 | 1013 |
| FY 2006 | 1014 | 929 |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

**Why We Did Not Meet This Goal:** Although the number of applicants from groups that are underrepresented in the science and engineering workforce did not increase from FY 2005 to FY 2006, the percentage of applicants did increase. In FY 2005, NSF received 9,133 applications, of which 1,013, or 11.09 percent were from groups that are underrepresented in the science and engineering workforce. In FY 2006, the number of applicants was only 8,162, of which 929, or 11.38 percent, were from those groups. There was a surge of applicants following the increase of the stipend to $30,000 in FY 2004, which lowered the success rate. The FY 2006 data suggest a decline in the number of applicants that is consistent with the community's awareness of the reduced success rate for this program. These trends are mirrored in the underrepresented populations. NSF will continue to encourage proposals from these groups.

## ANNUAL PERFORMANCE GOAL 7:
## CAREER AWARDS: BROADENING PARTICIPATION

**PART Program:** Support for Individual Researchers
**PART ID:** 10001148

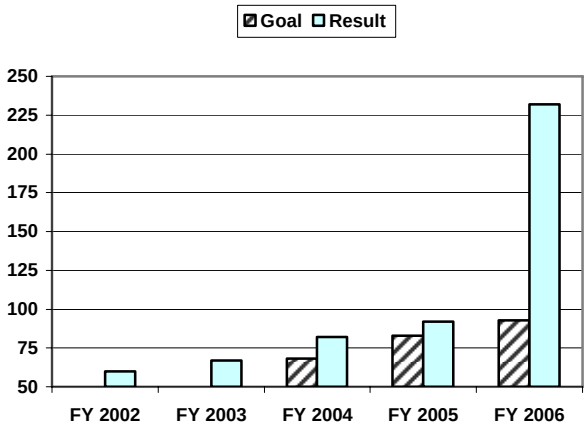
**Measure:** Number of applications for Faculty Early Career Development (CAREER) awards from investigators at minority serving institutions (MSIs).

**Purpose:** To develop and foster young faculty and to broaden the institutional base of applicants at MSIs.

The Faculty Early Career Development (CAREER) Program is an NSF-wide activity that supports junior faculty within the context of their overall career development. It combines in a single program the support of research and education of the highest quality and in the broadest sense. This premier program emphasizes the importance the Foundation places on the early development of academic careers dedicated to stimulating the discovery process in which the excitement of research is enhanced by inspired teaching and enthusiastic learning. Each year NSF selects nominees for Presidential Early Career Awards for Scientists and Engineers (PECASE) from among the first-year awardees supported by the CAREER Program. PECASE awards recognize outstanding scientists and engineers who are in the early stages in their careers, and show exceptional potential for leadership at the frontiers of knowledge. CAREER is NSF's flagship investment in the development of young faculty, and broadening the institutional base of applicants to the program is a continuing priority. Outreach efforts have specifically focused on attracting faculty from minority-serving institutions and from a broader geographic base.

**FY 2006 Result:** NSF achieved this goal. The dramatic rise in the number of applications may be due to an updating in FY 2006 of the list of minority serving institutions based on Department of Education data cross-referenced with NSF institution registrations. During that process, several institutions were added or dropped, with the net result that 119 more institutions were counted as MSIs in FY 2006. An MSI is defined as a Historically Black College and University (HBCU), a Hispanic-serving institution, or a Tribal College.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 60 |
| FY 2003 | N/A | 67 |
| FY 2004 | 68 | 82 |
| FY 2005 | 83 | 92 |
| FY 2006 | 93 | 232 |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 8:
## U.S. STUDENTS RECEIVING FELLOWSHIPS

**PART Program:** Support for Individual Researchers
**PART ID:** 10001148

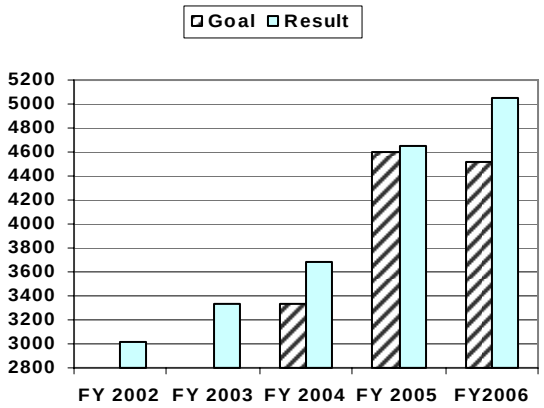
**Measure:** Number of graduate students funded through fellowships or traineeships from Graduate Research Fellowships (GRF), Integrative Graduate Education and Research Traineeships (IGERT), and Graduate Teaching Fellows in K-12 Education (GK-12).

**Purpose:** To increase the amount of graduate student support through three principal programs: GRF, IGERT, and GK-12.

The **Graduate Research Fellowship (GRF) Program** provides three years of support for graduate study leading to research-based master's or doctoral degrees and is intended for students at the early stages of their graduate study. The program invests in graduate education for a cadre of diverse individuals who demonstrate their potential to successfully complete graduate degree programs in disciplines relevant to NSF's mission. The **Integrative Graduate Education and Research Traineeship (IGERT) program** aims to educate U.S. Ph.D. scientists and engineers who will pursue careers in research and education, with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become, in their own careers, leaders and creative agents for change. The program establishes innovative new models for graduate education and training that transcends traditional disciplinary boundaries. It also facilitates diversity in student participation and preparation, and contributes to the development of a diverse, globally-engaged S&E workforce. The **Graduate Teaching Fellows in K-12 Education (GK-12) program** provides funding to graduate students in science, technology, engineering, and mathematics (STEM) disciplines to acquire additional skills to prepare them for professional and scientific careers in the 21st century. Through interactions with teachers in K-12 schools, graduate students can improve communication and teaching skills while enriching STEM instruction in K-12 schools.

**FY 2006 Result:** NSF achieved this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 3011 |
| FY 2003 | N/A | 3328 |
| FY 2004 | increase | 3681 |
| FY 2005 | 4600 | 4648 |
| *FY 2006 | 4525 | 5049 |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

* The FY 2006 number is revised from the FY 2006 Congressional Budget Request to report only graduate students directly funded. Previous results included all students participating in the GK-12 program.

## ANNUAL PERFORMANCE GOAL 9:
## INDIVIDUAL RESEARCHERS: TIME-TO-DECISION

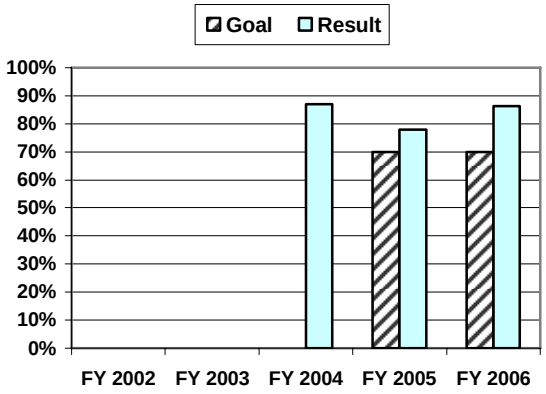
**PART Program:** Support for Individual Researchers
**PART ID:** 10001148

**Measure:** For 70 percent of proposals submitted to the Individuals Program, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or target date, or receipt date, while maintaining a credible and efficient merit review system, as evaluated by external experts. (NEW GOAL FOR FY 2006)

**Purpose:** To make proposal decisions available in a timely manner in order that investigators may more effectively plan activities.

**FY 2006 Result:** NSF achieved this goal. Considering the complexity and numbers of proposals coming into NSF, and the relative constancy of the number of staff to handle the review and recommendation of proposals, the goal is ambitious for the Foundation as a whole, as well as for the Individual Researchers PART Program, as it is increasingly difficult to maintain dwell time while performing quality merit review. This measure is a proxy for efficiency.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | N/A |
| FY 2003 | N/A | N/A |
| FY 2004 | N/A | 87% |
| FY 2005 | 70% | 78% |
| FY 2006 | 70% | 86% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 10:
## RESEARCH INSTITUTIONS: PROPOSALS FROM OUTSIDE THE TOP 100 INSTITUTIONS NSF FUNDS

**PART Program:** Support for Research Institutions
**PART ID:** 10002324

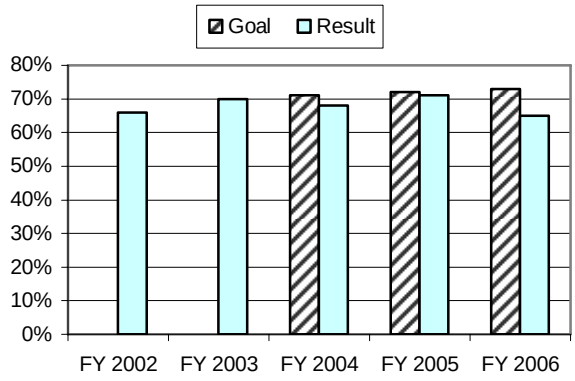
**Measure:** Percent of Research Institutions proposals received from academic institutions not in the top 100 of NSF funding recipients. (NEW GOAL FOR FY2006)

**Purpose:** To broaden participation by proposing institutions.

The top 100 NSF funded recipients are determined by calculating the total dollar amount of the Foundation's obligation to each institution. This list is then restricted to those recipients that have been identified as academic institutions. Finally, the list is ranked according to the dollar amount of the Foundation's obligation and the academic institutions.

**FY 2006 Result:** NSF did not achieve this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 66% |
| FY 2003 | N/A | 70% |
| FY 2004 | 71% | 68% |
| FY 2005 | 72% | 71% |
| FY 2006 | 73% | 65% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

**Why We Did Not Meet This Goal: This** goal was adopted in FY 2004 for the Research Institutions PART Program. The goal is ambitious, and it was made more challenging by the recent agency-wide effort to decrease the number of program solicitations for research opportunities in an attempt to improve the NSF-wide funding rate for proposals. There is also a lag time between taking action to increase broadening participation (e.g. through outreach) and receiving proposals. NSF will continue its efforts to encourage proposals from investigators at academic institutions not in the top 100 of NSF funding recipients.

## ANNUAL PERFORMANCE GOAL 11:
## RESEARCH INSTITUTIONS: TIME-TO-DECISION

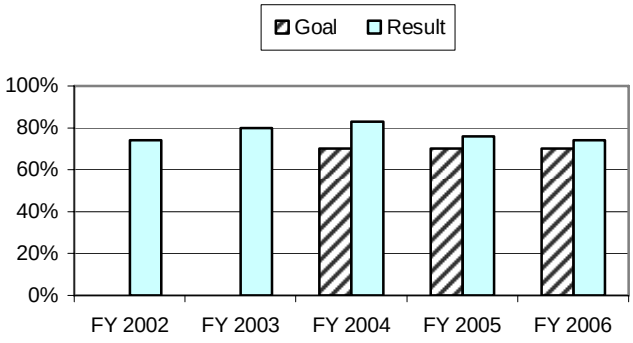
**PART Program:** Support for Research Institutions
**PART ID:** 10002324

**Measure:** For 70 percent of proposals submitted to the Research Institutions Program, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or target date, or receipt date, while maintaining a credible and efficient merit review system, as evaluated by external experts. (NEW GOAL FOR FY 2006)

**Purpose:** To make proposal decisions available in a timely manner in order that investigators may more effectively plan activities.

**FY 2006 Result:** NSF achieved this goal. Considering the complexity and numbers of proposals coming into NSF, and the relative constancy of the number of staff to handle the review and recommendation of proposals, the goal is ambitious for NSF as a whole, as well as for the Research Institutions PART Program, as it is increasingly difficult to maintain dwell time while performing quality merit review. This measure is a proxy for efficiency.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 74% |
| FY 2003 | N/A | 80% |
| FY 2004 | 80% | 83% |
| FY 2005 | 70% | 76% |
| FY 2006 | 70% | 74% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 12:
## RESEARCH COLLABORATIONS: PROPOSALS FROM OUTSIDE THE TOP 100 INSTITUTIONS NSF FUNDS

**PART Program:** Support for Small Research Collaborations
**PART ID:** 10002322

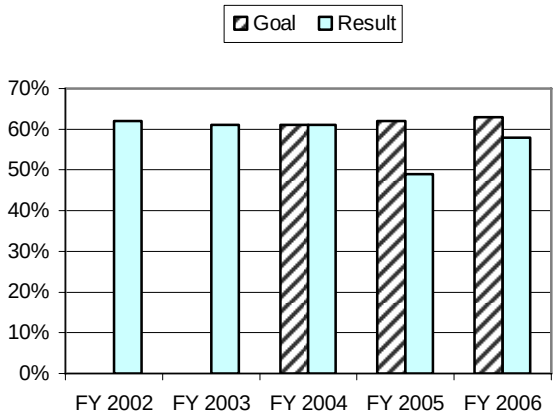
**Measure:** Percentage of Research Collaborations proposals received from academic institutions not in the top 100 of NSF funding recipients. (NEW GOAL FOR FY 2006)

**Purpose:** To broaden participation by proposing institutions.

The top 100 NSF funded recipients are determined by calculating the total dollar amount of the Foundation's obligation to each institution. This list is then restricted to those recipients that have been identified as academic institutions. Finally, the list is ranked according to the dollar amount of the Foundation's obligation and the academic institutions.

**FY 2006 Result:** NSF did not achieve this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 62% |
| FY 2003 | N/A | 61% |
| FY 2004 | 61% | 61% |
| FY 2005 | 62% | 49% |
| FY 2006 | 63% | 58% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

**Why We Did Not Meet This Goal:** This goal was adopted in FY 2004 for the Small Research Collaborations PART Program. The result for FY 2006 is an improvement over that for FY 2005. The goal is ambitious, and it was made more challenging by the recent agency-wide effort to decrease the number of program solicitations for research opportunities in an attempt to improve the NSF-wide funding rate for proposals. There is also a lag time between taking action to increase broadening participation (e.g. through outreach) and receiving proposals. NSF will continue its efforts to encourage proposals from investigators at academic institutions not in the top 100 of NSF funding recipients.

## ANNUAL PERFORMANCE GOAL 13:
## RESEARCH COLLABORATIONS: TIME-TO-DECISION

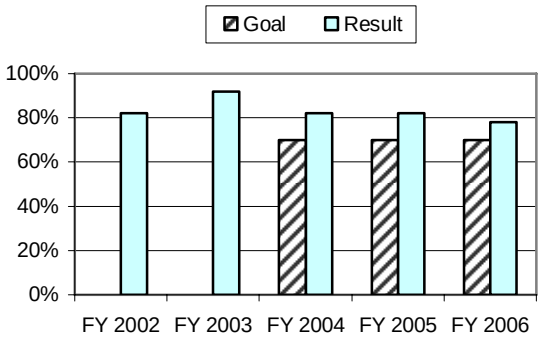
**PART Program:** Support for Small Research Collaborations
**PART ID:** 10002322

**Measure:** For 70 percent of proposals submitted to the Research Collaborations Program, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or target date, or receipt date, while maintaining a credible and efficient merit review system, as evaluated by external experts. (NEW GOAL FOR FY 2006)

**Purpose:** To make proposal decisions available in a timely manner in order that investigators may more effectively plan activities.

**FY 2006 Result:** NSF achieved this goal. Considering the complexity and numbers of proposals coming into NSF, and the relative constancy of the number of staff to handle the review and recommendation of proposals, the goal is ambitious for the Foundation as a whole, as well as for the Small Research Collaborations PART Program, as it is increasingly difficult to maintain dwell time while performing quality merit review. This measure is a proxy for efficiency.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 82% |
| FY 2003 | N/A | 92% |
| FY 2004 | 70% | 82% |
| FY 2005 | 70% | 82% |
| FY 2006 | 70% | 78% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 14: NANOTECHNOLOGY NETWORK USERS

**PART Program:** Nanoscale Science and Engineering Research
**PART ID:** 10001147

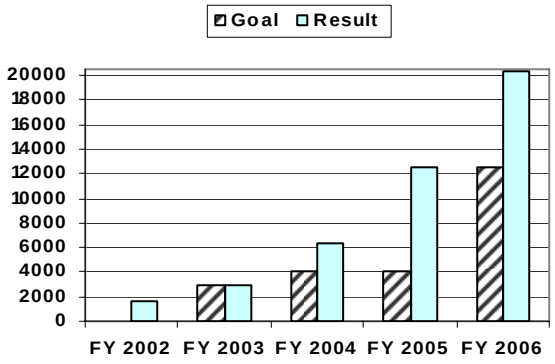
**Measure:** Number of users accessing National Nanofabrication Users Network/National Nanotechnology Infrastructure Network (NNUN/NNIN) and Network for Computational Nanotechnology (NCN) sites.

**Purpose:** To establish an infrastructure to improve access to nanotechnology facilities and services, thereby increasing the number of users. Estimates are based upon current budget estimates.

The **National Nanotechnology Infrastructure Network (NNIN)** is an integrated national network partnership of user facilities serving the resources needs of nanoscale science, engineering, and technology. It provides users across the nation – in academia, small and large industry, and government – with open access, both onsite and remotely, to leading-edge tools, instrumentation, and capabilities for fabrication, synthesis, characterization, design, simulation, and integration to help enable their individual research projects. The NNIN also has extensive education, training, and outreach activities. The NNIN supersedes the National Nanofabrication Users Network (NNUN), initiated in 1994 and for which NSF support concluded at the end of 2003. The **Network for Computational Nanotechnology (NCN)** supports research and provides an infrastructure that combines facilities and experts in nanoscale science and engineering, with a focus on three specific areas of nanotechnology. NCN provides electronic mediums for research and education through online simulation services, course, tutorials, seminars, debates, and facilities for collaboration. The use of the networks far exceeded expectation due, in part, to the great interest in the field of nanotechnology.

**FY 2006 Result:** NSF achieved this goal. The use of the networks far exceeded expectation due, in part, to the great interest in the field of nanotechnology, but also because of the introduction of a new interactive framework for nanoscale modeling and simulation.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 1700 |
| FY 2003 | 3000 | 3000 |
| FY 2004 | 4000 | 6350 |
| FY 2005 | 4000 | 12462 |
| FY 2006 | 12500 | 20374 |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 15: NANOTECHNOLOGY NETWORK NODES

**PART Program:** Nanoscale Science and Engineering Research
**PART ID:** 10001147

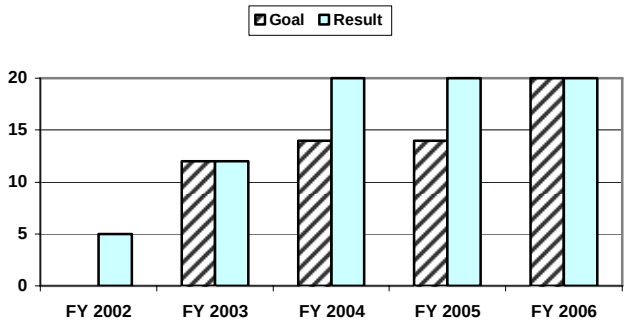
**Measure:** Number of nanotechnology nodes that comprise infrastructure.

**Purpose:** To support and enhance infrastructure through the maintenance of the total number of facility nodes within the nanotechnology networks funded by NSF.

NNIN nodes are defined as both large and small individual user facilities, geographically distributed and with diverse and complementary capabilities to design, create, characterize, and measure novel nanoscale structures, materials, devices, and systems.

**FY 2006 Result:** NSF achieved this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 5 |
| FY 2003 | 12 | 12 |
| FY 2004 | 14 | 20 |
| FY 2005 | 14 | 20 |
| FY 2006 | 20 | 20 |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 16:
## TIME-TO-DECISION: NANOSCALE SCIENCE AND ENGINEERING

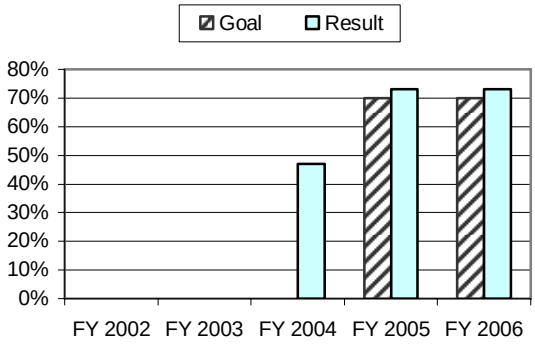
**PART Program:** Nanoscale Science and Engineering Research
**PART ID:** 10001147

**Measure:** For 70 percent of proposals submitted to the Nanoscale Science and Engineering Program, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or target date, or receipt date, while maintaining a credible and efficient merit review system, as evaluated by external experts.

**Purpose:** To make proposal decisions available in a timely manner in order that investigators may more effectively plan activities.

**FY 2006 Result:** NSF achieved this goal. Considering the complexity and numbers of proposals coming into NSF, and the relative constancy of the number of staff to handle the review and recommendation of proposals, the goal is ambitious for the Foundation as a whole, as well as for the Nanoscale Science and Engineering PART Program, as it is increasingly difficult to maintain dwell time while performing quality merit review. This measure is a proxy for efficiency.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | N/A |
| FY 2003 | N/A | N/A |
| FY 2004 | N/A | 46% |
| FY 2005 | 70% | 73% |
| FY 2006 | 70% | 73% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 17: NANOSCALE PROPOSALS WITH FEMALE INVESTIGATORS

**PART Program:** Nanoscale Science and Engineering Research
**PART ID:** 10001147

**Measure:** Percent of Nanoscale Science and Engineering (NS&E) proposals with at least one female principal investigator (PI) or Co-PI.

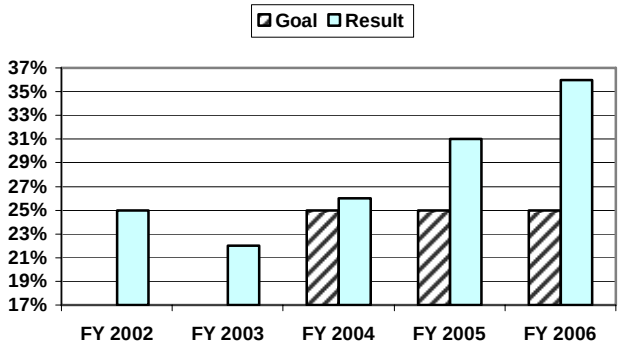
**Purpose:** To increase the number of female PIs or Co-PIs submitting NS&E proposals.

The Nanoscale Science and Engineering priority area 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, science, engineering, and technology are realizing revolutionary advances, in areas such as individualized pharmaceuticals, new drug delivery systems, more resilient materials and fabrics, catalysts for industry and order-of-magnitude faster computer chips.

NS&E research promises 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. NSF has a continued commitment to increasing participation of female investigators in this priority area.

**FY 2006 Result:** NSF achieved this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 25% |
| FY 2003 | N/A | 22% |
| FY 2004 | 25% | 26% |
| FY 2005 | 25% | 31% |
| FY 2006 | 25% | 36% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 18:
## NANOSCALE PROPOSALS WITH MINORITY INVESTIGATORS

**PART Program:** Nanoscale Science and Engineering Research
**PART ID:** 10001147

**Measure:** Percent of Nanoscale Science and Engineering (NS&E) proposals with at least one minority principal investigator (PI) or Co-PI.

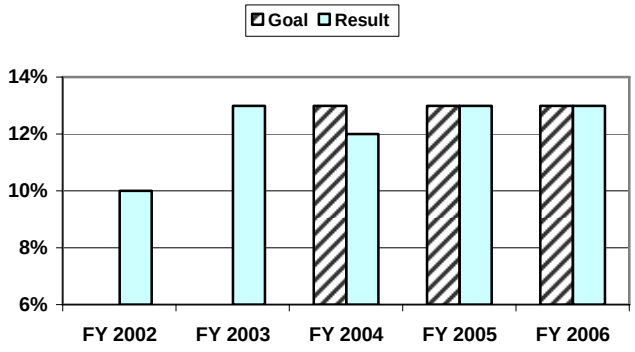
**Purpose:** To increase the number of minority and/or underrepresented PIs or Co-PIs submitting NS&E proposals.

The Nanoscale Science and Engineering priority area 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, science, engineering, and technology are realizing revolutionary advances, in areas such as individualized pharmaceuticals, new drug delivery systems, more resilient materials and fabrics, catalysts for industry and order-of-magnitude faster computer chips.

Nanoscale science and engineering research promises 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. NSF has a continued commitment to increasing participation of female investigators in this priority area.

**FY 2006 Result:** NSF achieved this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 10% |
| FY 2003 | N/A | 13% |
| FY 2004 | 13% | 12% |
| FY 2005 | 13% | 13% |
| FY 2006 | 13% | 13% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 19:
## NANOSCALE PROPOSALS WITH MULTIPLE INVESTIGATORS

**PART Program:** Nanoscale Science and Engineering Research
**PART ID:** 10001147

**Measure:** Foster collaboration among investigators in Nanoscale Science and Engineering and track this through the percent of Nanoscale Science and Engineering (NS&E) proposals that are multi-investigator proposals.

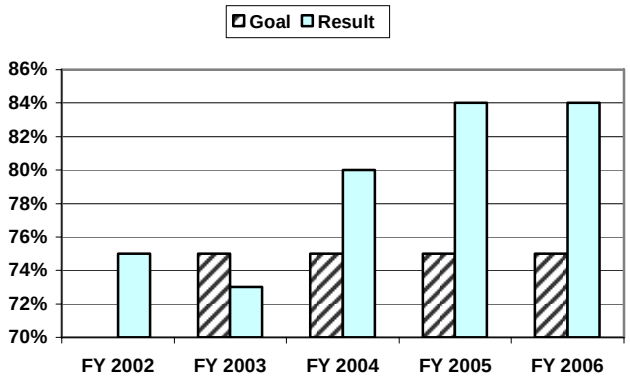
**Purpose:** To increase the collaboration among investigators that may not have otherwise occurred.

The Nanoscale Science and Engineering priority area 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, science, engineering, and technology are realizing revolutionary advances, in areas such as individualized pharmaceuticals, new drug delivery systems, more resilient materials and fabrics, catalysts for industry and order-of-magnitude faster computer chips.

Nanoscale science and engineering research promises a better understanding of nature, a new world of products beyond what it is now possible, high efficiency in manufacturing, sustainable development, better healthcare and improved human performance. The NSF NS&E priority area strives to foster collaborations among investigators that may not have otherwise occurred.

**FY 2006 Result:** NSF achieved this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 75% |
| FY 2003 | 75% | 73% |
| FY 2004 | 75% | 80% |
| FY 2005 | 75% | 84% |
| FY 2006 | 75% | 84% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

## ANNUAL PERFORMANCE GOAL 20:
## BIOCOMPLEXITY IN THE ENVIRONMENT: PROPOSALS WITH FEMALE INVESTIGATORS

**PART Program:** Research on Biocomplexity in the Environment
**PART ID:** 10002320

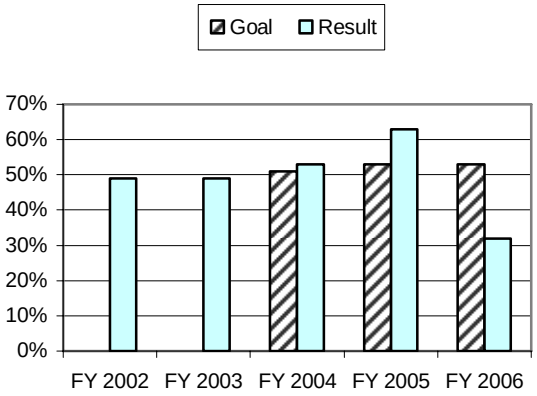
**Measure:** Percent of Biocomplexity in the Environment (BE) proposals with at least one female PI or co-PI for BE solicitation. (NEW GOAL FOR FY 2006)

**Purpose:** To encourage proposals to the BE Program from female investigators.

The Biocomplexity in the Environment (BE) Program promotes comprehensive, integrated investigations of environmental systems using advanced scientific and engineering methods. The concept of biocomplexity stresses the richness of biological systems in an environmental context. The BE Program emphasizes research with a high degree of interdisciplinarity, a focus on complex environmental systems that includes non-human biota or humans, and a focus on systems with high potential for exhibiting non-linear behavior.

**FY 2006 Result:** NSF did not achieve this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 49% |
| FY 2003 | N/A | 49% |
| FY 2004 | 51% | 53% |
| FY 2005 | 53% | 63% |
| FY 2006 | 53% | 32% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

**Why We Did Not Meet This Goal:** The Biocomplexity in the Environment program was established as a priority area for the Foundation in FY 2000, with the intention that it would extend through FY 2007. The goal of increasing the percentage of proposals from female investigators was established in FY 2004, and the goal was met that year as well as in FY 2005. Since three of the five BE programs did not request proposals in FY 2006 and the only solicitations that did were in the engineering and geoscience areas, the drop in percentage of proposals from female investigators in FY 2006 was not unexpected. Renewed attempts were made to encourage proposals from female investigators in the last series of program solicitations held in FY 2006 for awards that would begin during FY 2007.

## ANNUAL PERFORMANCE GOAL 21:
## BIOCOMPLEXITY IN THE ENVIRONMENT: PROPOSALS WITH MINORITY INVESTIGATORS

**PART Program:** Research on Biocomplexity in the Environment
**PART ID:** 10002320

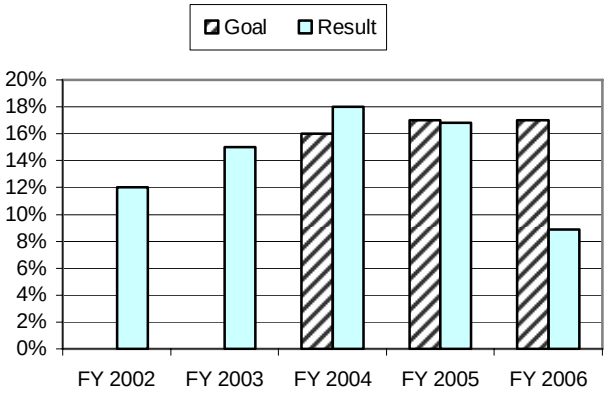
**Measure:** Percent of Biocomplexity in the Environment (BE) proposals with at least one minority PI or co-PI for BE solicitation. (NEW GOAL FOR FY 2006)

**Purpose:** To encourage proposals to the BE Program from minority investigators.

The Biocomplexity in the Environment (BE) Program promotes comprehensive, integrated investigations of environmental systems using advanced scientific and engineering methods. The concept of biocomplexity stresses the richness of biological systems in an environmental context. The BE Program emphasizes research with a high degree of interdisciplinarity, a focus on complex environmental systems that includes non-human biota or humans, and a focus on systems with high potential for exhibiting non-linear behavior.

**FY 2006 Result:** NSF did not achieve this goal.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 12% |
| FY 2003 | N/A | 15% |
| FY 2004 | 16% | 18% |
| FY 2005 | 17% | 17% |
| FY 2006 | 17% | 9% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

**Why We Did Not Meet This Goal:** The Biocomplexity in the Environment program was established as a priority area for the Foundation in FY 2000, with the intention that it would extend through FY 2007. The goal of increasing the percentage of proposals from minority investigators was established in FY 2004, and the goal was met that year as well as in FY 2005. Since three of the five BE programs did not request proposals in FY 2006 and the only solicitations that did were in the engineering and geoscience areas, the drop in percentage of proposals from minority investigators in FY 2006 was not unexpected. Renewed attempts were made to encourage proposals from minority investigators in the last series of program solicitations held in FY 2006 for awards that would begin during FY 2007.

## ANNUAL PERFORMANCE GOAL 22:
## BIOCOMPLEXITY IN THE ENVIRONMENT: TIME-TO-DECISION

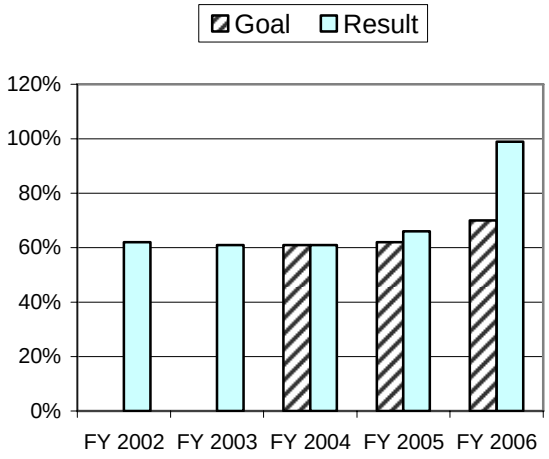
**PART Program:** Research on Biocomplexity in the Environment
**PART ID:** 10002320

**Measure:** For 70 percent of proposals submitted to the Biocomplexity in the Environment (BE) Program, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or target date, or receipt date, whichever is later, while maintaining a credible and efficient merit review system, as evaluated by external experts. (NEW GOAL FOR FY 2006)

**Purpose:** To make proposal decisions available in a timely manner in order that investigators may more effectively plan activities.

**FY 2006 Result:** NSF achieved this goal. Considering the complexity and numbers of proposals coming into NSF, and the relative constancy of the number of staff to handle the review and recommendation of proposals, the goal is ambitious for the Foundation as a whole, as well as for the Biocomplexity in the Environment PART Program, as it is increasingly difficult to maintain dwell time while performing quality merit review. This measure is a proxy for efficiency.

| | Goal | Result |
|---|---|---|
| FY 2002 | N/A | 62% |
| FY 2003 | N/A | 61% |
| FY 2004 | 61% | 61% |
| FY 2005 | 62% | 66% |
| FY 2006 | 70% | 99% |




**Implications For The FY 2007 Performance Plan:** NSF is currently in the process of developing a new performance evaluation and reporting framework to align with our new strategic plan that was implemented September 30, 2006. NSF is working with OMB to develop a new program structure for the agency's PART reviews as well as new performance goals. NSF is using the results of our FY 2006 performance goals to help inform this process. The agency's new performance goals will be reported in our FY 2008 President's Budget Request to Congress, which will be available in February 2007.

# ADDITIONAL INFORMATION

## Information on Use of Non-Federal Parties

This GPRA performance report was prepared solely by NSF staff.

Non-federal external sources of information we used in preparing this report include:

- Reports from awardees demonstrating results.
- Reports prepared by evaluators – Committees of Visitors (COV) and Advisory Committees – in assessing our programs for progress in achieving Outcome Goals.
- Reports prepared by a consulting firm to assess the procedures we use to collect, process, maintain, and report performance goals and measures.
- Reports from facilities managers on construction/upgrade costs and schedules and on operational reliability.

Specific examples:

Highlights or sources of examples shown as results may be provided by Principal Investigators who received support from NSF.

NSF uses external committees to assess the progress of our programs toward qualitative goal achievement. External evaluators provide us with reports of programs, and provide feedback to us on a report template we prepare. Examples are COV and AC reports that provide an independent external assessment of NSF's performance.

We engaged an independent third-party, IBM Global Business Services, to conduct a verification and validation review of the data and information used in reporting the quantitative annual performance goals. For NSF's four strategic outcome goals which are not measured quantitatively, IBM reviewed the process employed by the external Advisory Committee for GPRA Performance Assessment. This additional independent review helped to eliminate potential reporting bias that can develop in self-assessments. It also provides assurance as to the credibility of performance reporting information and results.

## Classified Appendixes not Available to the Public

None

## Analysis of Tax Expenditures

None

## Waivers of Administrative Requirements

None

## A MESSAGE FROM THE CHIEF FINANCIAL OFFICER

I am pleased to report NSF received a clean audit opinion in FY 2006, maintaining our record of excellence in financial management. This is a testament to our outstanding staff. A firm working with NSF for the first time, Clifton Gunderson LLP, performed an independent audit and issued NSF's ninth consecutive unqualified audit opinion. The audit report repeated two prior year reportable conditions: post-award monitoring and contract monitoring. Over the past year, significant progress has been made in both, and we will enhance our efforts to complete the activities highlighted in their respective corrective action plans.

NSF's longstanding commitment to organizational excellence and sound financial management practices continues to serve us well. Notable achievements of the past year include:

- Maintaining "Green" ratings for both the Financial Performance and the Budget and Performance Integration initiatives on the President's Management Agenda scorecard. NSF has successfully sustained a "Green" rating for Financial Performance for 18 consecutive quarters.

- Moving from an annual to a three-year reporting cycle for improper payments with OMB approval, as a result of the low improper payment rates reported in our FY 2004 and FY 2005 Performance and Accountability Reports.

- Recovering $3.19 million in excess cash held by grant recipients, and reducing erroneous program income reporting by grantees from $3.99 million to $0.77 million through the post-award monitoring efforts.

- Providing flat rate travel reimbursements through our new Guest Travel System to our numerous merit review panelists in 16 days, on average.

- Receiving a League of American Communications Professionals Honors Award for our *FY 2005 Performance Highlights* report. NSF is proud to be the only federal agency to be honored for five consecutive years of distinction in its annual reports - a recognition that reflects the agency's continuing commitment to be accountable to our stakeholders and the public for sound stewardship of the public's resources.

Sound innovative financial management enables NSF to pursue critical investments in science and engineering research and education that ultimately help ensure the nation's security, prosperity, and well being. NSF's commitment to managing programs in an informed and fiscally responsible manner, to ensuring resources are used efficiently and effectively, and to accountability and transparency reflect the dedication and diligence of a premier staff. I am proud of their accomplishments.

Thomas N. Cooley

November 7, 2006

NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
ARLINGTON, VIRGINIA 22230


OFFICE OF
INSPECTOR GENERAL

November 10, 2006

To: Dr. Steven C. Beering
Chairman, National Science Board

Dr. Arden L. Bement, Jr.
Director, National Science Foundation

From: Thomas C. Cost for Dr. Christine C. Boesz
Inspector General

Subject: Audit of the National Science Foundation's
Fiscal Years 2006 and 2005 Financial Statements

This memorandum transmits Clifton Gunderson LLP's financial statement audit report of the National Science Foundation (NSF) for Fiscal Year 2006, which includes Fiscal Year 2005 comparative information.

**Results of Independent Audit**

The Chief Financial Officer's (CFO) Act of 1990 (P.L. 101-576), as amended, requires NSF's Inspector General or an independent external auditor, as determined by the Inspector General, to audit NSF's financial statements. Under a contract monitored by the Office of Inspector General (OIG), Clifton Gunderson, an independent public accounting firm (IPA), performed an audit of NSF's Fiscal Year 2006 financial statements. The contract required that the audit be performed in accordance with the Government Auditing Standards issued by the Comptroller General of the United States, and Bulletin 06-03, *Audit Requirements for Federal Financial Statements*, issued by the United States Office of Management and Budget.

Clifton Gunderson issued an unqualified opinion on NSF's FY 2006 financial statements. In its Report on Internal Control over Financial Reporting, Clifton Gunderson identified two reportable conditions relating to NSF's post-award administration and contract monitoring. Clifton Gunderson also reported that there were no instances in which NSF's financial management systems did not substantially comply with the requirements of the Federal Financial Management Improvement Act of 1996 (FFMIA), and found no reportable noncompliance with laws and regulations it tested. Another IPA under contract with the OIG performed the audit of NSF's FY 2005 financial statements, and issued a report dated November 4, 2005.

Management's response dated November 7, 2006, follows Clifton Gunderson's report.

**Evaluation of Clifton Gunderson's Audit Performance**

To fulfill our responsibilities under the CFO Act of 1990, as amended, and other related financial management legislation, the OIG:

- Reviewed Clifton Gunderson's approach and planning of the audit;
- Evaluated the qualifications and independence of the auditors;
- Monitored the progress of the audit at key points;
- Coordinated periodic meetings with NSF management to discuss audit progress, findings, and recommendations;
- Reviewed Clifton Gunderson's audit report to ensure compliance with Government Auditing Standards and Office of Management and Budget Bulletin No. 06-03; and
- Coordinated issuance of the audit report.

Clifton Gunderson LLP is responsible for the attached auditor's report dated November 6, 2006, and the conclusions expressed in the report. We do not express any opinion on NSF's financial statements, internal control, conclusions on compliance with laws and regulations, or on whether NSF's financial management systems substantially complied with FFMIA.

The Office of Inspector General appreciates the courtesies and cooperation NSF extended to Clifton Gunderson LLP and OIG staff during the audit. If you or your staff has any questions, please contact me or Deborah H. Cureton, Associate Inspector General for Audit.

Attachment

cc: Dr. Dan E. Arvizu, Chair, Audit and Oversight Committee

Clifton Gunderson LLP
Certified Public Accountants & Consultants

# INDEPENDENT AUDITOR'S REPORT

Dr. Steven Beering
Chairman, National Science Board

Dr. Arden L. Bement, Jr.
Director, National Science Foundation

In our audit of the financial statements of the National Science Foundation (NSF) for fiscal year (FY) 2006 we found:

- The NSF financial statements, which are the balance sheet as of September 30, 2006, and the related statements of net cost, changes in net position, budgetary resources, and financing are presented fairly, in all material respects, in conformity with accounting principles generally accepted in the United States of America;
- No material weaknesses in internal control over financial reporting (including safeguarding assets) and compliance with laws and regulations;
- Even though progress has been made in FY 2006 on the two reportable conditions noted in the FY 2005 auditor's report, certain matters in those conditions continue to exist and, accordingly, the two reportable conditions are noted in this year's report;
- No instances of noncompliance with the Federal Financial Management Improvement Act of 1996 (FFMIA);
- No instances of noncompliance with laws and regulations.

The following sections discuss in more detail (1) these conclusions and our conclusions on Management's Discussion and Analysis and other supplementary information and (2) the scope of our audit.

## OPINION ON FINANCIAL STATEMENTS

In our opinion, the accompanying FY 2006 financial statements including the accompanying notes present fairly, in all material respects, in conformity with accounting principles generally accepted in the United States of America, NSF's assets, liabilities, and net position as of September 30, 2006; and its related net costs; changes in net position; budgetary resources; and reconciliation of net costs to budgetary obligations for the year then ended.

NSF's financial statements as of and for the year ended September 30, 2005, were audited by other auditors; whose report dated November 4, 2005 expressed an unqualified opinion on those financial statements.

## CONSIDERATION OF INTERNAL CONTROL

In planning and performing our audit, we considered NSF's internal control over financial reporting and compliance. We did this to determine our procedures for auditing the financial statements and to comply with the Office of Management and Budget (OMB) audit guidance, not to express an opinion on internal control. Accordingly, we do not express an opinion on internal control over financial reporting and compliance.

The objectives of an effective internal control system are the following:

- *Reliability of Financial Reporting*: Transactions are properly recorded, processed, and summarized to permit the preparation of financial statements and stewardship information in conformity with generally accepted accounting principles, and assets are safeguarded against loss from unauthorized acquisition, use, or disposition.
- *Compliance With Laws and Regulations*: Transactions are executed in accordance with laws governing the use of budget authority and with other laws and regulations that could have a direct and material effect on the financial statements and any other laws, regulations, and government-wide policies identified by OMB audit guidance.
- *Reliability of Performance Reporting*: Transactions and other data that support reported performance measures are properly recorded, processed, and summarized to permit the preparation of performance information in accordance with criteria stated by management.

Our consideration of the internal control over financial reporting would not necessarily disclose all matters in the internal control over financial reporting that might be reportable conditions. Under standards issued by the American Institute of Certified Public Accountants, reportable conditions are matters coming to our attention relating to significant deficiencies in the design or operation of the internal control that, in our judgment, could adversely affect NSF's ability to record, process, summarize, and report financial data consistent with the assertions made by management in the financial statements. Material weaknesses are reportable conditions in which the design or operation of one or more of the internal control components does not reduce to a relatively low level the risk that misstatements caused by error or fraud in amounts that would be material in relation to the financial statements being audited may occur and not be detected within a timely period by employees in the normal course of performing their assigned functions. Because of inherent limitations in internal controls, misstatements, losses, or noncompliance may nevertheless occur and not be detected.

The prior year audit report noted two reportable conditions on Post-award Monitoring and Contract Monitoring. Even though management made strides in resolving some of the specific weaknesses reported last year in these areas, the overall concept of the matters continue to be reflected as reportable conditions in this year's report. **Exhibit I** details these two repeat reportable conditions, and describes the improvements made in FY 2006 as well as the continuing deficiencies that require management's attention in FY 2007. Neither of these reportable conditions is considered to be a material weakness.

As required by OMB Bulletin No. 06-03, *Audit Requirements for Federal Financial Statements*, we considered NSF's internal control over Required Supplementary Stewardship Information by obtaining an understanding of the component's of NSF's internal control, determining whether these internal controls had been placed in operation, assessing control risk, and performing tests of controls. Our procedures were not designed to provide assurance on these internal controls. Accordingly, we do not provide an opinion on such controls.

As further required by OMB Bulletin No. 06-03, with respect to internal control related to performance measures reported in the Management Discussion and Analysis, we obtained an understanding of the design of significant internal controls relating to the existence and completeness assertions and determined whether they had been placed in operation. Our procedures were not designed to provide assurance on internal control over reported performance measures and, accordingly, we do not provide an opinion on such controls.

We also noted other non-reportable matters involving internal control and its operation that we will communicate in a separate management letter.

## SYSTEMS COMPLIANCE WITH FFMIA REQUIREMENTS

Under the Federal Financial Management Improvement Act of 1996 (FFMIA), we are required to report whether the financial management systems used by NSF substantially comply with the Federal financial management systems requirements, applicable Federal accounting standards, and the United States Standard General Ledger (SGL) at the transaction level. To meet this requirement, we performed tests of compliance with FFMIA Section 803(a) requirements.

The objective of our audit was not to provide an opinion on compliance with FFMIA. Accordingly, we do not express such an opinion. However, our work disclosed no instances, in which NSF's financial management systems did not substantially comply with federal financial management systems requirements, Federal Accounting Standards and the SGL at the transaction level.

## COMPLIANCE WITH LAWS AND REGULATIONS

Our tests for compliance with selected provisions of laws and regulations disclosed no instances of noncompliance that would be reportable under U.S. generally accepted government auditing standards or OMB audit guidance. Providing an opinion on compliance with those provisions was not an objective of our audit and, accordingly, we do not express such an opinion.

## STATUS OF PRIOR YEAR'S REPORTABLE CONDITIONS

As required by *Government Auditing Standards* and OMB Bulletin No. 06-03, we have reviewed the status of NSF corrective actions with respect to the findings and recommendations included

in the prior year's Independent Auditor's Report dated November 4, 2005. The prior year audit report noted two reportable conditions: Post-award Monitoring and Contract Monitoring. Even though management made strides in resolving some of the specific weaknesses reported last year in these areas, the overall concept of the matters continue to be reflected as reportable conditions in this year's report, and such reportable conditions are attached as **Exhibit I** to this report.

## CONSISTENCY OF OTHER INFORMATION

Management's Discussion and Analysis, required supplementary information (including stewardship information), and other accompanying information contain a wide range of data, some of which are not directly related to the financial statements. We do not express an opinion on this information. However, we compared this information for consistency with the financial statements and discussed the methods of measurement and presentation with NSF officials. Based on this limited work, we found no material inconsistencies with the financial statements or nonconformance with OMB guidance.

## OBJECTIVES, SCOPE AND METHODOLOGY

Management is responsible for (1) preparing the financial statements in conformity with accounting principles generally accepted in the United States, (2) establishing, maintaining, and assessing internal control to provide reasonable assurance that the broad control objectives of the Federal Managers' Financial Integrity Act (FMFIA), as codified in 31 U.S.C. 3512 are met, (3) ensuring that NSF's financial management systems substantially comply with FFMIA requirements, and (4) complying with other applicable laws and regulations.

We are responsible for obtaining reasonable assurance about whether the financial statements are presented fairly, in all material respects, in conformity with generally accepted accounting principles.

We are also responsible for (1) obtaining a sufficient understanding of internal control over financial reporting and compliance to plan the audit, (2) testing whether the financial management systems used by NSF substantially comply with the three FFMIA requirements, (3) testing compliance with selected provisions of laws and regulations that have a direct and material effect on the financial statements and laws for which OMB audit guidance requires testing, and (4) performing limited procedures with respect to certain other information appearing in the Performance and Accountability Report.

In order to fulfill these responsibilities, we (1) examined on a test basis, evidence supporting the amounts and disclosures in the financial statements, (2) assessed the accounting principles used and significant estimates made by management, (3) evaluated the overall presentation of the financial statements, (4) obtained an understanding of internal control related to financial reporting (including safeguarding of assets), compliance with laws and regulations (including execution of transactions in accordance with budget authority), and performance measures reported in Management's Discussion and Analysis of the Performance and Accountability Report, (5) tested relevant internal controls over financial reporting, and compliance, and

evaluated the design and operating effectiveness of internal control, (6) considered the process for evaluating and reporting on internal control and financial management systems under FMFIA, (7) tested whether the financial management systems used by NSF substantially complied with the three FFMIA requirements, and (8) tested compliance with selected provisions of certain laws and regulations.

We did not evaluate all internal controls relevant to operating objectives as broadly defined by the FMFIA, such as those controls relevant to preparing statistical reports and ensuring efficient operations. We limited our internal control testing to controls over financial reporting and compliance. Because of inherent limitations in internal control, misstatements due to error or fraud, losses, or noncompliance may nevertheless occur and not be detected. We also caution that projecting our evaluation to future periods is subject to risk that controls may become inadequate because of changes in conditions or that the degree of compliance with controls may deteriorate. In addition, we caution that our internal control testing may not be sufficient for other purposes.

We did not test compliance with all laws and regulations applicable to NSF. We limited our tests of compliance to those laws and regulations required by OMB audit guidance we deemed applicable to the financial statements for the fiscal year ended September 30, 2006. Our work on FFMIA would not necessarily disclose all instances of lack of substantial non-compliance with FFMIA requirements. We caution that noncompliance with laws and regulations may occur and not be detected by these tests and that such testing may not be sufficient for other purposes.

We conducted our audit in accordance with auditing standards generally accepted in the United States of America; the standards applicable to the financial audits contained in *Government Auditing Standards,* issued by the Comptroller General of the United States; and OMB Bulletin No. 06-03, *Audit Requirements for Federal Financial Statements.*

We have considered management's response (Exhibit II) and have concluded that no change is needed to our original findings, conclusions, or recommendations. We will evaluate the status of these findings during the FY 2007 audit.

This report is intended solely for the information and use of NSF's management, NSF's Office of Inspector General, OMB, the Government Accountability Office, and the U.S. Congress, and is not intended to be, and should not be, used by anyone other than these specified parties.

Clifton Gunderson LLP

Calverton, Maryland
November 6, 2006

**NATIONAL SCIENCE FOUNDATION**
**CONSIDERATION OF INTERNAL CONTROL**
**REPORTABLE CONDITIONS**
**September 30, 2006**

## 1. Post-Award Oversight For High Risk Grants and Cooperative Agreements

***Condition Background***

NSF awards grants and co-operative agreements (co-ops) to various organizations, including colleges and universities, non-profit organizations, state and local governments, and Federally Funded Research & Development Centers (FFRDC). In FY 2006, NSF expended approximately $4.9 billion in grant and co-op awards (collectively referred to as awards) to 2,367 institutions, representing over 41,000 awards. As such, it is important that NSF oversee the financial performance of these awards to ensure Federal funds are properly spent on allowable costs benefiting NSF's research activities. As noted in prior audit reports, Post-Award Monitoring was a Reportable Condition.

In response to the Reportable Condition in the FY 2005 audit report, NSF management initiated procedures which improved its post-award oversight process. Some of the more significant procedural changes began to be implemented after the second quarter of the year, including the hiring of a contractor in May 2006 to perform desk reviews of high risk awards that did not receive an Award Monitoring & Business Assistance Program (AMBAP) site visit in fiscal year 2005 and 2006. Other improvements in the processes made in FY 2006 were as follows:

- Modified the medium and low risk award Federal Cash Transactions Report (FCTR) transaction testing process for FY 2006 to include the first quarter of FY 2006 along with the last three quarters of FY 2005.
- Revised the risk assessment process to be used for FY 2007 by incorporating additional risk factors, such as "Total Intended Award Amount."

While we commend NSF for initiating these changes, continuous refinements and completion of these initiatives are needed. Accordingly, the following section explains why this matter continues to be a Reportable Condition.

***Condition Status at September 30, 2006***

NSF's process to monitor its grantees\co-op partners to ensure that expenditures were allowable, allocable, and reasonable under the terms of the award\agreement did not ensure that appropriate oversight reviews were performed at a material number of institutions with high risk awards where a site visit was not performed.

NSF's procedures require that awards are assessed as high, medium, or low risk based on objective factors. The procedures also require that institutions with high risk awards receive a more detailed level of review, such as an AMBAP or Total Business System Review (TBSR) site visits on a cyclical basis every four or five years.

For FY 2006, NSF's risk assessment process initially identified 340 high risk awards at 206 institutions valued at $3.2 billion. NSF applied various factors to reduce the number and dollar amount of awards for which a site visit or desk review would be performed, resulting in 286 awards to 153 institutions valued at $2.7 billion being excluded from the population for which site visits and desk reviews would be performed. Some factors NSF used to exclude grants from the population are not appropriate, such as grant awards due to expire and grant awards at institutions that had received an AMBAP review in the past 4 years. The grants about to expire totaled approximately $700 million and many of these awards were continuing and/or the award period had been extended. The grant awards with previous AMBAP reviews totaled approximately $880 million. The AMBAP site visits provide an in-depth oversight of the internal controls instituted by the awardees; however, they are performed on a four year cycle for an awardee.

As a result of using the exclusion factors, approximately $2.7 billion (84%) of the originally identified FY 2006 high risk awards did not receive any type of review in FY 2006. While eliminating certain awards from site visits and desk reviews is reasonable given available resources, there should still be some form of annually implemented oversight procedures for the remainder of the high risk awards at a level no less stringent than the oversight given to medium and low risk awards.

Ultimately NSF performed site visits for grantees (AMBAP reviews) and for co-ops (TBSR) on only 33 FY 2006 awards valued at $324 million at 32 institutions. While NSF initiated desk reviews for 24 awards valued at $287 million in FY 2006, it completed reviews of only 13 awards, valued at $103 million by September 30, 2006.

With respect to Federally Funded Research and Development Centers (FFRDCs), we found that the Standard Operating Guidance BFA 2005-1, *Post Award Monitoring & Oversight of FFRDCs and Complex Cooperative Agreements*, dated June 29, 2005, does not provide guidance on how to perform TBSRs for FFRDCs and large facilities that are in planning, under construction, or in operation. These are some of the largest awards that NSF makes valued at approximately $780 million annually. If there are no specific policies and procedures for conducting and documenting TBSR oversight activities for these FFRDCs and large facilities, there is an increased risk that NSF will not identify issues which need to be resolved and/or award funds that are not being used for their intended purposes.

***Condition Summary***

In conclusion, we believe that management has improved its award oversight control structure in FY 2006. However, the oversight review coverage for high risk awards, either by site visit or desk reviews, does not appear sufficient to conclude whether organizations managing high risk awards, as a whole, are spending funds awarded consistent with the terms

and conditions of the grant award or co-op agreements. In addition, the actual desk review process did not begin until May 2006, and only 13 high risk grant desk reviews and 2 co-op TBSR reviews were completed by September 30, 2006. Therefore, the effectiveness of these changes, the adequacy of the procedures performed, and the results of the desk reviews when they are ultimately completed are uncertain.

We commend NSF for expanding its award oversight process in FY 2006 to include implementing the desk review process recommended in the FY 2005 audit report, pursuing enhancements to the risk assessment process, and incorporating the first quarter of FY 2006 in the FCTR transaction testing. However, continued refinement to the oversight model and review process is needed to ensure that costs on the financial statements were spent in accordance with the terms of the grant agreements.

***Recommendations:*** We recommend that NSF management:

1. Complete the desk review program implemented for high risk awards and evaluate the benefit and effectiveness of such reviews to the overall award oversight process.
2. Refine factors used in the Risk Assessment model to determine which organizations managing high risk awards are considered for desk reviews or AMBAP site visits. Circumstances leading to exclusion should be clearly demonstrated.
3. Expand the coverage of review of high risk awards. Such coverage increase should include implementing FCTR transaction testing for high risk awards excluded from the AMBAP or TBSR site visits and desk reviews for that fiscal year.
4. Revise Standard Operating Guidance to reflect the process for planning and scheduling TBSRs for FFRDCs and other large facilities, the documentation requirements for the TBSR, and the disposition of its results.

## 2. Contract Monitoring

***Conditions:*** In FY 2006, NSF expended approximately $550 million on active contracts and interagency agreements for the delivery of products and services. Of this amount, $225 million was disbursed through advance payment programs with three contractors, including $177 million for logistical support of the U.S. Antarctic Program (USAP). In accordance with Federal requirements, Federal agencies must have controls in place to assess the risks faced from both external and internal sources to ensure that contractors use federal funds consistent with the objectives of the contract, and that funds are protected from waste, fraud, or mismanagement. However, during our FY 2006 audit, we found that NSF does not have a comprehensive, risk-based system, including detailed policies and procedures, in place to oversee and monitor its contract awards.

In March 2006, the Division of Acquisition and Cooperative Support (DACS) completed a Contracts Manual that details policies and procedures for contract administration and oversight. However, the manual is not comprehensive in that it does not include any specific policies and procedures for risk assessment or risk mitigation plans for contracts that may require expanded oversight. The manual also does not define the specific roles and

responsibilities for contract personnel (i.e. contracting specialist, contract officer) regarding their regular activities, including contract file documentation and maintenance. In addition, the manual describes the general requirements of the Federal Acquisition Regulation (FAR), but it does not provide NSF specific guidance necessary to implement FAR policies and procedures.

In addition, in response to the Reportable Condition disclosed in the FY 2005 audit report, NSF management initiated a quarterly expenditure report (QER) review program in FY 2006. While the QER program involves the review of vouchers submitted by its three largest contractors, these reviews, while important, are only one piece of a rigorous contract oversight program. As reported in the FY 2005 audit report, NSF did not adequately review quarterly expenditure reports submitted by its three largest contractors receiving payments in advance for services that they provide to NSF. To address this problem, during FY 2006, NSF contracted with the Defense Contract Audit Agency (DCAA) to perform quarterly expenditure report reviews for three advance payment contractors for the four quarters ended September 30, 2005, through June 30, 2006. These reviews have been completed, and while no significant findings were noted, these reviews have a limited scope that may not identify unallowable costs. Therefore, these reviews are not an adequate substitute for a comprehensive, risk-based system needed to provide management with material assurance that costs paid by NSF are valid.

This lack of appropriate contract oversight was also evident during our review of NSF's property account balance of approximately $551 million at September 30, 2006, including $142 million relating to Construction in Progress. NSF's largest contractor is responsible for acquiring, maintaining, and performing a physical inventory of the NSF's USAP property (PP&E). NSF relies on the contractor to maintain all related source documentation, and records amounts for PPE activities based on the summary reports provided by the contractor. However, NSF does not perform any independent verification of the PP&E amounts reported by the contractor, nor does it maintain copies of source documentation supporting PP&E amounts included in its financial statements.

In addition, cost-incurred audits continue to reveal internal control weaknesses, non-compliance with federal regulations, and significant questioned costs. For example, recent DCAA cost-incurred audits of NSF's largest contractor have identified approximately $55.5 million in questioned costs for FY 2000 through 2004. DCAA also reported that the contractor was not in compliance with Federal Cost Accounting Standard 418, *Allocation of Direct and Indirect Costs*, for FYs 2000 to 2002. NSF is responsible for establishing controls to ensure that contractors use federal funds consistent with the terms and conditions of their contractual agreements. Therefore, a combination of its QER program and implementation of comprehensive oversight policy and procedures is needed to ensure effective contract administration.

Furthermore, during our FY 2006 audit, we found that NSF did not fully document its oversight and contract monitoring activities. Specifically, we found:

- A contractor submitted its final FY 2006 Annual Program Plan (APP) to NSF for approximately $164 million in October 2005. In January 2006, the plan was approved by DACS at only $144 million; however, the funds were provided to the contractor during FY 2006 at the originally proposed amount of $164 million. In September 2006, the contract was modified to reflect the amount in the contractor's original APP. Consequently, the contractor was technically operating without an official approved APP during the first three months of FY 2006, and the advance payment allotments made during the year were not consistent with the DACS January 2006 approved amount of $144 million.

- For one major contractor, we noted that an interim TBSR report was issued in November 2001; however, the TBSR has not been finalized. Also, NSF was unable to provide documentation evidencing that accounting and estimating systems reviews had been conducted.

- A desk review of a contractor's FY 2006 employee compensation plan was initiated in October 2005; however, NSF was unable to provide documentation regarding the status or results of the review. As a result, it is unclear whether the contractor's compensation plan was found to be reasonable.

- In our review of a sample of procurement transactions during FY 2006, we noted 3 instances out of 45 contracts folders selected for examination that were incomplete. The deficiencies noted in our limited sampling contract folders are an indication that the total population as a whole may have similar deficiencies, if testing was expanded.

    - NSF was unable to provide documentation indicating whether the procurement was a sole source or competitive bid.
    - The purchase requisition amount was not properly authorized, resulting in the purchase order amount exceeding the authorized purchase requisition in one case.

In conclusion, it appears that contractors' use of NSF funds may not be consistent with the objectives of the contract; contract funds may not be adequately protected from waste, fraud, and mismanagement; laws and regulations may not be completely followed; and reliable and timely financial information may not be obtained for financial reporting in a timely manner.

***Recommendations:*** NSF needs to develop a more comprehensive, risk-based, internal management monitoring program to ensure that contractors use NSF funds consistent with the objectives of the contract, and that funds are protected from waste, fraud, or mismanagement. To accomplish these objectives, we recommend that NSF management:

1) Expand the Contracts Manual initiated in FY 2006 to include specific policies and procedures required for contract risk assessment, and risk mitigation plans for

contracts that may require expanded oversight. The manual should also provide specific guidance to implement FAR policies and procedures as they relate to NSF, and provide descriptions of specific roles and responsibilities for contract personnel regarding their day to day oversight activities. In addition, the manual should include procedures to ensure that contract folder documentation is complete, that there are no material discrepancies between documents, and that reviews of the adequacy of contract folder contents is performed more thoroughly. A checklist should be developed and consistently utilized to accomplish that objective.

2) Continue to perform Quarterly Expenditure Report reviews. In addition, management should perform appropriate and timely follow up on the findings and recommendations in the OIG cost-incurred reports issued for FYs 2000 to 2004, and subsequent years.

3) Maintain an electronic copy of key source documentation (i.e. invoices, purchase orders, etc.) used to support the PP&E activity and balances in NSF's financial statements. The documentation threshold amount requirement should be sufficient to achieve coverage of 75% of the total acquisition balance. In addition, NSF should implement a validation process to compare amounts reported in the PP&E accounts to supporting documentation prepared by the contractor on a test basis throughout the year (sampling both large and smaller purchases).

# NATIONAL SCIENCE FOUNDATION
# MANAGEMENT'S RESPONSE TO FY 2006
# INDEPENDENT AUDITOR'S REPORT
# November 6, 2006

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

November 7, 2006

To: Christine C. Boesz
Inspector General

From: Thomas N. Cooley
Chief Financial Officer

Subject: Management's Response to Independent Auditor's Report
Fiscal Year 2006

I am extremely pleased that the National Science Foundation (NSF) is receiving its ninth clean opinion on the audit of its Financial Statements for fiscal year 2006. Throughout the audit, NSF worked closely with the auditors and provided full cooperation and assistance in ensuring the successful completion of this important process. The Foundation is continually striving to enhance accountability and controls in a Federal environment of increasing financial complexity. This achievement continues to gain significance as the level of investments and commitments needed to obtain a clean opinion increase.

NSF generally agrees with the two reportable conditions and is committed to resolving the issues noted in your report. The attachment provides some specific comments in a few areas. NSF has made significant progress in addressing the underlying causes for these conditions and will continue its efforts in these areas. In addition, the Foundation plans to provide a detailed corrective action plan that will highlight its activities to resolve these matters.

I appreciated receiving the draft audit report earlier than anticipated. I particularly found the presentation to be balanced and the executive summary helpful in facilitating Management's communications.

I would like to commend both of our organizations for the professionalism exhibited during the audit. It is important to recognize the time and efforts spent by all parties during Clifton Gunderson's initial audit year.

cc: Dr. Arden L. Bement, Jr.
cc: Dr. Kathleen Olsen

Attachment (Management's Response to Auditor's Report)

## Attachment
## Management's Response to Auditor's Report

**Post –Award Oversight for High Risk Grants and Cooperative Agreements**

We generally agree with the condition as stated by the auditors. We would like to re-emphasize that the National Science Foundation (NSF) has proactively taken action to refine its post award monitoring program. In doing so, the Foundation has addressed many of the issues noted in the condition statement.

Concerning the specific recommendations, we offer the following comments:

**1. Desk Reviews** - We concur and note that it was always NSF's intention to complete the desk reviews initiated in fiscal year (FY) 2006. This was the inaugural year for the desk review process. As such, significant time was spent designing and implementing the policies, procedures, and practices governing this program. However, NSF was still able to complete 54% of the FY 2006 desk reviews before the FY ended.

The desk review component of our monitoring program is being implemented consistent with the Corrective Action Plan entered into between NSF Management and the Office of Inspector General on February 14, 2006. All desk reviews identified in the FY 2006 risk assessment will be completed. We have identified, scheduled, and commenced FY 2007 desk reviews.

**2. Risk Assessment Modifications** - We concur with this recommendation and have proactively taken steps to address this issue. We have implemented changes to the 2007 Risk Assessment Model that incorporated a new data field called Total Intended Award Amount (TIAA) in an effort to identify awards that stood a chance of being incrementally funded and extended. The TIAA field indicates NSF's intention to award additional funds above the amount cumulatively awarded as of the date of the Risk Assessment data run. This allows the Risk Assessment Model to identify continuing award increments that appear to be about to expire soon from the data run information, but where there is an intention (assuming satisfactory scientific progress and availability of funds) to issue additional award increments.

NSF's award system is a dynamic, living portfolio. The Risk Assessment data run is a "snap shot in time." There may always be a possibility that an award appearing to expire in the near future on the Risk Assessment data run, might be extended.

**3. Federal Cash Transactions Report (FCTR) Transactional Testing** - We concur that our FCTR transactional testing is focused on low and medium risk awards. FCTRs are an aggregated expenditure report of all awards, regardless of risk ranking, at an institution. Through previous analyses we determined that a very small subset of NSF awardees managed a portfolio solely comprised of high risk awards. The total dollar value of those awards was less than 1 percent of the high risk population.

We plan to consult with our contractors, who execute our FCTR transactional testing, to obtain assistance in constructing a sampling and stratification plan for appropriate coverage of low, medium, and those high risk awards not subject to desk reviews, Award Monitoring and Business Assistance Program or Total Business Systems Review site visits.

**Contract Monitoring**

We generally agree with the condition stated in the report concerning the need for independent verification of property plant and equipment information. In addition, NSF will consider your recommendation on maintaining source documentation in relation to the cost/benefit involved and other potential alternatives that may address the overall condition.

# National Science Foundation

## FINANCIAL STATEMENTS

as of and for the years ended
September 30, 2006 and 2005

**National Science Foundation**
**Balance Sheet**
**As of September 30, 2006 and 2005**
**(Amounts in Thousands)**

| | | 2006 | | 2005 |
|---|---|---|---|---|
| **ASSETS** | | | | |
| Intragovernmental | | | | |
| Fund Balance With Treasury (Note 2) | $ | 7,823,954 | $ | 7,674,185 |
| Accounts Receivable (Note 4) | | 37,530 | | 35,825 |
| Advances (Note 5) | | 35,189 | | 26,531 |
| Total Intragovernmental Assets | | 7,896,673 | | 7,736,541 |
| Cash and Other Monetary Assets (Note 3) | | 12,941 | | 11,196 |
| Accounts Receivable, Net (Note 4) | | 139 | | 97 |
| Advances (Note 5) | | 76,511 | | 69,661 |
| General Property, Plant and Equipment, Net (Note 6) | | 261,347 | | 257,564 |
| **Total Assets** | **$** | **8,247,611** | **$** | **8,075,059** |
| **LIABILITIES** | | | | |
| Intragovernmental Liabilities | | | | |
| Advances From Others | $ | 1,593 | $ | 15,171 |
| Employer Contributions & Other (Note 9) | | 712 | | 671 |
| FECA Employee Benefits (Note 8) | | 284 | | 281 |
| Other Intragovernmental Liabilities (Notes 11 and 12) | | 3,050 | | 3,000 |
| Total Intragovernmental Liabilities | | 5,639 | | 19,123 |
| Accounts Payable | | 43,932 | | 44,019 |
| FECA Employee Benefits (Note 8) | | 1,287 | | 1,381 |
| Estimated Clean Up Cost Liability (Note 11) | | - | | 116 |
| Accrued Liabilities - Grants, Payroll & Other (Note 9) | | 376,970 | | 299,953 |
| Accrued Annual Leave (Note 8) | | 13,892 | | 12,951 |
| **Total Liabilities (Note 8)** | **$** | **441,720** | **$** | **377,543** |
| Commitments and Contingencies (Notes 11 and 12) | | | | |
| **NET POSITION** | | | | |
| Unexpended Appropriations | $ | 7,255,489 | $ | 7,198,420 |
| Cumulative Results of Operations – Earmarked Funds (Note 13) | | 279,282 | | - |
| Cumulative Results of Operations | | 271,120 | | 499,096 |
| **Total Net Position** | | 7,805,891 | | 7,697,516 |
| **Total Liabilities and Net Position** | **$** | **8,247,611** | **$** | **8,075,059** |

**National Science Foundation**
**Statement of Net Cost**
**For the Years Ended September 30, 2006 and 2005**
**(Amounts in Thousands)**

| **Program Costs** | | **2006** | | **2005** |
|---|---|---|---|---|
| **Ideas** | | | | |
| Fundamental Science & Engineering | $ | 2,333,848 | $ | 2,327,110 |
| Centers | | 182,486 | | 176,183 |
| Capability Enhancements | | 214,013 | | 202,855 |
| Total Ideas Program Costs | | 2,730,347 | | 2,706,148 |
| Less: Earned Revenue | | (78,944) | | (119,826) |
| **Net Ideas Program Costs** | | **2,651,403** | | **2,586,322** |
| **Tools** | | | | |
| Large Facilities | $ | 535,284 | $ | 531,911 |
| Infrastructure and Instrumentation | | 418,095 | | 321,155 |
| Polar Tools, Facilities and Logistics | | 361,910 | | 312,784 |
| Federally Funded Research & Development Centers | | 227,158 | | 209,570 |
| Total Tools Program Costs | | 1,542,447 | | 1,375,420 |
| Less: Earned Revenue | | (31,954) | | (324) |
| **Net Tools Program Costs** | | **1,510,493** | | **1,375,096** |
| **People** | | | | |
| Individuals | $ | 863,438 | $ | 894,227 |
| Institutions | | 158,259 | | 179,356 |
| Collaborations | | 427,089 | | 379,489 |
| Total People Program Costs | | 1,448,786 | | 1,453,072 |
| Less: Earned Revenue | | (14,921) | | (6,316) |
| **Net People Program Costs** | | **1,433,865** | | **1,446,756** |
| **Net Cost of Operations (Note 14)** | **$** | **5,595,761** | **$** | **5,408,174** |

*The accompanying notes are an integral part of these statements.*

**National Science Foundation**
**Statement of Changes in Net Position**
**For the Year Ended September 30, 2006**
**(Amounts in Thousands)**

| | | 2006 | | |
|---|---|---|---|---|
| | | **Earmarked** | **All Other** | **Total** |
| **Cumulative Results of Operations** | | | | |
| **Beginning Balances (Note 13)** | **$** | **217,955** | **281,141** | **499,096** |
| **Budgetary Financing Sources** | | | | |
| Appropriations Used | | - | 5,501,447 | 5,501,447 |
| Non-exchange Revenue and Other | | - | 278 | 278 |
| Donations | | - | 31,142 | 31,142 |
| Appropriated Earmarked Receipts Transferred In | | 105,324 | - | 105,324 |
| **Other Financing Sources** | | | | |
| Transfers In / (Out) Without Reimbursement | | - | (257) | (257) |
| Imputed Financing From Costs Absorbed By Others | | - | 9,151 | 9,151 |
| Other | | - | (18) | (18) |
| **Total Financing Sources** | | **105,324** | **5,541,743** | **5,647,067** |
| **Net Cost of Operations** | | **43,997** | **5,551,764** | **5,595,761** |
| **Cumulative Results of Operations (Note 13)** | **$** | **279,282** | **271,120** | **550,402** |
| **Unexpended Appropriations** | | | | |
| **Beginning Balances** | **$** | **-** | **7,198,420** | **7,198,420** |
| **Budgetary Financing Sources** | | | | |
| Appropriations Received | | - | 5,653,370 | 5,653,370 |
| Appropriations Transferred In / (Out) (Note 15) | | - | 7,975 | 7,975 |
| Other Adjustments | | - | (102,829) | (102,829) |
| Appropriations Used | | - | (5,501,447) | (5,501,447) |
| **Total Budgetary Financing Sources** | | **-** | **57,069** | **57,069** |
| **Unexpended Appropriations** | **$** | **-** | **7,255,489** | **7,255,489** |

**National Science Foundation**
**Statement of Changes in Net Position**
**For the Year Ended September 30, 2005**
**(Amounts in Thousands)**

| | 2005 | |
|---|---|---|
| | Cumulative Results of Operations | Unexpended Appropriations |
| **Beginning Balances** | **$ 435,907** | **$ 7,097,014** |
| **Budgetary Financing Sources** | | |
| Appropriations Received (Net of Offsetting Receipts) | - | 5,516,960 |
| Appropriations Transferred In / (Out) (Note 15) | - | 9,670 |
| Other Adjustments | - | (78,395) |
| Appropriations Used | 5,346,829 | (5,346,829) |
| Non-exchange Revenue and Other | 87 | - |
| Donations | 31,077 | - |
| Appropriated Earmarked Receipts Transferred In | 83,677 | - |
| **Other Financing Sources** | | |
| Transfers In / (Out) Without Reimbursement | 675 | - |
| Imputed Financing From Costs Absorbed By Others | 9,002 | - |
| Other | 16 | - |
| **Total Financing Sources** | **5,471,363** | **101,406** |
| **Net Cost of Operations** | **5,408,174** | **-** |
| **Ending Balances (Note 13)** | **$ 499,096** | **$ 7,198,420** |

*The accompanying notes are an integral part of these statements.*

**National Science Foundation**
**Statement of Budgetary Resources (page 1 of 2)**
**For the Years Ended September 30, 2006 and 2005**
**(Amounts in Thousands)**

| | 2006 | 2005 |
|---|---|---|
| **Budgetary Resources** | | |
| **Unobligated Balance - Brought Forward, October 1** | **$ 243,674** | **$ 179,144** |
| **Recoveries of Prior Year Obligations** | **44,781** | **43,510** |
| Budget Authority | | |
| Appropriation | 5,790,114 | 5,631,800 |
| Spending Authority From Offsetting Collections: | | |
| Earned | | |
| Collected | 124,165 | 114,517 |
| Change in Receivable From Federal Sources | 1,705 | 11,949 |
| Change in Unfilled Customer Orders | | |
| Advance Received | (13,577) | (8,240) |
| Without Advance From Federal Sources | (14,458) | (6,378) |
| Anticipated for Rest of Year, Without Advances | - | - |
| **Subtotal - Budget Authority** | **5,887,949** | **5,743,648** |
| **Non-expenditure Transfers, Net – Anticipated and Actual (Note 15)** | **7,975** | **9,670** |
| **Permanently Not available** | **(102,829)** | **(78,395)** |
| **Total Budgetary Resources (Note 17)** | **$ 6,081,550** | **$ 5,897,577** |

**National Science Foundation**
**Statement of Budgetary Resources (page 2 of 2)**
**For the Years Ended September 30, 2006 and 2005**
**(Amounts in Thousands)**

| | 2006 | 2005 |
|---|---|---|
| **Status of Budgetary Resources** | | |
| Obligations Incurred: | | |
| Direct (Note 16) | 5,777,489 | 5,542,061 |
| Reimbursable (Note 16) | 100,517 | 111,842 |
| Total Obligations Incurred (Note 15) | 5,878,006 | 5,653,903 |
| Unobligated Balance – Apportioned (Note 15) | 120,872 | 155,531 |
| Unobligated Balance - Not Available (Note 15) | 82,672 | 88,143 |
| **Total Status of Budgetary Resources (Note 17)** | $ 6,081,550 | $ 5,897,577 |
| **Change in Obligated Balance** | | |
| Obligated Balance, Net | | |
| Unpaid Obligations - Brought Forward, October 1 | 7,570,194 | 7,498,420 |
| Less: Uncollected Customer Payments From Federal Sources, Brought Forward, October 1 | (139,683) | (134,112) |
| Total Unpaid Obligated Balance, Net | 7,430,511 | 7,364,308 |
| Obligations Incurred | 5,878,006 | 5,653,903 |
| Less: Gross Outlays | (5,656,078) | (5,538,620) |
| Less: Recoveries of Prior Year Unpaid Obligations, Actual | (44,781) | (43,510) |
| Change in Uncollected Customer Payments From Federal Sources | 12,753 | (5,570) |
| Subtotal | $ 7,620,411 | $ 7,430,511 |
| Obligated Balance, Net - End of Period | | |
| Unpaid Obligations | 7,747,341 | 7,570,194 |
| Less: Uncollected Customer Payments From Federal Sources | (126,930) | (139,683) |
| Total Unpaid Obligated Balance, Net - End of Period | $ 7,620,411 | $ 7,430,511 |
| **Net Outlays** | | |
| Gross Outlays | 5,656,078 | 5,538,620 |
| Less: Offsetting Collections | (110,588) | (106,277) |
| Less: Distributed Offsetting Receipts (Note 17) | (4,207) | (31,164) |
| **Net Outlays (Note 17)** | $ 5,541,283 | $ 5,401,179 |

*The accompanying notes are an integral part of these statements.*

**National Science Foundation**
**Statement of Financing**
**For the Years Ended September 30, 2006 and 2005**
**(Amounts in Thousands)**

| **Resources Used to Finance Activities** | **2006** | **2005** |
|---|---|---|
| **Budgetary Resources Obligated** | | |
| Obligations Incurred | $ 5,878,006 | $ 5,653,903 |
| Less: Spending Authority for Offsetting Collections and Recoveries | (142,616) | (155,358) |
| Obligations Net of Offsetting Collections and Recoveries | 5,735,390 | 5,498,545 |
| Less: Offsetting Receipts | (4,207) | (31,164) |
| Net Obligations | 5,731,183 | 5,467,381 |
| **Other Resources** | | |
| Transfers In | - | 675 |
| Imputed Financing | 9,151 | 9,002 |
| Net Other Resources Used to Finance Activities | 9,151 | 9,677 |
| **Total Resources Used to Finance Activities** | **5,740,334** | **5,477,058** |
| **Resources Used to Finance Items Not Part of the Net Cost of Operations** | | |
| Change in Budgetary Resources Obligated for Goods, Services and Benefits Ordered but Not Yet Provided | (148,852) | (83,636) |
| Resources that Fund Expenses Recognized in Prior Periods | (143) | (85) |
| Budgetary Offsetting Collections and Receipts that Do Not Affect Net Cost of Operations | 4,207 | 31,164 |
| Resources that Finance the Acquisition of Assets | (22,431) | (35,793) |
| **Total Resources Used to Finance Items Not Part of the Net Cost of Operations** | **(167,219)** | **(88,350)** |
| **Total Resources Used to Finance Net Cost of Operations** | **5,573,115** | **5,388,708** |
| **Components of the Net Cost of Operations that will not Require or Generate Resources in the Current Period** | | |
| Other | 3,993 | 790 |
| Total Components of Net Cost of Operations that will Require or Generate Resources in Future Periods (Note 19) | 3,993 | 790 |
| Components Not Requiring or Generating Resources | | |
| Depreciation and Amortization | 18,666 | 18,655 |
| Other | (13) | 21 |
| Total Components of Net Cost of Operations that will not Require or Generate Resources | 18,653 | 18,676 |
| **Total Components of Net Cost of Operations that Will Not Require or Generate Resources in the Current Period** | **22,646** | **19,466** |
| **Net Cost of Operations (Note 14)** | **$ 5,595,761** | **$ 5,408,174** |

# NOTES TO THE PRINCIPAL FINANCIAL STATEMENTS

## Note 1. Summary of Significant Accounting Policies

### A. Reporting Entity

The National Science Foundation (NSF or "Foundation") is an independent federal agency created by the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861-75). Its mission is to promote and advance scientific progress in the United States. NSF initiates and supports scientific research and research fundamental to the engineering process and programs to strengthen the Nation's science and engineering potential. NSF also supports education programs at all levels in all fields of science and engineering. NSF funds research and education in science and engineering by awarding grants and contracts to educational and research institutions in all parts of the United States. NSF, by law, cannot operate research facilities except in the polar regions. By award, NSF enters into relationships to fund the research operations conducted by grantees.

NSF is led by a presidentially-appointed director and the policy-making National Science Board (NSB). The NSB, composed of 24 members, represents a cross section of American leaders in science and engineering research and education, who are appointed by the President for six-year terms. The NSF Director is a member *ex officio* of the Board.

### B. Basis of Presentation

These financial statements have been prepared to report the financial position and results of operations of NSF as required by the Chief Financial Officers Act of 1990, the Government Management Reform Act of 1994, the Reports Consolidation Act of 2000, and the Office of Management and Budget (OMB) Circular A-136, *Financial Reporting Requirements*. While the statements have been prepared from the books and records of NSF in accordance with United States generally accepted accounting principles (GAAP) for federal entities and the formats prescribed by OMB, the statements are in addition to the financial reports used to monitor and control budgetary resources which are prepared from the same books and records.

### C. Basis of Accounting

The accompanying financial statements have been prepared using the accrual method of accounting in addition to recognizing certain budgetary transactions. Under the accrual method, revenues are recognized when earned and expenses are recognized when a liability is incurred, without regard to receipt or payment of cash. Budgetary accounting facilitates compliance with legal constraints and controls over the use of federal funds. NSF records grant expenses from expenditure reports submitted by the grantees.

### D. Revenues and Other Financing Sources

NSF received the majority of its funding through appropriations contained in the Science, State, Justice, Commerce, and related Agencies Appropriations Act. NSF receives annual, multi-year, and no-year appropriations that may be expended, within statutory limits. NSF also receives funding from a special funds receipt account that is reported as Earmarked funds. Additional amounts are obtained from reimbursements for services provided to other federal agencies and allocation transfers from other federal agencies. NSF receives funds from receipts to the donation account. Also, NSF receives interest earned on overdue receivables and excess cash advances to grantees. The interest earned on overdue receivables is returned to the Treasury. Interest earned on excess cash advances to grantees is sent directly to the

Department of Health and Human Services in accordance with OMB Circular A-110, *Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals and Other Non Profit Organizations.*

Appropriations are recognized as a financing source at the time the related "funded" program or administrative expenses are incurred. Appropriations are also recognized when used to purchase property, plant and equipment. "Unfunded" liabilities result from liabilities not covered by budgetary resources and will be paid when future appropriations are made available for these purposes. Donations are recognized as revenues when funds are received. Revenues from reimbursable agreements are recognized when the services are provided and the related expenditures are incurred. Reimbursable agreements are mainly for grant administrative services provided by NSF on behalf of other federal agencies.

NSF is authorized to accept and use U.S. and foreign funds into the NSF Donation Account per the General Authority of the Foundation as found in 42 U.S.C. 1862 Section 3 (a)(3), "to foster the interchange of scientific and engineering information among scientists and engineers in the United States and foreign countries", and also 42 U.S.C. 1870 Section 11 (f) which allows NSF to receive and use funds donated by others. Donations are received from foreign governments, private companies, academic institutions, non-profit foundations, and individuals. Donated funds are either earmarked for a specific NSF program or unrestricted, which can be used on one or more of the general purposes of the Foundation. NSF maintains four interest bearing donation accounts. Interest earned on the bank deposits are used for the same purpose as the principal donations. When needed for program support, donations are transferred to the U.S. Treasury. Funds are made available for obligations as necessary to support NSF programs.

## E. Fund Balance with Treasury and Cash and Other Monetary Assets

Cash receipts and disbursements are processed by the Treasury. Fund Balance with Treasury is composed primarily of appropriated funds that are available to pay current liabilities and finance authorized purchase commitments. Cash and Other Monetary Assets primarily include non-appropriated funding sources from donations, non-convertible Indian rupees, and undeposited collections.

NSF has also established commercial bank accounts to hold some donated funds in trust, in interest bearing accounts as permitted by the contributors. These funds are collateralized by the bank through the U.S. Treasury.

## F. Accounts Receivable, Net

Accounts Receivable consists of amounts due from governmental agencies, private organizations, and individuals. NSF establishes an allowance for loss on accounts receivable from private sources that are deemed uncollectible, but regards amounts due from other federal agencies as fully collectible. NSF writes off delinquent debt that is more than two years old. NSF also analyzes each account independently to assess collectability and the need for an offsetting allowance or write-off.

## G. Advances

Advances consist of advances to grantees, contractors, and federal agencies. Advance payments are made to grant recipients so that recipients may incur expenses related to the approved grant. Payments are only made within the amount of the recorded grant obligation and are intended to cover immediate cash needs. The total grant expenditures for the year include an estimate of the fourth quarter amounts due from and payable to grantees. The majority of NSF's grantees are on a reimbursement basis. The grant accrual

calculation is based on historical trend analysis prepared by NSF. NSF uses a methodology to track the spending patterns by fiscal year and quarter for each of its fund groups. NSF has determined that each appropriation and the year of the appropriation have a noted spending pattern. Based on historical information NSF applies an average percentage rate to the current year grant related obligations for each individual appropriation within a fund group. The calculation provides NSF with the accrued expenditure. NSF estimates the ending cash on hand balance in total for its grantees after the accrued grant expenditure has been determined. Based on an average of six years of historical cash on hand data, NSF applies the negative cash on hand rate to the estimated ending cash on hand to determine the amount to record as a liability. The difference between the total expenditure amount accrued and the liability recorded is used to reduce the asset. Advances to contractors are payments made in advance of incurring expenses. Advances to federal agencies are only issued when agencies are operating under working capital funds and are unable to incur costs on a reimbursable basis. Advances are reduced when documentation supporting expenditures is received and recorded.

## H. General Property, Plant and Equipment (PP&E)

*PP&E*: NSF capitalizes acquisition costs exceeding $25 thousand and useful lives of two or more years. Acquisitions not meeting these criteria are recorded as operating expenses. NSF currently reports capitalized PP&E at original acquisition cost; assets acquired from General Services Administration's (GSA) excess property schedules are recorded at the value assigned by the donating agency; assets transferred in from other agencies are at the cost recorded by the transferring entity for the asset net of accumulated depreciation or amortization. Completed buildings under the U.S. Antarctic Program (USAP) are transferred from Construction in Progress to Real Property at NSF's acceptance. Depreciation expense is calculated using the half year convention rule. The economic life classifications for capitalized assets are as follows:

Equipment

| | | |
|---|---|---|
| 5 years | - | computers and peripheral equipment, fuel storage tanks, laboratory equipment, and vehicles |
| 7 years | - | communications equipment, office furniture and equipment, pumps and compressors |
| 10 years | - | generators, Department of Defense equipment |
| 20 years | - | long duration balloon facilities (LDB) |

Aircraft and Satellites

| | | |
|---|---|---|
| 7 years | - | aircraft, aircraft conversions, and satellites |

Buildings and Structures

| | | |
|---|---|---|
| 31.5 years | - | buildings and structures placed in service prior to 1993 |
| 39 years | - | buildings and structures placed in service after 1993 |

Internal Use Software

| | | |
|---|---|---|
| 5 years | - | internal use software |

Leasehold Improvements

The economic life of Leasehold Improvements is amortized over the number of years remaining on the occupancy agreement for the NSF headquarters building. In FY 2006, Leasehold Improvements completed during the year were amortized over 7 years. This represents the remaining years on NSF's lease with GSA.

The PP&E balance consists of Equipment, Aircraft and Satellites, Buildings and Structures, Leasehold Improvements, and Construction in Progress. Costs are accumulated in construction in progress until the complete project is accepted by NSF and at that time, project costs are capitalized and depreciated over the respective useful life of the asset. These balances are comprised of PP&E maintained "in-house" by NSF to support agency operations and PP&E under the U.S. Antarctic Program (USAP). The majority of USAP property is currently the custodial responsibility of Raytheon Technical Services Company, the NSF contractor for the program. Additionally, the U.S. Navy's Space and Naval Warfare Center, the Air National Guard 109th, and Ken Borek Air have custodial responsibility for some USAP property.

*Office Space*: The NSF headquarters buildings are leased through the GSA under an occupancy agreement. The cancellation clause within the agreement allows NSF to terminate use with a 120 day notice. NSF is billed by GSA for the leased space as rent based upon estimated lease payments made by GSA plus an administrative fee. The cost of the headquarters building is not capitalized by NSF. The cost of leasehold improvements performed by GSA is financed with NSF appropriated funds. The leasehold improvements are capitalized by NSF as they are transferred from Construction in Progress. Amortization is calculated using the half year convention rule over the lesser of their useful lives or the unexpired lease term.

*Internal Use Software*: NSF controls, values and reports purchased or developed software as tangible property assets, in accordance with the Statement of Federal Financial Accounting Standards (SFFAS) No. 10 – "Accounting for Internal Use Software." NSF identifies software investments as accountable property for items that, in the aggregate, cost $500 thousand or more to purchase, develop, enhance or modify a new or existing NSF system. Software projects that are not completed at year-end and are expected to exceed the capitalization threshold are recorded as software in development. All internal use software meeting the capitalization threshold is amortized over a five-year period using the half year convention rule.

*Assets Owned by NSF in the Custody of Other Entities:* NSF awards grants, cooperative agreements, and contracts to various organizations, including colleges and universities, non-profit organizations, state and local governments, Federally Funded Research and Development Centers (FFRDC), and private entities. The funds provided may be used in certain cases to purchase or construct (PP&E) to be used for operations or research on projects or programs sponsored by NSF. In these instances, NSF funds the acquisition of property, but transfers control to these entities. NSF's authorizing legislation specifically prohibits it from operating such property directly. In practice, NSF's ownership interest in such PP&E is similar to a reversionary interest. To address the accounting and reporting of these assets, specific guidance was sought by NSF and provided by the Federal Accounting Standards Advisory Board (FASAB). This guidance stipulated that NSF should: (i) disclose the value of such PP&E held by others in its financial statements based on information contained in the audited financial statements of these entities (if available). Where separate audited amounts are not available for a specific entity, NSF should name the entity and note that these amounts are unavailable; and (ii) report information on costs incurred to acquire the research facilities, equipment, and platforms in the Research and Human Capital Activity costs as required by the SFFAS No. 8, *Supplementary Stewardship Reporting*.

## I. Advances from Others

Advances from Others consist of prior year amounts obligated and advanced by other federal entities to NSF for grant administration and other services to be furnished under reimbursable agreements. Balances at the end of the year are adjusted by an allocated amount from the fourth quarter grantee expenditure

estimate described under Note 1G, *Advances*. The amount to be allocated is based on a percentage of reimbursable grant expenditures, by trading partner, to total grant expenditures.

## J. Accounts Payable

Accounts Payable consists of liabilities to commercial vendors, contractors, and disbursements in transit. Accounts payable to commercial vendors and contractors are expenses for goods and services received but not yet paid by NSF at the end of the fiscal year. At year-end, NSF accrues for the amount of estimated unpaid expenses to commercial vendors. Accounts payable also consists of disbursements in transit recorded by NSF but not paid by Treasury.

## K. Other Liabilities

Other liabilities consist of grant accruals, contract accruals, accrued payroll and benefits. Grant liabilities are estimated grantee expenses over and above the amount of advances given to grantees. At year-end, NSF accrues for the amount of estimated grantee expenses not covered by advances given to grantees. Contract accruals are estimated expenses over and above the amount of advances given to contractors. At year-end, NSF accrues the amount of estimated expenses not covered by advances given to contractors. Accrued payroll and benefits relate to services rendered by NSF employees but not yet paid. At year-end, NSF accrues the amount of wages and benefits earned, but not yet paid. NSF's payroll services are provided by the Department of the Interior.

## L. Annual, Sick, and Other Leave

Annual leave is accrued as it is earned, and the accrual is reduced as leave is taken. Each year, the balance in the accrued annual leave account is adjusted to reflect changes. To the extent current and prior-year appropriations are not available to fund annual leave earned but not taken, funding will be obtained from future Salaries and Expenses appropriations. Sick leave and other types of nonvested leave are expensed as taken.

## M. Employee Benefits

A liability is recorded for estimated and actual future payments to be made for workers' compensation pursuant to the Federal Employees' Compensation Act (FECA). The liability consists of the net present value of estimated future payments calculated by the U.S. Department of Labor (DOL) and the actual unreimbursed cost paid by DOL for compensation paid to recipients under FECA. The actual costs incurred are reflected as a liability because NSF will reimburse DOL two years after the actual payment of expenses. Future NSF Salary and Expense Appropriations will be used for DOL's estimated reimbursement.

## N. Net Position

Net position is the residual difference between assets and liabilities and is composed of unexpended appropriations and cumulative results of operations. Unexpended appropriations represent the amount of unobligated and unexpended budget authority. Unobligated balances are the amount of appropriations or other authority remaining after deducting the cumulative obligations from the amount available for obligation. The cumulative results of operations is the net result of NSF's operations since inception.

In 2006, the NSF has accounted for revenues and other financing sources for earmarked funds separately from other funds. This new method was adopted in accordance with the provisions of the FASAB's SFFAS No. 27, *Identifying and Reporting Earmarked Funds*, which became effective October 1, 2006.

This new standard amended SFFAS No.7, *Revenue and Other Financing Sources*, by:

- elaborating the special accountability needs associated with dedicated collections;
- separating dedicated collections into two categories – earmarked funds and fiduciary activity; and
- defining and providing accounting and reporting guidance for earmarked funds.

In accordance with SFFAS No. 27, NSF did not restate the prior period columns of the financial statements and related disclosures. See Note 13 for specific required disclosures related to NSF's earmarked funds.

## O. Retirement Plan

In FY 2006, approximately 25 percent of NSF employees participated in the Civil Service Retirement System (CSRS), to which NSF made matching contributions equal to 7 percent of pay. The majority of NSF employees are covered by the Federal Employees Retirement System (FERS) and Social Security. A primary feature of FERS is that it offers a thrift savings plan to which NSF automatically contributes 1 percent of pay and matches employee contributions up to an additional 4 percent of pay. NSF also contributes the employer's matching share for Social Security for FERS participants.

Although NSF funds a portion of the benefits under FERS and CSRS relating to its employees and withholds the necessary payroll deductions, the agency has no liability for future payments to employees under these plans, nor does NSF report CSRS, FERS, or Social Security assets, or accumulated plan benefits, on its financial statements. Reporting such amounts is the responsibility of the Office of Personnel Management (OPM) and The Federal Retirement Thrift Investment Board.

SFFAS No. 5, *Accounting for Liabilities of the Federal Government*, requires employing agencies to recognize the cost of pensions and other retirement benefits during their employees' active years of service. OPM actuaries determine pension cost factors by calculating the value of pension benefits expected to be paid in the future, and provide these factors to the agency for current period expense reporting. Information is also provided by OPM regarding the full cost of health and life insurance benefits.

## P. Commitments, Contingencies, and Possible Future Costs

*Commitments*: Commitments are contractual agreements involving financial obligations. NSF is committed for goods and services that have been ordered, but have not yet been delivered.

*Contingencies - Claims and Lawsuits*: NSF is a party to various legal actions and claims brought against it. In the opinion of NSF management and legal counsel, the ultimate resolution of the actions and claims will not materially affect the financial position or operations of the Foundation. NSF recognizes the contingency in the financial statements when claims are expected to result in a material loss, whether from NSF's appropriations or the "Judgment Fund" administered by the Department of Justice under Section 1304 of Title 31 of the United States Code, and, the payment amounts can be reasonably estimated.

Claims and lawsuits have also been made and filed against awardees of the Foundation by third parties. NSF is not a party to these actions and NSF believes there is no possibility that NSF will be legally required to satisfy such claims. Judgments or settlements of the claims against awardees that impose financial obligation on them may be claimed as costs under the applicable contract, grant, or cooperative agreement and thus may affect the allocation of program funds in future fiscal years. In the event that the claim becomes probable, amounts can be reasonably estimated, the claim will be recognized.

*Contingencies – Unasserted Claims*: For claims and lawsuits that have not been made and filed against the Foundation, NSF management and legal counsel determine, in their opinion, whether resolution of the actions and claims it is aware of will materially affect the agency's financial position or operations. NSF recognizes a contingency in the financial statements when unasserted claims are probable of assertion, and if asserted would be probable of an unfavorable outcome, and expected to result in a measurable loss, whether from NSF's appropriations or the "Judgment Fund." NSF discloses unasserted claims if materiality or measurability of a potential loss cannot be determined or the loss is more likely than not to occur rather than probable.

*Termination Claims*: NSF engages organizations in cooperative agreements and contracts to manage, operate and maintain research facilities for the benefit of the scientific community. As part of these agreements and contracts, NSF funds on a pay-as-you-go basis certain employee benefit costs, (accrued vacation and other employee related liabilities, severance pay and medical insurance), long term leases and vessel usage. These agreements permit awardees to make claims for any unpaid costs upon termination or non-renewal of the agreements and contracts.

NSF considers the likelihood of termination or non-renewal to be remote, and has not recorded liabilities for these termination claims on its financial statements. However, one FFRDC operator has identified these payments as obligations of NSF. The termination provision of the cooperative agreement clearly states that NSF's liability for such costs exists only upon termination and is limited to the lesser of available appropriations or $25 million. NSF, at the discretion of its Director, has offered to use its best efforts to obtain these additional funds, including efforts to obtain such funds from Congress. However, nothing in the agreements or contracts can be construed as implying that Congress will appropriate funds to meet the terms of these claims.

*Environmental Liabilities*: NSF manages the U.S. Antarctic Program. The Antarctic Conservation Act and its implementing regulations identify the requirements for environmental clean-up in Antarctica. NSF continually monitors the U.S. Antarctic Program in regards to environmental issues. NSF establishes its environmental liability estimates in accordance with the requirements of the SFFAS No. 5, "*Accounting for Liabilities of the Federal Government*," and as amended by SFFAS No. 12, "Recognition *of Contingent Liabilities Arising from Litigation*," and the Federal Financial Accounting and Auditing Technical Release No. 2, "*Determining Probable and Reasonably Estimable for Environmental Liabilities in the Federal Government.*"

## Q. Use of Estimates

Management has made certain estimates and assumptions when reporting assets, liabilities, revenue, and expenses, and also in the note disclosures. Significant estimates underlying the accompanying financial statements include accounting for grants, contracts, accounts payable and USAP property. Actual results may differ from these estimates, and the difference will be adjusted for and included in the financial statements of the following fiscal year.

## R. Reclassification of Statement of Budgetary Resources

The presentation used for the Statement of Budgetary Resources (SBR) prior to FY 2006 has been revised to reflect a new format required pursuant to the OMB Circular A-136, "*Financial Reporting Requirements*". Circular A-136 requires agencies to present both the FY 2006 and 2005 SBR in the same format. Accordingly, certain reclassifications were made to the previously issued FY 2005 SBR to conform to the new format.

## Note 2. Fund Balance with Treasury

Fund Balance with Treasury consisted of the following components as of September 30, 2006 and 2005:

| (Amounts in Thousands) | 2006 | | | |
|---|---|---|---|---|
| | Appropriated Funds | Donated Funds | Earmarked Funds | Total |
| Obligated | $ 7,431,272 | 5,852 | 183,286 | 7,620,410 |
| Unobligated Available | 7,662 | 17,709 | 95,501 | 120,872 |
| Unobligated Unavailable | 79,595 | 391 | 2,686 | 82,672 |
| Total Fund Balance with Treasury | $ 7,518,529 | 23,952 | 281,473 | 7,823,954 |

| (Amounts in Thousands) | 2005 | | | |
|---|---|---|---|---|
| | Appropriated Funds | Donated Funds | Earmarked Funds | Total |
| Obligated | $ 7,279,716 | 20,678 | 130,117 | 7,430,511 |
| Unobligated Available | 54,064 | 14,495 | 86,972 | 155,531 |
| Unobligated Unavailable | 85,324 | 213 | 2,606 | 88,143 |
| Total Fund Balance with Treasury | $ 7,419,104 | 35,386 | 219,695 | 7,674,185 |

The Donations Account includes amounts donated to NSF from all sources. Amounts in the Donations Account are restricted for intended purposes. Unavailable balances include recovered expired appropriations and other amounts related to expired authority and holdings, which are unavailable for NSF use.

In 1999, in accordance with P.L. 105-277, NSF established a special fund called H-1B Nonimmigrant Petitioner Fees Account. These funds are considered Earmarked Funds and are not included in Appropriated Funds. The funds are fees collected for each petition for nonimmigrant status. Under the law, NSF was prescribed a percentage of these fees for specific programs.

## Note 3. Cash and Other Monetary Assets

NSF's Cash and Other Monetary Assets as of September 30, 2006 and 2005 consisted of the following:

| (Amounts in Thousands) | | 2006 | 2005 |
|---|---|---|---|
| Cash | $ | 12,898 | 10,879 |
| Foreign Currency | | 43 | 317 |
| Total Cash and Other Monetary Assets | $ | 12,941 | 11,196 |

## Note 4. Accounts Receivable, Net

*Intragovernmental*

The Intragovernmental Accounts Receivable consists of reimbursements and repayments due from other government agencies. As of September 30, 2006 and 2005, the amount of intragovernmental accounts receivable was $37,530 thousand and $35,825 thousand respectively.

*Public*

As of September 30, 2006 and 2005, Accounts Receivable (net) due from private organizations and individuals consisted of:

| (Amounts in Thousands) | 2006 | 2005 |
|---|---|---|
| Accounts Receivable | $ 146 | $ 98 |
| Allowance for Uncollectible Accounts | (7) | (1) |
| Net Amount Due | $ 139 | $ 97 |

As of September 30, 2006 and 2005, the reconciliation of the allowance for uncollectible accounts is as follows:

| (Amounts in Thousands) | 2006 | 2005 |
|---|---|---|
| Beginning Allowance | $ (1) | $ - |
| Additions | (7) | (1) |
| Reductions (write-offs) | 1 | - |
| Ending Allowance | $ (7) | $ (1) |

## Note 5. Advances

As of September 30, 2006 and 2005, Advances consisted of the following components:

*Intragovernmental*

| (Amounts in Thousands) | 2006 | 2005 |
|---|---|---|
| Advances to Others | $ 35,189 | $ 26,531 |

*Public*

| (Amounts in Thousands) | 2006 | 2005 |
|---|---|---|
| Advances to Grantees | $ 76,413 | $ 65,123 |
| Advances to Others | - | 448 |
| Advances to Contractors | 98 | 4,090 |
| Total Advances with the Public | $ 76,511 | $ 69,661 |

## Note 6. General Property, Plant and Equipment, Net

The components of General Property Plant and Equipment as of September 30, 2006 and 2005 were:

| (Amounts in Thousands) | 2006 | | |
|---|---|---|---|
| | Acquisition Cost | Accumulated Depreciation | Net Book Value |
| Equipment | $ 129,604 | $ 110,148 | $ 19,456 |
| Aircraft and Satellites | 138,487 | 122,485 | 16,002 |
| Buildings and Structures | 129,025 | 51,181 | 77,844 |
| Leasehold Improvements | 3,686 | 1,112 | 2,574 |
| Construction in Progress | 141,880 | - | 141,880 |
| Internal Use Software | 7,879 | 5,203 | 2,676 |
| Software in Development | 915 | - | 915 |
| Total PP&E | $ 551,476 | $ 290,129 | $ 261,347 |

| (Amounts in Thousands) | 2005 | | |
|---|---|---|---|
| | Acquisition Cost | Accumulated Depreciation | Net Book Value |
| Equipment | $ 98,659 | $ 79,592 | $ 19,067 |
| Aircraft and Satellites | 138,487 | 116,084 | 22,403 |
| Buildings and Structures | 132,209 | 48,125 | 84,084 |
| Construction in Progress | 127,975 | - | 127,975 |
| Internal Use Software | 7,881 | 3,846 | 4,035 |
| Total PP&E | $ 505,211 | $ 247,647 | $ 257,564 |

## Note 7. Property, Plant and Equipment in the Custody of Other Entities

As explained in Note 1-H, *Assets Owned by NSF in the Custody of Other Entities*, NSF received a ruling from FASAB on accounting for PP&E owned by NSF but in the custody of and used by others. The FASAB guidance requires PP&E in the custody of others be excluded from NSF PP&E as defined in the SFFAS No. 6 *Accounting for Property, Plant and Equipment.* NSF is however required to disclose the dollar amount of NSF PP&E held by others in the footnotes based on information contained in the audited financial statements of the organization holding the assets.

At September 30, 2006 there were 23 Colleges or Universities that held NSF property but for which relevant net book value of such property was unavailable. There were 29 commercial entities that held NSF property, of which Vista Engineering, Inc. was the only entity to separately report NSF titled property in its audited financial statements. Per the financial statements, Vista Engineering, Inc, held NSF titled property with a net book value of $195 thousand.

At September 30, 2005 there were 14 Colleges or Universities, and 23 commercial entities, that held NSF property but for which relevant net book value of such property was unavailable.

The amount of PP&E owned by NSF but in the custody of a FFRDC is identified in the following table and was obtained from the respective entities' audited financial statements. If NSF PP&E is not

separately stated on the entities' audited financial statements, the related amounts are annotated as Not Available (N/A) in the table.

(Amounts in Thousands)

| *Federally Funded Research and Development Centers* | 2006 | 2005 | Year End |
|---|---|---|---|
| National Astronomy & Ionosphere Center - NAIC Cornell | $ N/A | $ N/A | 6/30 |
| National Center for Atmospheric Research - UCAR | N/A | 179,884 | 9/30 |
| National Optical Astronomy Observatories - AURA | N/A | 432,105 | 9/30 |
| National Radio Astronomy Observatory - AUI | N/A | N/A | 9/30 |

## Note 8. Liabilities Not Covered by Budgetary Resources

Certain liabilities are not funded by current budgetary resources. As of September 30, 2006 and 2005, Liabilities Not Covered by Budgetary Resources consisted of the following:

| (Amounts in Thousands) | 2006 | 2005 |
|---|---|---|
| Intragovernmental: FECA Employee Benefits | $ 284 | $ 281 |
| Public: FECA Employee Benefits | 1,287 | 1,381 |
| Accrued Annual Leave | 13,892 | 12,951 |
| Total Liabilities Not Covered by Budgetary Resources | 15,463 | 14,613 |
| Total Liabilities Covered by Budgetary Resources | 426,257 | 362,930 |
| Total Liabilities | $ 441,720 | $ 377,543 |

## Note 9. Other Liabilities

These are current accrued liabilities, which consist of grant and contract accruals, accrued employer contributions for payroll and benefits, accrued payroll and benefits, and various employee related liabilities for payroll and benefit deductions. As of September 30, 2006 and 2005, these liabilities consisted of the following:

| (Amounts in Thousands) | 2006 | 2005 |
|---|---|---|
| Intragovernmental – Employer Contributions | | |
| Employer Contributions for Payroll Benefits and Other | $ 712 | $ 671 |
| Total Intragovernmental Employer Contributions | $ 712 | $ 671 |

| (Amounts in Thousands) | 2006 | 2005 |
|---|---|---|
| Accrued Liabilities - Grants and Payroll | | |
| Contract Accrual | $ 22,480 | $ - |
| Grant Accrual | 347,737 | 293,631 |
| Total Accrued Liabilities | $ 370,217 | $ 293,631 |
| Accrued Payroll and Benefits | 6,753 | 6,322 |
| Total Accrued Liabilities - Grants and Payroll | $ 376,970 | $ 299,953 |

## Note 10. Leases

NSF leases it's headquarter buildings under an operating lease with the GSA. The following are schedules of future minimum rental payments required under leases that have initial or remaining terms in excess of a year.

(Amounts in Thousands)

| Fiscal Year | | Operating Lease Amount |
|---|---|---|
| 2007 | $ | 19,347 |
| 2008 | | 19,477 |
| 2009 | | 20,117 |
| 2010 | | 20,275 |
| 2011 | | 20,591 |
| 2012 and thereafter | | 45,374 |
| Total Minimum Lease Payments | $ | 145,181 |

## Note 11. Estimated Clean up Cost Liability

*Environmental and Clean up Costs*: The Toolik Field Station is operated by the Institute of Arctic Biology at the University of Alaska, Fairbanks. As the primary customer for the Institute, in FY 2006, NSF paid $116 thousand which was the remaining balance of remediation costs for the Toolik Field Station oil spill that occurred on August 25, 2001.

Joint planning for the clean up of Cape Hallett, the former U.S. and New Zealand station was successful and no U.S. funds were spent during this period and the U.S. commitment is complete.

NSF is continuing its actions to assess the condition of the Columbia Scientific Balloon Facility (CSBF) site before completing a no-cost transfer through the GSA to the National Aeronautics and Space Administration (NASA). NASA engineers have reported 10 wells on the NSBF site and are aware of one contaminated well from battery disposal. NSF estimates, in consultation with the general counsel office, that the clean-up costs will range between $50 thousand and $200 thousand, the lower of which is reflected on the balance sheet as *Other Intragovernmental Liabilities*. This estimate is based upon the proposed NSF share of Phase II Environmental Due Diligence Audit (EDDA) of the CSBF assessment resulting from findings in the EDDA Phase I. A final report is due December 2007 at which time NSF will be able to evaluate whether future outflow is necessary.

## Note 12. Commitments and Contingencies

*Cost Incurred Audits:* Raytheon Polar Services Company (Raytheon), a NSF contractor, manages one of NSF's major programs, USAP. Raytheon has undergone cost incurred audits for FY 2000 through FY 2004. As a result of these audits, $55,500 thousand of costs are being questioned. The cost incurred audits for FY 2005 and FY 2006 have not been completed. A receivable related to this contingency is not reflected in the balance sheet due to the uncertainty of NSF recouping any of the questioned costs.

*Claims*: Contractor claims for additional compensation under a contract awarded by the United States Air Force for the reconfiguration of three NSF owned LC130 aircrafts, were paid by the Judgment Fund for $3,000 thousand and are reflected on the *Other Intragovernmental Liabilities* line of the balance sheet.

NSF submitted a request for funds in its FY 2007 budget submission in order to reimburse the Judgment Fund. However, based on the Senate Appropriation Report, NSF may not be required to reimburse the Judgment Fund.

## Note 13. Earmarked Funds

In FY 1999, Title IV of the American Competitiveness and Workforce Improvement Act of 1998 (P.L. 105-277) established an H-1B Non immigrant petitioner account in the General Fund of the U.S Treasury. Funding is established from fees collected for alien, non immigrant status petitions. This law required that a prescribed percentage of the funds in the account be made available to NSF for the following activities:

- Computer Science, Engineering, and Mathematics Scholarship (CSEMS)
- Grants for Mathematics, Engineering, or Science Enrichment Courses
- Systemic Reform Activities

The H-1B Non immigrant Petitioner fees are available to the Director of NSF until expended. The funds may be used for scholarships to low income students, or to carry out a direct or matching grant program to support private and/or public partnerships in K-12 education. The H-1B Fund is set up as a permanent, indefinite appropriation by NSF and is enacted by legislation. These funds are included in the President's budget. The budgetary resources for the earmarked fund are recorded in the *Appropriated Earmarked Receipts Transferred In* general ledger account, and reported according to the guidance for earmarked funds.

| (Amounts in Thousands) | | **2006 Earmarked Funds** |
|---|---|---|
| **Balance Sheet as of September 30, 2006** | | |
| Fund Balance with Treasury | $ | 281,473 |
| Advances | | 588 |
| Total Assets | $ | 282,061 |
| Other Liabilities | $ | 2,779 |
| Total Liabilities | $ | 2,779 |
| Unexpended Appropriations | $ | - |
| Cumulative Results of Operations | | 279,282 |
| Total Liabilities and Net Position | $ | 282,061 |
| **Statement of Net Cost For the Year Ended September 30, 2006** | | |
| Program Costs | $ | 43,997 |
| Less Earned Revenues | | - |
| Net Program Costs | | 43,997 |
| Net Cost of Operations | $ | 43,997 |

| (Amounts in Thousands) | | 2006 Earmarked Funds |
|---|---|---|
| **Statement of Changes in Net Position For the Year Ended September 30, 2006** | | |
| Net Position Beginning of Period | $ | 217,955 |
| Net Cost of Operation | | (43,997) |
| Appropriated Earmarked Receipts Transferred In | | 105,324 |
| Change in Net Position | | 61,327 |
| Net Position End of Period | $ | 279,282 |

New requirements under OMB Circular A-136 – Revised July 2006, state that material net position balances attributable to earmarked funds are reported separately from other funds. In addition, requirements advise that beginning balances shall agree with the amounts reported as net position on the prior year's balance sheet.

| (Amounts in Thousands) | | |
|---|---|---|
| Net Position – Cumulative results of operations as previously reported at September 30, 2005 | $ | 499,096 |
| Less: non-earmarked funds | $ | (281,141) |
| Net Position – Cumulative results of operations – Earmarked funds, as reclassified at September 30, 2005 | $ | 217,955 |

## Note 14. Statement of Net Cost

*Major Program Descriptions*

NSF's primary business is to make merit-based grants and cooperative agreements to individual researchers and groups, in partnership with colleges, universities, and other public, private, state, local, and federal institutions, throughout the U.S. By providing these resources, NSF contributes to the health and vitality of the U.S. research and education enterprise, which enables and enhances the Nation's capacity to sustain growth and prosperity. These grants are managed through eight programmatic organizations within NSF that review and evaluate competitive proposals submitted by the science and engineering community for its consideration.

NSF is a single entity for net cost reporting purposes. NSF's programmatic organizations are the Directorates for the Biological Sciences; Computer and Information Science and Engineering; Education and Human Resources; Engineering; Geosciences; Mathematical and Physical Sciences; Social, Behavioral and Economic Sciences; and the Office of Polar Programs.

The Statement of Net Cost is a general overall presentation of NSF-wide expenses incurred by the agency. The presentation of the Statement of Net Cost is aligned with NSF's strategic goals of *Ideas, Tools, and People.* NSF's fourth strategic goal, *Organizational Excellence*, focuses on NSF's administrative and management activities. NSF has assigned ten investment categories that align to *Ideas, Tools and People.* The Investment categories for *Ideas* are Fundamental Science and Engineering; Centers; and Capability Enhancements. For *Tools* they are Large Facilities; Infrastructure and

Instrumentation; Polar Tools, Facilities and Logistics; and FFRDCs. For *People* they are Individuals; Institutions; and Collaborations. These goals are outlined in NSF's FY 2003 – 2008 Strategic Plan.

In pursuit of its mission, NSF makes investments in *Ideas*, *Tools* and *People*. These goals reflect outcomes at the heart of the research enterprise: discoveries across the frontier of science and engineering, connected to learning, innovation and service to society (*Ideas*); broadly accessible, state-of-the-art science and engineering facilities (*Tools*); and a diverse, competitive, and globally-engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens (*People*). *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.

In FY 2006 and 2005, approximately 94 and 95 percent respectively, of NSF's budget authority is directly related to the *Ideas*, *Tools, and People* strategic areas of focus. The remaining percentage of NSF's investments supports *Organizational Excellence* activities. In FY 2006 and 2005, *Organizational Excellence* costs amounted to $321,085 thousand and $292,426 thousand, respectively. All organizational excellence costs are assigned on a prorated basis to the *Ideas, Tools and People* strategic areas.

In FY 2006 and 2005, organizational excellence activities include Salary & Expenses, NSB and Office of Inspector General (OIG) expenses which provide for salaries and benefits of persons employed at the NSF; general operating expenses, including key activities to advance NSF's information systems technology and to enhance staff training, audit and OIG activities, and OPM and DOL benefits costs paid on behalf of NSF. These indirect costs are allocated to NSF programs based on each program's direct costs.

In accordance with OMB Circular A-136, *Financial Reporting Requirements,* costs incurred for services provided by other federal entities are reported in the full costs of NSF programs and are identified as "intragovernmental." All earned revenues are funding sources provided through reimbursable agreements with other federal entities and are retained by NSF. Earned revenues are recognized when the related program or administrative expenses are incurred and are deducted from the full cost of the programs to arrive at the net cost of operating NSF's programs. In FY 2006, NSF re-categorized a number of program reference codes, which caused expenditures to be assigned to a different investment category than in FY 2005. NSF also refined its methodology for reporting on incomplete code strings. NSF applies an administrative fee for grant management services provided to other federal entities. The administrative fee is based on the ratio of prior year administrative costs to total expenses. The intragovernmental costs are as follows:

*Intragovernmental and Public Costs and Earned Revenue by Investment Category*

| (Amounts in Thousands) | | 2006 | | |
|---|---|---|---|---|
| | | Federal | Public | Total |
| Ideas | | | | |
| Fundamental Science & Engineering | $ | 9,187 | 2,324,661 | 2,333,848 |
| Centers | | - | 182,486 | 182,486 |
| Capability Enhancements | | - | 214,013 | 214,013 |
| Total Ideas Program Cost | | 9,187 | 2,721,160 | 2,730,347 |
| Less: Earned Revenue | | (78,944) | - | (78,944) |
| Net Ideas | | (69,757) | 2,721,160 | 2,651,403 |
| Tools | | | | |
| Large Facilities | $ | 10,992 | 524,292 | 535,284 |
| Infrastructure and Implementation | | 16,398 | 401,697 | 418,095 |
| Polar Tools, Facilities and Logistics | | 167,709 | 194,201 | 361,910 |
| Federally Funded R&D Centers | | 9,400 | 217,758 | 227,158 |
| Total Tools Program Cost | | 204,499 | 1,337,948 | 1,542,447 |
| Less: Earned Revenue | | (31,954) | - | (31,954) |
| Net Tools | | 172,545 | 1,337,948 | 1,510,493 |
| People | | | | |
| Individuals | $ | 2,769 | 860,669 | 863,438 |
| Institutions | | 568 | 157,691 | 158,259 |
| Collaborations | | 46 | 427,043 | 427,089 |
| Total People Program Cost | | 3,383 | 1,445,403 | 1,448,786 |
| Less: Earned Revenue | | (14,921) | - | (14,921) |
| Net People | | (11,538) | 1,445,403 | 1,433,865 |
| Total Net Costs | $ | 91,250 | 5,504,511 | 5,595,761 |

| (Amounts in Thousands) | | 2005 | | |
|---|---|---|---|---|
| | | Federal | Public | Total |
| Ideas | | | | |
| Fundamental Science & Engineering | $ | 28,167 | 2,298,943 | 2,327,110 |
| Centers | | - | 176,183 | 176,183 |
| Capability Enhancements | | - | 202,855 | 202,855 |
| Total Ideas Program Cost | | 28,167 | 2,677,981 | 2,706,148 |
| Less: Earned Revenue | | (119,826) | - | (119,826) |
| Net Ideas | | (91,659) | 2,677,981 | 2,586,322 |
| Tools | | | | |
| Large Facilities | $ | 10,399 | 521,512 | 531,911 |
| Infrastructure and Implementation | | 16,836 | 304,319 | 321,155 |
| Polar Tools, Facilities and Logistics | | 105,351 | 207,433 | 312,784 |
| Federally Funded R&D Centers | | 6,067 | 203,503 | 209,570 |
| Total Tools Program Cost | | 138,653 | 1,236,767 | 1,375,420 |
| Less: Earned Revenue | | (324) | - | (324) |
| Net Tools | | 138,329 | 1,236,767 | 1,375,096 |
| People | | | | |
| Individuals | $ | 4,116 | 890,111 | 894,227 |
| Institutions | | 206 | 179,150 | 179,356 |
| Collaborations | | 130 | 379,359 | 379,489 |
| Total People Program Cost | | 4,452 | 1,448,620 | 1,453,072 |
| Less: Earned Revenue | | (6,316) | - | (6,316) |
| Net People | | (1,864) | 1,448,620 | 1,446,756 |
| Total Net Costs | $ | 44,806 | 5,363,368 | 5,408,174 |

*Gross Cost and Earned Revenue by Budget Functional Classification*

Total Gross Cost and Earned Revenue by Budget Functional Classification for FY 2006 and 2005 were as follows:

| Budget Functional Classification | | | | |
|---|---|---|---|---|
| NSF - General Science, Space and Technology (Code 250) | | | | |
| (Amounts in Thousands) | | 2006 | | 2005 |
| Gross Cost | $ | 5,721,580 | $ | 5,534,640 |
| Earned Revenue | | (125,819) | | (126,466) |
| Net Cost | $ | 5,595,761 | $ | 5,408,174 |

*Intragovernmental Gross Cost and Earned Revenue by Budget Functional Classification*

Intragovernmental Gross Cost and Earned Revenue by Budget Functional Classification for FY 2006 and 2005 were as follows:

| Budget Functional Classification<br>NSF - General Science, Space and Technology (Code 250) | | | | |
|---|---|---|---|---|
| (Amounts in Thousands) | | 2006 | | 2005 |
| Gross Cost | $ | 217,069 | $ | 171,272 |
| Earned Revenue | | (125,819) | | (126,466) |
| Net Cost | $ | 91,250 | $ | 44,806 |

## Note 15. Budgetary Resources

In FY 2006 and 2005, Budget Authority increased as a result of non-expenditure transfers from the U.S. Agency for International Development in the amount of $7,975 thousand and $9,670 thousand, respectively. Budget Authority in FY 2006 was also adjusted for Congressional initiated rescissions contained in P.L. 109-108 and P.L. 109-148 totaling $72,205 thousand. In FY 2005, Budget Authority was adjusted for Congressional initiated rescissions contained in P.L. 108-447 totaling $44,136 thousand.

NSF maintains permanent indefinite appropriations for Research and Related Activities - 49x0100 and Major Research Equipment - 49x0551. NSF also maintains permanent indefinite accounts for Donations - 49x8960 and H-1B Nonimmigrant Petitioner fees - 49x5176.

The status of Budgetary Resources as of September 30, 2006, consisted of Budgetary Resources obligated of $5,878,006 thousand available authority of $120,872 thousand and unavailable authority of $82,672 thousand. The status of Budgetary Resources as of September 30, 2005, consisted of Budgetary Resources obligated of $5,653,903 thousand available authority of $155,531 thousand and unavailable authority of $88,143 thousand.

## Note 16. Apportionment Categories of Obligations Incurred: Direct vs. Reimbursable Obligations

OMB, Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, requires that direct and reimbursable obligations are reported as Category A, Category B, or Exempt from Apportionment. In FY 2006 and FY 2005, NSF's SF-132, *Apportionment and Reapportionment Schedule*, apportions all obligations incurred by activity, project, or object (Category B). In FY 2006 and FY 2005, direct obligations amounted to $5,777,489 thousand and $5,542,061 thousand, respectively; and reimbursable obligations amounted to $100,517 thousand and $111,842 thousand respectively.

## Note 17. Explanation of Differences between the Statement of Budgetary Resources and the Budget of the United States Government

SFFAS No. 7, Accounting for Revenue and Other Financing Sources and Concepts for Reconciling Budgetary and Financial Accounting, calls for explanations of material differences between amounts reported in the SBR and the actual balances published in the Budget of the United States Government (President's Budget). However, the President's Budget that will include FY 2006 actual budgetary execution information has not yet been published. The President's Budget is scheduled for publication in February 2007 and can be found on the OMB web site: http://www.whitehouse.gov/omb.

Balances reported in the FY 2005 SBR and the related President's Budget are shown in a table below for Budgetary Resources, Obligations Incurred, Distributed Offsetting Receipts, and Net Outlays and any related difference. The difference reported under Budgetary Resources is due to reporting requirement differences for expired and unexpired appropriations between the Treasury guidance used to prepare the SBR and the OMB guidance used to prepare the President's Budget. The SBR includes both unexpired and expired appropriations, while the President's Budget discloses only unexpired budgetary resources that are available for new obligations. The differences reported under Distributed Offsetting Receipts and Net Outlays are the amounts of budgeted receipts reported in the donations account. In FY 2006, NSF corrected its reporting of budgeted receipts and excluded them from offsetting receipts.

| (Amounts in Thousands) | FY 2005 | | | |
|---|---|---|---|---|
| | Budgetary Resources | Obligations Incurred | Distributed Offsetting Receipts | Net Outlays |
| Combined Statement of Budgetary Resources | $ 5,897,577 | $ 5,653,903 | $ (31,164) | $ 5,401,179 |
| Budget of the U.S. Government | $ 5,809,000 | $ 5,649,000 | $ - | $ 5,432,000 |
| Difference | $ 88,577 | $ 4,903 | $ (31,164) | $ (30,821) |

## Note 18. Undelivered Orders at the end of the Period

Beginning with FY 2006, the format of the SBR has changed and the amount of undelivered orders at the end of the period is no longer required to be reported on the face of the statement. SFFAS No. 7, *Accounting for Revenue and Other Financing Sources and Concepts for Reconciling Budgetary and Financial Accounting*, states that the amount of budgetary resources obligated for undelivered orders at the end of the period should be disclosed. For the years ended September 30, 2006 and 2005, Undelivered Orders amounted to $7,338,624 thousand and $7,233,315 thousand, respectively.

## Note 19. Statement of Financing Disclosures

*Explanation of the Relationship Between Liabilities Not Covered by Budgetary Resources on the Balance Sheet and the Change in Components Requiring or Generating Resources in Future Periods.*

Liabilities Not Covered by Budgetary Resources of $15,463 thousand and $14,613 thousand for FY 2006 and FY 2005, respectively, represent NSF's FECA liability to DOL and employees, leave earned but not taken, and lease liabilities. The amount reported on the Statement of Financing as *Total Components of Net Cost of Operations that will Require or Generate Resources in Future Periods* of $3,993 thousand for FY 2006 and $790 thousand for FY 2005, represents the change in NSF's expenses for unfunded liabilities for FECA, leave earned but not taken, and lease liabilities.

*This information is an integral part of the Financial Statement*

# Required Supplementary Stewardship Information

Stewardship Investments

## Stewardship Investments
## Research and Human Capital

## (Dollar Amounts in Thousands)

| | 2006 | 2005 | 2004 | 2003 | 2002 |
|---|---|---|---|---|---|
| **Research and Human Capital Activities** | | | | | |
| Basic Research | $ 3,682,266 | $ 3,564,093 | $ 3,494,302 | $ 3,519,159 | $ 3,092,060 |
| Applied Research | 339,757 | 291,169 | 209,225 | 218,152 | 193,788 |
| Education and Training | 1,378,472 | 1,386,952 | 1,224,058 | 867,489 | 767,734 |
| Non-Investing Activities | 321,085 | 292,426 | 268,298 | 196,363 | 183,887 |
| **Total Research & Human Capital Activities** | $ 5,721,580 | $ 5,534,640 | $ 5,195,883 | $ 4,801,163 | $ 4,237,469 |
| **Inputs, Outputs and/or Outcomes** | | | | | |
| **Research and Human Capital Activities** | | | | | |
| Investments In: | | | | | |
| Universities | $ 3,994,682 | $ 3,970,851 | $ 3,705,751 | $ 3,310,365 | $ 2,919,897 |
| Industry | 199,523 | 223,563 | 196,260 | 178,000 | 185,062 |
| Federal Agencies | 221,002 | 143,316 | 107,212 | 144,792 | 106,458 |
| Small Business | 218,334 | 193,199 | 200,995 | 186,400 | 144,844 |
| Federally Funded R&D Centers | 1,088,039 | 1,003,711 | 985,665 | 981,606 | 881,208 |
| | $ 5,721,580 | $ 5,534,640 | $ 5,195,883 | $ 4,801,163 | $ 4,237,469 |
| Support To: | | | | | |
| Scientists | $ 473,457 | $ 454,053 | $ 477,970 | $ 427,304 | $ 394,144 |
| Postdoctoral Programs | 158,528 | 162,132 | 175,680 | 163,239 | 148,334 |
| Graduate Students | 544,513 | 538,233 | 546,084 | 475,315 | 402,620 |
| | $ 1,176,498 | $ 1,154,418 | $ 1,199,734 | $ 1,065,858 | $ 945,098 |
| **Outputs & Outcomes:** | | | | | |
| Number Of: | | | | | |
| Awards Actions | 22,000 | 22,000 | 23,000 | 23,000 | 21,000 |
| Senior Researchers | 32,000 | 32,000 | 31,000 | 30,000 | 28,000 |
| Other Professionals | 11,000 | 12,000 | 15,000 | 12,000 | 11,000 |
| Postdoctoral Associates | 5,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| Graduate Students | 26,000 | 27,000 | 29,000 | 27,000 | 26,000 |
| Undergraduate Students | 27,000 | 33,000 | 35,000 | 32,000 | 32,000 |
| K-12 Students | 8,000 | 11,000 | 14,000 | 14,000 | 11,000 |
| K-12 Teachers | 59,000 | 74,000 | 86,000 | 85,000 | 84,000 |

NSF's mission is to support basic scientific research and research fundamental to the engineering process as well as science and engineering education programs. Toward this end, NSF's Stewardship Investments fall principally into the categories of Research and Human Capital. In Research, most NSF funding is devoted to basic research, with a relatively small share going to applied research. This funding supports both the conduct of research and the necessary supporting infrastructure, including state-of-the-art instrumentation, equipment, computing resources, and multi-user facilities such as digital libraries, observatories, and research vessels and aircraft. Basic and applied research costs are determined by prorating the program costs of *Tools* and *Ideas* reported on the *Statement of Net Cost*. The proration uses the basic and applied research percentages of total estimated research and development obligations reported in the current year Budget Request to OMB. The actual numbers are not available until later in the following fiscal year. Education and Training costs equate to *People* costs and Non-Investing activities reflect *Organizational Excellence* costs.

The data provided for Scientists, Postdoctoral Associates, and Graduate Students are obtained from NSF's proposal system and is information reported by each Principal Investigator. The number of award actions are actual values from NSF's Enterprise Information System (EIS). The remaining outputs and outcomes are estimates obtained annually from the NSF Directorates. They are reported in the annual Budget Request to OMB.

NSF's Human Capital investments focus principally on education and training, toward a goal of creating a diverse, internationally competitive and globally engaged workforce of scientists, engineers and well-prepared citizens. NSF supports activities to improve formal and informal science, mathematics, engineering and technology education at all levels, as well as public science literacy projects that engage people of all ages in life-long learning. The decrease in the number of people involved in NSF activities in FY 2006 reflects decreased funding for programmatic activities related to science and engineering education.

# Required Supplementary Information

Deferred Maintenance

**Deferred Maintenance**

NSF performs condition assessment surveys in accordance with FASAB standards for capitalized property, plant and equipment to determine if any maintenance is needed to keep an asset in an acceptable condition or restore an asset to a specific level of performance. NSF considers deferred maintenance to be any maintenance that is not performed on schedule, unless it is determined from the condition of the asset that scheduled maintenance does not have to be performed. Deferred maintenance also includes any other type of maintenance that, if not performed, would render the PP&E non-operational. Circumstances such as non-availability of parts or funding are considered reasons for deferring maintenance.

NSF considered whether any scheduled maintenance necessary to keep fixed assets of the agency in an acceptable condition was deferred at the end of FY 2006 and FY 2005. Assets deemed to be in excellent or good condition are considered to be in acceptable condition. Assets in fair or poor condition are in unacceptable condition and the deferred maintenance required to get them to an acceptable condition are reported. NSF determines the condition of an asset in accordance with standards comparable to those used in the private industry. Due to the environment and remote location of Antarctica, all deferred maintenance on assets in fair or poor condition is considered critical in order to maintain operational status.

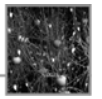
At September 30 for FY 2006, NSF determined that scheduled maintenance on 136 items of Antarctic equipment in fair or poor condition were not completed and were deferred or delayed for a future period. The largest dollar amount of deferred maintenance for any single item approximated $60 thousand. The items included light and heavy mobile equipment with a few items of power distribution. 127 items were rated to be in fair condition, and 9 were rated to be in poor condition. All of the equipment is considered critical to NSF operations and estimated to require $170 thousand in maintenance.

At September 30 for FY 2005, NSF determined that scheduled maintenance on 141 items of Antarctic equipment was not completed and was deferred or delayed for a future period. The largest dollar amount of deferred maintenance for any single item approximated $8 thousand dollars. The items included light and heavy mobile equipment with a few items of power distribution and shop equipment. 134 items were rated to be in fair condition and 7 were rated to be in poor condition. All of the equipment is considered critical to NSF operations and estimated to require $95 thousand in maintenance.

# Required Supplementary Information

Budgetary Resources by Major Budgetary Accounts

In the following table, NSF budgetary information for the fiscal periods ended September 30, 2006 and 2005, as presented in the Statement of Budgetary Resources, is disaggregated for each of NSF's major budgetary accounts.



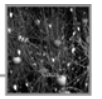
## Combining Statement of Budgetary Resources (page 1 of 2)

**2006**
**(Amounts in Thousands)**

| | Research and Related | Education | Major Research Equipment | OIG, S&E, and NSB | Special and Donated | Total |
|---|---|---|---|---|---|---|
| **Budgetary Resources** | | | | | | |
| Unobligated Balance – Brought Forward, October 1 | $ 56,813 | 29,232 | 45,682 | 7,661 | 104,286 | $ 243,674 |
| Recoveries of Prior Year Obligations | 26,789 | 12,766 | 28 | 2,121 | 3,077 | 44,781 |
| Budget Authority: | | | | | | |
| Appropriation | 4,387,520 | 807,000 | 193,350 | 265,500 | 136,744 | 5,790,114 |
| Spending Authority from Offsetting Collections: | | | | | | |
| Earned: | | | | | | |
| Collected | 104,819 | 14,839 | - | 4,506 | 1 | 124,165 |
| Change in Receivable from Federal Sources | 474 | 1,141 | - | 90 | - | 1,705 |
| Change in Unfilled Customer Orders: | | | | | | |
| Advance Received | (2,192) | (11,385) | - | - | - | (13,577) |
| Without Advance from Federal Sources | (15,945) | 1,492 | - | (5) | - | (14,458) |
| Anticipated for Rest of Year, Without Advances | - | - | - | - | - | - |
| Subtotal – Budget Authority | 4,474,676 | 813,087 | 193,350 | 270,091 | 136,745 | 5,887,949 |
| Nonexpenditure Transfers, Net – Anticipated and Actual | 7,725 | - | - | 250 | - | 7,975 |
| Permanently Not Available | (75,524) | (19,467) | (2,469) | (5,369) | - | (102,829) |
| **Total Budgetary Resources** | $ 4,490,479 | 835,618 | 236,591 | 274,754 | 244,108 | $ 6,081,550 |
| **Status of Budgetary Resources** | | | | | | |
| Obligations Incurred: | | | | | | |
| Direct | 4,353,308 | 799,721 | 233,814 | 262,825 | 127,821 | 5,777,489 |
| Reimbursable | 87,401 | 8,604 | - | 4,512 | - | 100,517 |
| Total Obligations Incurred | 4,440,709 | 808,325 | 233,814 | 267,337 | 127,821 | 5,878,006 |

**Combining Statement of Budgetary Resources (page 2 of 2)**
**2006**
**(Amounts in Thousands)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Unobligated Balance - Apportioned | | 3,722 | 128 | 2,777 | 1,035 | 113,210 | 120,872 |
| Unobligated Balance - Not Available | | 46,048 | 27,165 | - | 6,382 | 3,077 | 82,672 |
| **Total Status of Budgetary Resources** | $ | 4,490,479 | 835,618 | 236,591 | 274,754 | 244,108 | $ 6,081,550 |
| **Change in Obligated Balances** | | | | | | | |
| Obligated Balance, Net | | | | | | | |
| Unpaid Obligations - Brought Forward, October 1 | | 5,599,212 | 1,556,429 | 211,273 | 52,485 | 150,795 | 7,570,194 |
| Less: Uncollected Customer Payments from Federal Sources - Brought Forward, October 1 | | (130,325) | (9,188) | - | (170) | - | (139,683) |
| Total Unpaid Obligated Balance, Net | | 5,468,887 | 1,547,241 | 211,273 | 52,315 | 150,795 | 7,430,511 |
| Obligations Incurred | | 4,440,709 | 808,325 | 233,814 | 267,337 | 127,821 | 5,878,006 |
| Less: Gross Outlays | | (4,244,939) | (882,529) | (180,929) | (261,280) | (86,401) | (5,656,078) |
| Less: Recoveries of Prior Year Unpaid Obligations, Actual | | (26,789) | (12,766) | (28) | (2,121) | (3,077) | (44,781) |
| Change in Uncollected Customer Payments from Federal Sources | | 15,470 | (2,632) | - | (85) | - | 12,753 |
| Subtotal | $ | 5,653,338 | 1,457,639 | 264,130 | 56,166 | 189,138 | $ 7,620,411 |
| Obligated Balance, Net – End of Period | | | | | | | |
| Unpaid Obligations | | 5,768,192 | 1,469,459 | 264,130 | 56,422 | 189,138 | 7,747,341 |
| Less: Uncollected Customer Payments from Federal Sources | | (114,854) | (11,820) | - | (256) | - | (126,930) |
| Total Unpaid Obligated Balance, Net - End of Period | $ | 5,653,338 | 1,457,639 | 264,130 | 56,166 | 189,138 | $ 7,620,411 |
| **Net Outlays** | | | | | | | |
| Gross Outlays | | 4,244,938 | 882,529 | 180,930 | 261,280 | 86,401 | 5,656,078 |
| Less: Offsetting Collections | | (102,627) | (3,454) | - | (4,506) | (1) | (110,588) |
| Less: Distributed Offsetting Receipts | | - | - | - | - | (4,207) | (4,207) |
| **Net Outlays** | $ | 4,142,311 | 879,075 | 180,930 | 256,774 | 82,193 | $ 5,541,283 |



## Combining Statement of Budgetary Resources (page 1 of 2)

**2005**
**(Amounts in Thousands)**

| | Research and Related | Education | Major Research Equipment | OIG, S&E, and NSB | Special and Donated | Total |
|---|---|---|---|---|---|---|
| **Budgetary Resources** | | | | | | |
| Unobligated Balance – Brought Forward, October 1 | $ 58,948 | 32,768 | 37,124 | 7,564 | 42,740 | $ 179,144 |
| Recoveries of Prior Year Obligations | 27,517 | 11,192 | 49 | 1,790 | 2,962 | 43,510 |
| Budget Authority | | | | | | |
| Appropriation | 4,254,593 | 848,207 | 175,050 | 239,110 | 114,840 | 5,631,800 |
| Spending Authority from Offsetting Collections: | | | | | | |
| Earned: | | | | | | |
| Collected | 98,848 | 10,618 | - | 5,050 | 1 | 114,517 |
| Change in Receivable from Federal Sources | 11,847 | 146 | - | (44) | - | 11,949 |
| Change in Unfilled Customer Orders: | | | | | | |
| Advance Received | (2,463) | (5,777) | - | - | - | (8,240) |
| Without Advance from Federal Sources | (10,070) | 3,692 | - | - | - | (6,378) |
| Anticipated for Rest of Year, without Advances | - | - | - | - | - | - |
| Subtotal – Budget Authority | 4,352,755 | 856,886 | 175,050 | 244,116 | 114,841 | 5,743,648 |
| Non Expenditure Transfers, Net | 9,420 | - | - | 250 | - | 9,670 |
| Permanently Not Available | (55,103) | (18,743) | (1,400) | (3,149) | - | (78,395) |
| **Total Budgetary Resources** | $ 4,393,537 | 882,103 | 210,823 | 250,571 | 160,543 | $ 5,897,577 |
| **Status of Budgetary Resources** | | | | | | |
| Obligations Incurred: | | | | | | |
| Direct | 4,238,499 | 844,210 | 165,141 | 237,954 | 56,257 | 5,542,061 |
| Reimbursable | 98,225 | 8,661 | - | 4,956 | - | 111,842 |
| Total Obligations Incurred | 4,336,724 | 852,871 | 165,141 | 242,910 | 56,257 | 5,653,903 |

**Combining Statement of Budgetary Resources (page 2 of 2)**
**2005**
**(Amounts in Thousands)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Unobligated Balances - Apportioned | 6,613 | 402 | 45,633 | 1,416 | 101,467 | | 155,531 |
| Unobligated Balances Not Available | 50,200 | 28,830 | 49 | 6,245 | 2,819 | | 88,143 |
| **Total Status of Budgetary Resources** | $ 4,393,537 | 882,103 | 210,823 | 250,571 | 160,543 | $ | 5,897,577 |
| **Change in Obligated Balances** | | | | | | | |
| Obligated Balance, Net | | | | | | | |
| Unpaid Obligations, Brought Forward, October 1 | 5,446,258 | 1,623,390 | 219,704 | 49,145 | 159,923 | | 7,498,420 |
| Less: Uncollected Customer Payments from Federal Sources - Brought Forward, October 1 | (128,547) | (5,351) | - | (214) | - | | (134,112) |
| Total Unpaid Obligated Balance, Net | 5,317,711 | 1,618,039 | 219,704 | 48,931 | 159,923 | | 7,364,308 |
| Obligations Incurred | 4,336,724 | 852,871 | 165,141 | 242,910 | 56,257 | | 5,653,903 |
| Less: Gross Outlays | (4,156,256) | (908,639) | (173,522) | (237,778) | (62,425) | | (5,538,620) |
| Less: Recoveries of Prior Year Unpaid Obligations, Actual | (27,517) | (11,192) | (49) | (1,790) | (2,962) | | (43,510) |
| Change in Uncollected Customer Payments from Federal Sources | (1,776) | (3,838) | - | 44 | - | | (5,570) |
| Subtotal | $ 5,468,886 | 1,547,241 | 211,274 | 52,317 | 150,793 | $ | 7,430,511 |
| Obligated Balance, Net – End of Period | | | | | | | |
| Unpaid Obligations | 5,599,211 | 1,556,429 | 211,274 | 52,487 | 150,793 | | 7,570,194 |
| Less: Uncollected Customer Payments from Federal Sources | (130,325) | (9,188) | - | (170) | - | | (139,683) |
| Total Unpaid Obligated Balance, Net - End of Period | $ 5,468,886 | 1,547,241 | 211,274 | 52,317 | 150,793 | $ | 7,430,511 |
| **Net Outlays** | | | | | | | |
| Gross Outlays | 4,156,256 | 908,639 | 173,522 | 237,778 | 62,425 | | 5,538,620 |
| Less: Offsetting Collections | (96,385) | (4,841) | - | (5,050) | (1) | | (106,277) |
| Less: Distributed Offsetting Receipts | - | - | - | - | (31,164) | | (31,164) |
| **Net Outlay** | $ 4,059,871 | 903,798 | 173,522 | 232,728 | 31,260 | $ | 5,401,179 |

# DESCRIPTION OF NSF DIRECTORATES AND MANAGEMENT OFFICES

The **Directorate for Biological Sciences (BIO)** provides support for research to advance understanding of the underlying principles and mechanisms governing life. Research ranges from the study of the structure and dynamics of biological molecules, such as proteins and nucleic acids, through cells, organs, and organisms, to studies of populations and ecosystems. It encompasses all processes that are internal to the organism as well as those that are external, and includes temporal frameworks ranging from measurements in real-time through individual life spans, to the full scope of evolutionary time. BIO plays a major role in support of research resources for the biological sciences including multi-user instrumentation, living stock centers, systematics collections, biological field stations, and computerized databases, including sequence databases for plants and microorganisms. As part of the National Plant Genome Initiative (NPGI), BIO plays a major role through support for research infrastructure to enable a broad community and for research to understand the structure, organization and function of plant genomes. For more information, go to: www.nsf.gov/dir/index.jsp?org=BIO.

The **Directorate for Computer and Information Science and Engineering (CISE)** supports research in all areas of computer and information science and engineering, helps develop and maintain cutting-edge national computing and information infrastructure for research and education, and contributes to the education and training of the next generation of computer scientists and engineers. CISE supports projects designed to establish the scientific foundations of computing and communication devices and to explore their usage. For example, CISE funds advances in computing and communication theory, algorithms for computer and computational sciences, architecture and design of computers and software, and revolutionary computing paradigms based on emerging scientific ideas. At the systems level, CISE supports projects to better understand the fundamental properties of computer and network systems and to create better abstractions and tools for designing, building, analyzing, and measuring future systems. CISE programs also support advances in our understanding of the effective integration and co-evolution of social and computing systems, the capabilities of human beings and computing machines to create, discover and reason with knowledge, the application of information technology to science and engineering problems, and, the potential of computational systems to perform tasks autonomously, robustly, and flexibly. For more information, go to: www.nsf.gov/dir/index.jsp?org=CISE.

The **Directorate for Education and Human Resources (EHR)** supports activities that promote excellence in U.S. science, technology, engineering, mathematics (STEM) education at all levels and in all settings, both formal and informal. The goal of these activities is to develop a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians, and educators, as well as a well-informed citizenry with access to the ideas and tools of science and engineering. EHR supports education research and infrastructure development in all science and engineering disciplines. Support is provided for individuals to pursue advanced study, for institutions to build their capacity to provide excellent STEM education, and for collaborations to strengthen STEM education at all levels by fostering alliances and partnerships among colleges, universities, school districts, and other institutions in the public and private sectors. For more information, go to: www.nsf.gov/dir/index.jsp?org=EHR.

The **Directorate for Engineering (ENG)** supports research and education activities that provide a foundation for our nation's global leadership in technology and innovation. This leadership is the key to our continued economic growth and national security. ENG investments include such emerging technologies as sensors and sensor systems, molecular electronics, photonics, cyberinfrastructure, metabolic engineering, bioengineering, manufacturing innovation, and nanotechnology. Fundamental engineering research has a profound impact on areas such as environmental protection, improving human

health, enabling science to better understand the natural world, and growing our standard of living. For more information, go to: www.nsf.gov/dir/index.jsp?org=ENG.

The **Directorate for Geosciences (GEO)** supports research in the atmospheric, earth and ocean sciences. Basic research in the Geosciences advances our scientific knowledge of the Earth and advances our ability to predict natural phenomena of economic and human significance, such as climate change, weather, earthquakes, fish-stock fluctuations, and disruptive events in the solar-terrestrial environment. GEO also supports the operation of national user facilities. For more information, go to: www.nsf.gov/dir/index.jsp?org=GEO.

The **Directorate for Mathematical and Physical Sciences (MPS)** supports research and education in astronomical sciences, chemistry, materials research, mathematical sciences, and physics. Major equipment and instrumentation such as telescopes and particle accelerators are provided to support the needs of individual investigators. MPS also supports state-of-the-art facilities that enable research at the cutting edge of science and research opportunities in totally new directions. For more information, go to: www.nsf.gov/dir/index.jsp?org=MPS.

The **Directorate for Social, Behavioral and Economic Sciences (SBE)** supports research and education to build fundamental scientific knowledge about human cognition, language, social behavior and culture, and on economic, legal, political and social systems, organizations and institutions. To improve understanding of the science and engineering enterprise, SBE also supports science resources studies that are the Nation's primary source of data on the science and engineering enterprise. For more information, go to: www.nsf.gov/dir/index.jsp?org=SBE.

The **Office of Cyberinfrastructure (OCI)** coordinates and supports the acquisition, development and provision of state-of-the-art cyberinfrastructure resources, tools and services essential to the conduct of 21st century science and engineering research and education. OCI supports cyberinfrastructure, such as supercomputers, high-capacity mass-storage systems, system software suites and programming environments, scalable interactive visualization tools, productivity software libraries and tools, large-scale data repositories and digitized scientific data management systems, networks of various reach and granularity and an array of software tools and services that hide the complexities and heterogeneity of contemporary cyberinfrastructure while providing broad access and enhanced usability. OCI supports the preparation and training of current and future generations of researchers and educators to use cyberinfrastructure to further their research and education goals, while also supporting the scientific and engineering professionals who create and maintain these IT-based resources and systems and who provide essential customer services to the national science and engineering user community. For more information, go to: www.nsf.gov/dir/index.jsp?org=OCI.

The **Office of Polar Programs (OPP)**, which includes the U.S. Polar Research Programs and U.S. Antarctic Logistical Support Activities, supports multidisciplinary research in the Arctic and Antarctic regions. These geographic frontiers—premier natural laboratories—are the areas predicted to be the first affected by global change. They are vital to understanding past, present, and future responses of Earth systems to natural and man-made changes. Polar Programs support provides unique research opportunities ranging from studies of Earth's ice and oceans to research in atmospheric sciences and astronomy. For more information, go to: www.nsf.gov/dir/index.jsp?org=OPP.

The **Office of International Science and Engineering (OISE)** serves as the focal point, both within and outside NSF, for international science and engineering activities. OISE promotes the development of an integrated, Foundation-wide international strategy and manages international programs that are innovative, catalytic, and responsive to a broad range of NSF interests. The Office also supports

programs that provide international research experiences to students and young investigators, preparing them for full participation in the global research enterprise. In addition, OISE manages cooperative relationships with partner countries around the world and scientific international organizations on behalf of NSF. For more information, go to: www.nsf.gov/div/index.jsp?div=OISE.

The **Office of Budget, Finance and Award Management (BFA)** is headed by the Chief Financial Officer who has responsibility for budget, financial management, grants administration and procurement operations and related policy. Budget responsibilities include the development of the Foundation's annual budget, long range planning and budget operations and control. BFA's financial, grants, and other administrative management systems ensure that the Foundation's resources are well managed and that efficient, streamlined business and management practices are in place. NSF has been acknowledged as a leader in the federal research administration community, especially in its pursuit of a paperless environment that provides more timely and efficient awards administration. For more information, go to: www.nsf.gov/bfa/.

The **Office of Information and Resource Management (OIRM)** provides human capital management, information technology solutions, continuous learning opportunities, and general administrative services to the NSF community of scientists, engineers, and educators. OIRM also provides logistical support functions for NSF staff as well as the general public. It is responsible for recruiting, staffing, and other human resource service requirements for all NSF staff and visiting personnel. OIRM is responsible for the management of NSF's physical infrastructure and conference facilities; the administration of its sophisticated technology infrastructure, and the dissemination of information about NSF programs to the external community through the agency's website. It is also responsible for delivery of the hardware, software, and support systems necessary to manage the Foundation's grant-making process and to maintain advanced financial and accounting systems. For more information, go to: www.nsf.gov/oirm/.

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*NSB Member pending senate confirmation.

[1] Board member as of May 2006.
[2] Board member as of July 31, 2006.
[3] Resigned in November 2005.
[4] Rotated off in August 2006.

# SCHEDULE OF PROGRAM EVALUATIONS

The following table provides information on the scheduling of meetings for Committees of Visitors (COVs) for NSF programs. The table lists the fiscal year of the most recent COV meeting for the program and the fiscal year for the next COV review of the program. The COV meetings that were held in FY 2006 are highlighted in bold.

## Committee of Visitors Meetings By Directorate

| **DIRECTORATE**<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **BIOLOGICAL SCIENCES** | | |
| *Biological Infrastructure* | 2004 | 2007 |
| Research Resources (includes former Instrument-Related Activities) | 2004 | 2007 |
| Human Resources (includes former Training Cluster) | 2004 | 2007 |
| Plant Genome Research Program | 2004 | 2007 |
| ***Environmental Biology*** | **2006** | 2009 |
| **Ecological Biology** | **2006** | 2009 |
| **Ecosystem Science** | **2006** | 2009 |
| **Population and Evolutionary Processes** | **2006** | 2009 |
| **Systematic Biology and Biodiversity Inventories** | **2006** | 2009 |
| **Systematic Biology and Biodiversity Inventories** | **2006** | 2009 |
| *Integrative Organismal Biology(formerly Int. Biology and Neuroscience)* | 2005 | 2008 |
| Behavioral Systems | 2005 | 2008 |
| Developmental Systems | 2005 | 2008 |
| Environmental and Structural Systems | 2005 | 2008 |
| Functional and Regulatory Systems | 2005 | 2008 |
| *Molecular and Cellular Biosciences* | 2005 | 2008 |
| Biomolecular Systems (formerly Biomolecular Structure and Function | 2005 | 2008 |
| and Biomolecular Processes) | 2005 | 2008 |
| Cellular Systems (formerly Cell Biology) | 2005 | 2008 |
| Genes and Genome Systems (formerly Genetics) | 2005 | 2008 |
| ***Emerging Frontiers (new in 2003)*** | **2006** | 2009 |

| **DIRECTORATE**<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **COMPUTER AND INFORMATION SCIENCE AND ENGINEERING**<br><br>Please note that CISE programs and divisions were reorganized in FY 2003. COVs for three divisions were held in FY 2003. | | |
| ***Computing & Communication Foundations (CCF)*** | **2006** | 2009 |
| **Emerging Models & Technologies for Computation** | **2006** | 2009 |
| **Theoretical Foundations** | **2006** | 2009 |
| **Foundations of Computing Processes & Artifacts** | **2006** | 2009 |
| ***Computer & Network Systems (CNS)*** | | |
| **Computer Systems** | **2006** | 2009 |
| **Computing Research Infrastructure** | **2006** | 2009 |
| **Education & Workforce** | **2006** | 2009 |
| **Network Systems** | **2006** | 2009 |
| ***Information & Intelligent Systems (IIS)*** | **2006** | 2009 |
| **Human-centered Computing** | **2006** | 2009 |
| **Information Integration and Informatics** | **2006** | 2009 |
| **Robust Intelligence** | | |

| **DIRECTORATE**<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **EDUCATION AND HUMAN RESOURCES** | | |
| *Experimental Program to Stimulate Competitive Research (EPSCoR)* | 2005 | 2008 |
| *Elementary, Secondary and Informal Science Education (ESIE)* | | |
| Informal Science Education | 2005 | 2008 |
| Instructional Materials Development (discontinued FY 2006) | 2005 | N/A |
| Centers for Learning and Teaching (discontinued FY 2006) | 2004 | N/A |
| Teacher Professional Continuum (discontinued FY 2006) | 2003 | N/A |
| Presidential Awards for Science and Mathematics Teaching | 2003 | 2007 |
| Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring | N/A | 2007 |
| Discovery Research K-12 (new in FY 2007) | N/A | 2010 |
| *Undergraduate Education* | | |
| **Advanced Technological Education** | **2006** | 2009 |
| NSF Computer, Science, Engineering and Mathematics Scholarships (S-STEM in FY 2007) | 2003 | 2007 |
| Distinguished Teaching Scholars | 2005 | 2008 |
| Scholarship for Service | 2004 | 2007 |
| National SMETE Digital Library | 2005 | 2008 |
| **Course, Curriculum, and Laboratory Improvement** | **2006** | 2009 |
| **The STEM Talent Expansion Program (STEP)** | **2006** | 2009 |
| *Graduate Education* | | |
| **Graduate Research Fellowships** | **2006** | 2009 |
| Integrative Graduate Education and Research Traineeship (IGERT) | 2005 | 2008 |
| GK-12 Fellows | 2005 | 2008 |
| *Human Resource Development* | | |
| The Louis Stokes Alliances for Minority Participation | 2005 | 2008 |
| Centers for Research Excellence in Science and Technology (CREST) | 2005 | 2008 |
| **Gender Diversity in STEM Education** | **2006** | 2009 |
| **Program on Research in Disabilities** | **2006** | 2009 |
| Alliances for Graduate Education and the Professoriate (AGEP) | 2005 | 2008 |
| Tribal Colleges and Universities Program (TCP) | 2004 | 2007 |
| Historically Black Colleges and Universities (HBCU) | 2005 | 2008 |
| *Research, Evaluation & Communications* | | |
| REPP/ROLE (discontinued in FY 2006) | 2005 | N/A |
| Research & Evaluation on Education in Science & Engineering | 2003 | 2009 |
| Interagency Education Research Initiative (discontinued in FY 2006) | 2005 | N/A |
| *Other* | | |
| H-IB VISA K-12 | 2005 | N/A |
| Math and Science Partnership (MSP) | 2005 | 2008 |

| DIRECTORATE<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **ENGINEERING**<br>Note: Effective October 1, 2006, the Directorate for Engineering has been reorganized. The COV for the new divisions is as follows: | | |
| ***Chemical, Bioengineering, Environmental and Transport Systems (CBET)*** | **2006** | 2009 |
| **Process and Reaction Engineering** | **2006** | 2009 |
| **Catalysis and Biocatalysis** | **2006** | 2009 |
| **Biochemical Engineering** | **2006** | 2009 |
| **Biotechnology** | **2006** | 2009 |
| **Chemical and Biological Separations** | | |
| **Thermal Transport Processes** | **2006** | 2009 |
| **Interfacial Processes and Thermodynamics** | **2006** | 2009 |
| **Particulate and Multiphase Processes** | **2006** | 2009 |
| **Fluid Dynamics and Hydraulics** | **2006** | 2009 |
| **Combustion, Fire, and Plasma Systems** | **2006** | 2009 |
| **Research to Aid Persons with Disabilities (RAPD)** | **2006** | 2009 |
| **Biomedical Engineering** | **2006** | 2009 |
| **Biophotonics** | **2006** | 2009 |
| **Environmental Engineering** | **2006** | 2009 |
| **Environmental Technology** | **2006** | 2009 |
| **Environmental Sustainability** | **2006** | 2009 |
| **Energy for Sustainability** | **2006** | 2009 |
| *Civil, Mechanical and Manufacturing Innovation (CMMI)* | **2006** | 2009 |
| **Information Technology and Infrastructure Systems** | **2006** | 2009 |
| **Geoenvironmental Engineering and Geohazards Mitigation** | **2006** | 2009 |
| **Manufacturing Machines & Equipment** | **2006** | 2009 |
| **Structural Systems and Hazard Mitigation of Structures** | **2006** | 2009 |
| **Infrastructure Systems Management and Hazard Responses** | **2006** | 2009 |
| **Network for Earthquake Engineering Simulation Research and Operations** | **2006** | 2009 |
| **Control Systems** | **2006** | 2009 |
| **Dynamical Systems** | **2006** | 2009 |
| **Engineering Design** | **2006** | 2009 |
| **Manufacturing Enterprise Systems** | **2006** | 2009 |
| **Operations Research** | **2006** | 2009 |
| **Service Enterprise Engineering** | **2006** | 2009 |
| **Sensor Innovation and Systems** | **2006** | 2009 |
| **Geomechanics and Geotechnical Systems** | **2006** | 2009 |
| **Infrastructure Materials and Structural Mechanics** | **2006** | 2009 |
| **Material Design and Surface Engineering** | **2006** | 2009 |
| **Material Processing and Manufacturing** | **2006** | 2009 |
| **Mechanics and Structures of Materials** | **2006** | 2009 |
| **Nano/Bio Mechanics** | **2006** | 2009 |
| **Nanomanufacturing** | **2006** | 2009 |

**ENGINEERING (continued)**

| | | |
|---|---|---|
| *Electrical, Communications and Cyber Systems(ECCS)* | 2005 | 2008 |
| Micro/Nanoelectronics; MEMS/NEMS Sensors; Bioelectronics | 2005 | 2008 |
| Micro/Nanoelectronics; Molecular Electronics; Spin Electronics; Organic Electronics; Power Electronics; Micromagnetics | 2005 | 2008 |
| Optoelectronics; Photonics; Ultrafast Technologies; EUV; Nanophotonics | 2005 | 2008 |
| Integrative Nano and Micro Systems; Complex Systems; Machine Intelligent Systems | 2005 | 2008 |
| Wireless and Optical Communications Systems; Mixed Signal Technologies | 2005 | 2008 |
| Cybersystems | 2005 | 2008 |
| Embedded, Distributed and Adaptive Control; Robotics; Sensor Networks | 2005 | 2008 |
| Power and Energy Networks; Renewable and Alternative Energy Sources; Economics of Power Grids; Security and Reliability of Critical Infrastructures | 2005 | 2008 |
| Neural Networks; Learning and Self-organizing Computations; Adaptive Dynamic Programming | 2005 | 2008 |
| *Engineering Education and Centers (EEC)* | 2004 | 2007 |
| Engineering Education Program | 2004 | 2007 |
| Research Experiences for Teachers | 2004 | 2007 |
| Research Experiences for Undergraduates | 2004 | 2007 |
| Earthquake Engineering and Infrastructure ERC's | 2004 | 2007 |
| ERC Education Programs | 2004 | 2007 |
| Nano Cluster & Manufacturing ERC's | 2004 | 2007 |
| Bioengineering ERCs | 2004 | 2007 |
| Microelectronics ERCs | 2004 | 2007 |
| Pre-College Outreach | 2004 | 2007 |
| Program Evaluation & Assessment | 2004 | 2007 |
| *Emerging Frontiers in Research and Innovation (EFRI) (Created October 1, 2006)* | N/A | 2010 |
| *Industrial Innovation and Partnerships (IIP)* | 2004 | 2007 |
| Small Business Innovation Research/Small Business Technology Transfer | 2004 | 2007 |
| Industry/University Cooperative Research Centers (I/UCRC) | 2004 | 2007 |
| I/UCRC Fundamental Research | 2004 | 2007 |
| Partnership for Innovation (PFI) | 2004 | 2007 |
| Grant Opportunities for Academic Liaison with Industry (GOALI) | 2004 | 2007 |

| **DIRECTORATE**<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **GEOSCIENCES** | | |
| *Atmospheric Sciences* | | |
| Lower Atmosphere Research Section | | |
| Atmospheric Chemistry | 2004 | 2007 |
| Climate Dynamics | 2004 | 2007 |
| Mesoscale Dynamic Meteorology | 2004 | 2007 |
| Large-scale Dynamic Meteorology | 2004 | 2007 |
| Physical Meteorology | 2004 | 2007 |
| Paleoclimate | 2004 | 2007 |
| Upper Atmosphere Research Section | | |
| Magnetospheric Physics | 2005 | 2008 |
| Aeronomy | 2005 | 2008 |
| Upper Atmospheric Research Facilities | 2005 | 2008 |
| Solar Terrestrial Research | 2005 | 2008 |
| **UCAR and Lower Atmospheric Facilities Oversight Section** | | |
| **Lower Atmospheric Observing Facilities** | **2006** | 2009 |
| **UNIDATA** | **2006** | 2009 |
| **NCAR/UCAR** | **2006** | 2009 |
| *Earth Sciences* | | |
| Instrumentation and Facilities | 2004 | 2007 |
| Research Support | | |
| Tectonics | 2005 | 2008 |
| Geology and Paleontology | 2005 | 2008 |
| Hydrological Sciences | 2005 | 2008 |
| Petrology and Geochemistry | 2005 | 2008 |
| Geophysics | 2005 | 2008 |
| Continental Dynamics | 2005 | 2008 |
| *Ocean Sciences* | | |
| Integrative Programs Section | | |
| Oceanographic Technical Services | 2005 | 2008 |
| Ship Operations | 2005 | 2008 |
| Oceanographic Instrumentation | 2005 | 2008 |
| Ship Acquisitions and Upgrades (new in ’02) | 2005 | 2008 |
| Shipboard Scientific Support Equipment (new in ’02) | 2005 | 2008 |
| **Oceanographic Tech and Interdisciplinary Coordination** | **2006** | 2009 |
| **Ocean Science Education and Human Resources** | **2006** | 2009 |
| **Marine Geosciences Section** | | |
| **Marine Geology and Geophysics** | **2006** | 2009 |
| **Ocean Drilling** | **2006** | 2009 |
| **Ocean Section** | | |
| **Chemical Oceanography** | **2006** | 2009 |
| **Physical Oceanography** | **2006** | 2009 |
| **Biological Oceanography** | **2006** | 2009 |

| GEOSCIENCES (continued) | | |
|---|---|---|
| *Other Programs* | | |
| Global Learning and Observation to Benefit the Environment | 2003 | 2007 |
| Opportunities to Enhance Diversity in the Geosciences | 2003 | 2007 |
| Geoscience Education | 2003 | 2007 |

| **DIRECTORATE**<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **MATHEMATICAL AND PHYSICAL SCIENCES** | | |
| *Astronomical Sciences* | 2005 | 2008 |
| Planetary Astronomy | 2005 | 2008 |
| Stellar Astronomy and Astrophysics | 2005 | 2008 |
| Galactic Astronomy | 2005 | 2008 |
| Education, Human Resources and Special Programs | 2005 | 2008 |
| Advanced Technologies and Instrumentation | 2005 | 2008 |
| Electromagnetic Spectrum Management | 2005 | 2008 |
| Extragalactic Astronomy and Cosmology | 2005 | 2008 |
| Facilities Cluster | | |
| Gemini Observatory | 2005 | 2008 |
| National Radio Astronomy Observatory (NRAO) | 2005 | 2008 |
| National Optical Astronomy Observatories (NOAO) | 2005 | 2008 |
| National Solar Observatory (NSO) | 2005 | 2008 |
| National Astronomy and Ionosphere Center (NAIC) | 2005 | 2008 |
| Atacama Large Millimeter Array (ALMA) | 2005 | 2008 |
| *Chemistry* | 2004 | 2007 |
| Analytical & Surface Chemistry | 2004 | 2007 |
| Chemistry Research Instrumentation and Facilities | 2004 | 2007 |
| Collaborative Research in Chemistry | 2004 | 2007 |
| Inorganic, Bioinorganic and Organometallic Chemistry | 2004 | 2007 |
| Organic & Macromolecular Chemistry | 2004 | 2007 |
| Physical Chemistry | 2004 | 2007 |
| Undergraduate Research Centers (pilot program, new in '04) | 2005 | 2007 |
| *Materials Research* | 2005 | 2008 |
| Base Science Cluster | | |
| Condensed Matter Physics | 2005 | 2008 |
| Solid-State Chemistry | 2005 | 2008 |
| Polymers | 2005 | 2008 |
| Advanced Materials and Processing Cluster | | |
| Metals | 2005 | 2008 |
| Ceramics | 2005 | 2008 |
| Electronic Materials | 2005 | 2008 |
| Materials Research and Technology Enabling Cluster | | |
| Materials Theory | 2005 | 2008 |
| Instrumentation for Materials Research | 2005 | 2008 |
| National Facilities | 2005 | 2008 |
| Materials Research Science and Engineering Centers | 2005 | 2008 |
| Office of Special Programs (new in 2003) | N/A | 2008 |

| | | |
|---|---|---|
| **MATHEMATICAL AND PHYSICAL SCIENCES (continued)** | | |
| *Mathematical Sciences* | | |
| Applied Mathematics | 2004 | 2007 |
| Geometric Analysis, Topology and Foundations | 2004 | 2007 |
| Computational Mathematics | 2004 | 2007 |
| Infrastructure | 2004 | 2007 |
| Analysis | 2004 | 2007 |
| Algebra, Number Theory, and Combinatorics | 2004 | 2007 |
| Statistics and Probability | 2004 | 2007 |
| Mathematical Biology (new in '04) | 2004 | 2007 |
| ***Physics*** | | |
| **Atomic, Molecular, Optical and Plasma Physics** | **2006** | 2009 |
| **Elementary Particle Physics** | **2006** | 2009 |
| **Theoretical Physics** | **2006** | 2009 |
| **Particle and Nuclear Astrophysics** | **2006** | 2009 |
| **Nuclear Physics** | **2006** | 2009 |
| **Biological Physics** | **2006** | 2009 |
| **Physics at the Information Frontier** | **2006** | 2009 |
| **Physics Frontier Centers** | **2006** | 2009 |
| **Education and Interdisciplinary Research** | **2006** | 2009 |
| **Gravitational Physics** | **2006** | 2009 |
| *Office of Multidisciplinary Research* | 2003 | 2006 |

| **DIRECTORATE**<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **SOCIAL, BEHAVIORAL, AND ECONOMIC SCIENCES** | | |
| ***Science Resource Statistics (SRS)*** | **2006** | 2009 |
| *Behavioral and Cognitive Sciences (BCS)* | | |
| **Cultural Anthropology** | **2006** | 2009 |
| **Linguistics** | **2006** | 2009 |
| **Social Psychology** | **2006** | 2009 |
| **Physical Anthropology** | **2006** | 2009 |
| **Geography and Regional Science** | **2006** | 2009 |
| **Cognitive Neuroscience** | **2006** | 2009 |
| **Developmental and Learning Sciences** | **2006** | 2009 |
| **Perception, Action, and Cognition** | **2006** | 2009 |
| **Archaeology and Archaeometry** | **2006** | 2009 |
| *Social and Economic Sciences (SES)* | 2004 | 2007 |
| Decision, Risk, and Management Sciences | 2004 | 2007 |
| Political Science | 2004 | 2007 |
| Law and Social Science | 2004 | 2007 |
| Innovation and Organizational Change | 2004 | 2007 |
| Methodology, Measurement and Statistics | 2004 | 2007 |
| Science and Technology Studies | 2004 | 2007 |
| Societal Dimensions of Engineering, Science, and Technology | 2004 | 2007 |
| Economics | 2004 | 2007 |
| Sociology | 2004 | 2007 |
| *ADVANCE (Cross-Directorate Program, new in FY01/FY02)* | 2005 | 2008 |
| *Science of Learning Centers (new in FY03/FY04)* | N/A | 2008 |
| *Human and Social Dynamics (new in FY04)* | N/A | 2007 |

| **DIRECTORATE**<br>*Division*<br>Program or Cluster | Fiscal Year of Most Recent COV | Fiscal Year of Next COV |
|---|---|---|
| **OFFICE OF CYBERINFRASTRUCTURE**<br>(Formerly Division of Shared Cyberinfrastructure) | 2005 | 2008 |
| **OFFICE OF INTEGRATIVE ACTIVITIES** | | |
| Major Research Instrumentation (MRI) | 2005 | 2008 |
| Science and Technology Centers (STC) | 1996* | 2007* |
| **OFFICE OF INTERNATIONAL SCIENCE & ENGINEERING** | 2005 | 2008 |
| **OFFICE OF POLAR PROGRAMS** | | |
| *Polar Research Support* | 2004 | 2007 |
| *Antarctic Sciences* | 2003 | 2007 |
| Antarctic Aeronomy and Astrophysics | 2003 | 2007 |
| Antarctic Biology and Medicine | 2003 | 2007 |
| Antarctic Geology and Geophysics | 2003 | 2007 |
| Antarctic Glaciology | 2003 | 2007 |
| Antarctic Ocean and Climate Systems | 2003 | 2007 |
| *Arctic Sciences* | | |
| Arctic Research Support and Logistics | 2003 | 2007 |
| Arctic System Sciences | 2003 | 2007 |
| Arctic Natural Sciences | 2003 | 2007 |
| Arctic Social Sciences | 2003 | 2007 |
| **NSF PRIORITY AREAS AND CROSSCUTTING PROGRAMS** | | |
| Nanoscale Science and Engineering Priority Area | 2004 | 2007 |
| Biocomplexity in the Environment | 2004 | 2007 |
| CAREER | 2001 | 2007* |
| *External Evaluations | | |

# TABLE OF EXTERNAL EVALUATIONS

The Table on the following pages provides information on program assessments and evaluations other than Committee of Visitor and Advisory Committee assessments.

The Table lists other types of evaluations not used in GPRA performance assessment that were completed in FY 2006. These reports, studies, and evaluations are frequently used in setting new priorities in a field or in documenting progress in a particular area. The reader is encouraged to review the reports for additional information on findings and recommendations that are beyond the scope of this report.

Reports (other than COV reports) produced by NSF are available online at using the NSF's online document system and the publication number indicated. Reports are available here: www.nsf.gov/pubs/start.htm.

Information on obtaining reports produced by the National Research Council or National Academy of Sciences can be found online by searching www.nap.edu or from the National Academy Press, 2101 Constitution Avenue, N.W., Lockbox 285, Washington, D.C. 20055 (1.800.642.6242).

# Evaluations Completed in FY 2006

| | Directorate for Biological Sciences (BIO) |
|---|---|
| ***Mid-course Assessment of the Arabidopsis 2010 Project"*** | **Findings:**<br>In 2000 the *Arabidopsis* community proposed an ambitious program to determine the function of every gene by 2010. This became the basis for the NSF 2010 Project (NSF 05-624 and prior announcements), which has funded 86 projects in the first five years. The North American *Arabidopsis* Steering Committee held a workshop in Arlington, VA on Aug. 25 and 26, 2005, to evaluate the progress made toward the specific goals of the program and to recommend directions for the next five years. Prior to the meeting, input was solicited from the community through a web-based survey to which more than 580 researchers responded. Additional information on the impact of funded projects was obtained that described the number of stocks deposited, data generated and publications resulting from 2010 projects. The workshop participants' assessment was that most of the goals for the first five years have been met or surpassed. Of particular note were the genome-wide resources including knockout lines and full-length cDNAs, which have been of remarkable utility to a large number of researchers. It was the participants' view that certain approaches toward functional analysis have had more impact than others. In particular, those that pioneered new approaches to understanding biological processes using high throughput and/or computational approaches have served as paradigms for other research efforts. In fact, it is expected that *Arabidopsis* will be the model for resource and tool development and application for all plants.<br><br>**Recommendations:**<br>For the remaining five years of the program the workshop participants recommended emphasis on the following areas:<br>1. Benchmarking gene function<br>2. Developing genome-wide tools and reagents for analyzing gene function and regulation<br>3. Improving genome annotation and tools for visualization, annotation and curation<br>4. Improving database integration and developing new modeling and computational tools<br>5. Exploring exemplary networks and systems<br>6. Analyzing non-protein coding genes<br>7. Leveraging natural variation to understand gene function in *Arabidopsis thaliana*<br>8. Localizing gene products at the cellular and subcellular level<br>9. Facilitating metabolomics and ionomics<br>10. Engaging the broader community<br>11. Enhancing international collaboration<br><br>The workshop also looked beyond 2010 to challenges that could form the basis for an *Arabidopsis* 2020 program. This ongoing and future research program should have critical impacts on many areas of basic science, agriculture, engineering and environmental improvement as well as on all aspects of plant biology.<br><br>**Availability:** **www.nsf.gov/pubs/2006/bio0601/bio0601.pdf** |

| | |
|---|---|
| ***The Multinational Coordinated Arabidopsis thaliana Functional Genomics Project: Annual Report 2006*** | **Findings**:<br>This is the 2005/2006 annual report of the Multinational *Arabidopsis* Steering Committee (MASC) on the status of the Multinational Coordinated *Arabidopsis thaliana* Functional Genomics Project, which has completed its fifth year. The MASC is composed of representatives from each country with major *Arabidopsis* functional genomics efforts or coalition of countries with smaller programs. This report highlights the progress made over the last year by the international *Arabidopsis* functional genomics community. It also demonstrates the continued high level of cooperation that exists throughout the global community and the importance of the support by funding agencies in producing important and exciting results in plant biology. The continuing rapid progress in *Arabidopsis* functional genomics emphasizes the central role that work on this reference plant has for furthering understanding of all plants. In 2005/2006 there was a continued increase in publicly accessible data and resources including SNPs, MPSS, microarray, full length-cDNA information as well as full-length cDNA clones, ORF clones, RNAi clones and insertion mutants. Intensive international efforts have made a large number of biological resources available to the *Arabidopsis* community and the ease of access to these materials is particularly noteworthy. While there is still much to discover in the *Arabidopsis* genome and transcriptome particularly using systems approaches, new frontiers include proteomics and metabolomics. In addition, information gathering between genomes, i.e. comparative genomics and natural variation, is increasingly enabled by genome resequencing and reannotation, and the development of more sophisticated genome surveying tools and bioinformatics and data integration approaches. MASC Subcommittees focusing on Systems Biology, Metabolomics, Proteomics, and Natural Variation and Comparative Genomics recently formed to evaluate current knowledge, identify needs and bottlenecks, and establish appropriate courses of action. International cooperation by motivated researchers, a high level of coordination, and sufficient funding remain critical to the success of this ambitious project.<br><br>Areas that lag behind initial plans or are currently underrepresented:<br>1. The improvement of database integration is critical.<br>2. Proteomics, metabolomics and natural variation and comparative genomics are all areas that need more emphasis.<br>3. Tools needed for *Arabidopsis* functional research.<br>4. Development of networks and systems biology is needed.<br>5. Temporal and spatial gene expression data are still needed under varied conditions, in specific tissues, and in different genotypes.<br>6. Analysis of non-protein coding genes is still lagging.<br><br>**Recommendations:**<br>▪ Ensure the successful establishment of recently formed MASC subcommittees including Metabolomics, Natural Variation and Comparative Genomics, Phenomics, and Proteomics.<br>▪ Update and improve the Project's webpages at The *Arabidopsis* Information Resource (TAIR).<br>▪ Work toward completion of genetic resources projects including the collection of homozygous insertion mutants and RNAi clones.<br>▪ Develop resources for studying protein interactions and localization, including complete cloning of full length cDNAs into expression vectors.<br>▪ Expand data integration and interoperability efforts for optimal use of data resources.<br>▪ Facilitate and encourage submission of data and stocks into public repositories.<br>▪ Implement a Systems Biology working group.<br><br>**Availability:** **www.nsf.gov/pubs/reports/2006_complete_masc_report1.pdf** |

| | Directorate for Education and Human Resources (EHR) |
|---|---|
| **Abt Associates, Inc. and SRI International (forthcoming, 2006).** ***Summary of the Formative Evaluation of the National Science Foundation's Centers for Learning and Teaching [CLT] Program: An Internal Report.*** | **Findings:**<br>▪ All Centers are involved in graduate education, and eight of the 10 centers in Cohorts 1, 2, and 3 have multiple university partners. [There are now 5 cohorts in the CLT program.]<br>▪ Three Centers have adopted entirely new degree programs, two have developed new degree concentrations for students earning a STEM education doctoral degree, and the other five Centers have substantially modified existing degree programs.<br>▪ The number of Education faculty is rather evenly distributed among Centers, averaging 6 faculty per Center. The average number of STEM faculty involved in graduate education is two.<br>▪ Of the 230 doctoral students responding to the survey, 50 percent report that they were already enrolled in graduate school when they joined the CLT program. In their start-up years, Centers are more likely to draw in students who are already enrolled in participating degree programs, bringing in new students as Centers mature. [Since the initial study, aggressive recruitment efforts have resulted in a preponderance of new students.]<br>▪ The CLT Program has had considerable success in recruiting students with varied backgrounds. Before starting graduate school, almost two-fifths of CLT doctoral students had either taught in K-12 settings or worked in a school district Another quarter were undergraduate or graduate students without work experience. Centers have, had less success in diversifying the cadre of leaders by race or ethnicity, though several point out that they have diversified their graduate programs in other ways (such as attracting traditionally underrepresented rural or Appalachian students). [Enhanced recruitment efforts are yielding noticeable increases in participants from underrepresented groups.]<br>▪ CLT doctoral education is still under development. Two-thirds of the doctoral students are still taking courses, while most of the remaining third have passed qualifying exams or had dissertation proposals accepted. Doctoral students' career goals are consonant with those of the overall CLT program. That is, most students plan to conduct research/evaluation (89 percent) and/or teach at a higher education institution (86 percent) upon graduation.<br>Centers reported that 923 teachers or other educators received CLT -sponsored professional development in academic year 2003-2004. The number of participants served by any given CLT institution varies from as few as eight at one CLT partner University to more than 150 at another. Two thirds (67 percent) of 2003-2004 professional development participants received 60 hours or less of CLT-sponsored professional development during the last academic year.<br>▪ Ten of the 12 Centers have made in-service teachers the primary target of their professional development efforts. Two centers are also including a few district administrators in their efforts. Some Centers, however have made other populations the targets of their professional development. One is providing professional development to two Cohorts of museum educators from across the nation. Two others are making special efforts to provide professional development to teacher professional developers. |

- All Centers report that they are involved in research. Almost all report that the research is either new or substantially modified, with most of the new research being done by graduate students. Faculty typically have continued their pre-Center research efforts, albeit sometimes with new emphases that more closely reflect the Center's focus research topics mirror the programmatic emphasis of the Centers. Given that doctoral students are engaged in most of the research, it will likely be several years before research makes its way onto a national stage.

**Recommendations:**

DIRECTIONS FOR FUTURE RESEARCH

- *Careers of CLT Graduate Students*—Investigations to assess the net increase in, and diversity of, holders of masters' and doctoral degrees in STEM education who are expert in STEM research, curriculum development, education policy, large-scale assessment of education reform, or informal STEM education.
- *Outcomes of Center Research Efforts*—Investigations to assess increase in the volume, and improvement in quality of, STEM education research; work on interdisciplinary topics and topics that are more pertinent to current issues; wide sharing and implementation of research findings.
- *Anticipated Longer-Term Outputs*—Investigations that assess progress toward a number of anticipated long-term impacts:
    - A revitalized human resource infrastructure that meets the needs of the informal and formal STEM teaching system, including better reflection of the diversity of America's population.
    - A substantial body of research on emerging and interdisciplinary STEM education topics, and translation of research findings into practice.
    - Higher quality K-12 and informal teaching and learning in STEM fields, based on better research that leads to better policies, better practices, and better materials.
    - More, and better qualified, students applying for postsecondary education in STEM fields and to become STEM educators.
    - Closer integration of STEM academic disciplinary programs with education programs.
    - Enhancement of the reputation of the STEM educational system.

**Availability:** Forthcoming on contractor's web site.

| | |
|---|---|
| **ORC Macro and Guardians of Honor, LLC (forthcoming, 2006).** ***A Performance Monitoring Report of the National Science Foundation's Centers for Research Excellence in Science and Technology (CREST) Program*****.** | **Findings:**<br>▪ Female student participants increased from 2001 to 2003. In 2001, females were 31.5 percent of CREST students. By 2003, females were 37.5 percent of CREST students.<br>▪ At least 69 percent of the student participants were from underrepresented groups. Black students are the largest CREST participant group for all three program years, with approximately 150 black students participating each year.<br>▪ Two hundred seventy-two degrees were awarded to CREST participants from 2001 through 2003.<br>o Fifty-one percent of all degrees awarded to CREST graduates were bachelor's degrees.<br>o Forty-three percent of all degrees awarded to CREST graduates were master's degrees.<br>o Doctoral degrees were six percent of all degrees awarded to CREST graduates.<br>o More than half of all degrees awarded to CREST-supported graduates were awarded in engineering.<br>▪ On average CREST centers were performing at least 3 activities that focused on outreach and recruitment and at least two activities that focused on retaining STEM students and helping them progress towards graduation.<br>▪ The number of partnerships increased from 19 in 2001, to 77 in 2003 with each Center reporting partnerships with at least three entities.<br>▪ Since 2001, more than 1000 manuscripts have been submitted for publication consideration by CREST faculty and students. Sixty-eight percent of all manuscript submissions have resulted in publication.<br>▪ The number of recognition awards received has increased from 58 awards in 2001 to 132 awards in 2003.<br>▪ In 2001, CREST centers received more than $22 million dollars in awards from federal and state agencies, foundations, universities as well as other sources. By 2003, CREST center awards totaled more than $52 million.<br>▪ Conference participation by CREST faculty and students have increased from just 22 in 2001, to more than 90 in 2003 in 25 locations across 14 countries.<br><br>**Recommendations:**<br><br>• To further their goal of increasing diversity, CREST Centers need to continue their recruitment of female undergraduates and graduates, increase the number of women in leadership positions, and increase the racial and ethnic diversity of their faculty.<br>• To become self-sustaining, Centers should be encouraged to make every effort to identify and secure alternative funding sources.<br>• To provide a clearer picture of Centers' progress in moving their research to market, more extensive data collection on product development and patent processes is needed.<br><br>**Availability:** Forthcoming on contractor's web site. |

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| **Temple University—Institute for Survey Research and Caliber Associates (2006),** ***Highlights of CSEMS Survey Findings 2003-2004: An Internal Report.*** | **Findings:**<br><br>• The majority of CSEMS institutions reported increased enrollment of students from the following target groups: financially needy (69% of institutions said so), women (59%), generally under-represented (57%), academically talented (57%), ethnic/racial minorities (55%), and first-generation college students (40%).<br>• Students reported that without CSEMS, they would have to borrow money (79%) or work more hours for pay (71%) to finance their education.<br>• While the majority of CSEMS students were concentrated in engineering (38%) and computer science (25%), notable patterns emerged according to gender and race/ethnicity. Female recipients, for example, comprised 35% of the CSEMS student population, but represented 44% of students enrolled in math, and 60% in engineering technology. Similarly, Black students, although 15% of the CSEMS population, made up 20% of students in engineering technology.<br>• 72% of scholarship recipients believed that CSEMS increased their likelihood of completing a CSEMS program of study and pursuing a CSEMS-related career, and 68% reported that CSEMS increased the likelihood of their pursuing a higher degree.<br>• 66% of PIs at 2-year institutions reported that, after implementation of CSEMS, their institutions witnessed an increase in completed CSEMS degrees; 60% reported an increase in transfers to CSEMS in 4-year schools; and 57% said that enrollments in CSEMS disciplines had increased.<br>• 55% of PIs at 4-year institutions reported that the number of completed CSEMS undergraduate degrees had increased at their institutions after implementation of CSEMS; 51% said that enrollments in CSEMS disciplines had increased; and 47% reported an increase in students continuing beyond high attrition points (at 2-year institutions, 43% of PIs said so). 46% of PIs at 4-year IHEs reported an increase in students pursuing graduate study in a CSEMS field; 30% reported increases in completed CSEMS master's degrees, and 11% said that their institutions had seen an increase in completed CSEMS doctoral degrees.<br>• PIs reported that CSEMS enhanced: industry experiences and internship opportunities (67%), faculty support and mentoring of students (84%), student use of tutoring and other academic services (76%), and career counseling and other job placement services for CSEMS areas (75%).<br>• Among the services and programs used by at least half of scholarship recipients, the most helpful (according to 65% of students) was faculty support and mentoring.<br>• Within CSEMS institutions, PIs reported that the program helped to strengthen internal relationships between participating departments (82%), between faculty and students (88%), and between faculty and administration (69%).<br><br>**Recommendations:**<br><br>• Conduct a longitudinal or follow-up study of CSEMS scholarship recipients in this study.<br>• Continue to provide and enhance administrative support and technical assistance.<br>• Conduct additional follow-up site visits to several CSEMS institutions and a follow-up principal investigator study to identify and disseminate promising practices that facilitate students' ability to complete CSEMS degrees.<br><br>**Availability:** Forthcoming on the contractor's web site. |

**WESTAT (June 2005), *Evaluative Research Study for the NSF's Director's Award for Distinguished Teaching Scholars (DTS) Program: An Internal Report.***

**Findings:**

*Planned Project Impact on Various Groups*

- All 18 projects planned to directly impact college faculty, the median impact is at 28 faculty per project.
- Nine of the projects intended to work with K–12 or precollege teachers.
- Collaboration with faculty peers to integrate research and education was done by one-half of the awardees post-award, whereas five (28 percent) had done so prior to the award.
- Ten awardees (56 percent) were mentoring graduate students regarding the integration of research and teaching; three (17 percent) were working with graduate students to show them how to conduct educational research with respect to their teaching effectiveness
- Nearly three-quarters of the awardees offered workshops on their DTS projects in their departments and/or elsewhere in their home institutions. Eight felt that their standing as a research scholar was enhanced by the award.
- Six reported that their status as a DTS awardee had helped them have an impact on the academic culture in their departments or institutions.
- Eight recipients (44 percent) reported that the DTS award enhanced their standing as a research scholar at their home institution.
- Twenty-eight percent of DTS awardees served as leaders of professional societies in their STEM discipline's education arm, and 39 percent serve on editorial and advisory boards.
- Just under half (44 percent) have published results of their education efforts, and some reported having difficulty finding journals in their disciplines that dealt with educational issues other than those directed toward secondary teachers.
- Sixteen (89 percent) have been recognized, through venues other than the DTS Award, for their accomplishments and contributions in education, and the same number have reached out to the broader community by speaking or giving workshops at other institutions regarding the integration of research and education.

**Table 7.—Number and percent of DTS awardees who report having increased visibility and prestige in their academic fields since the DTS award (N = 18)**

| Item | Number | Percent |
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| **Serve as leaders** of professional societies in their STEM discipline's **education arm** | 5 | 28 |
| **Are recognized** for their accomplishments and contributions as **researchers** | 10 | 56 |
| **Are recognized** for their accomplishments and contributions in **education** | 16 | 89 |
| **Serve** on editorial review boards and or advisory boards or committees | 7 | 39 |
| Have published results of **research** efforts | 9 | 50 |
| Have published results of **education** efforts | 8 | 44 |
| Have reached out to the **broader community** in various ways about their efforts to integrate research and education—e.g., speaking or giving workshops at other institutions | 16 | 89 |

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| | **Recommendations:**<br><br>(Detailed suggestions and criteria for each of the following recommendations can be found in Chapter 4 of the internal report.)<br><br>• Raise the profile of DTS externally beyond NSF and expand outreach efforts;<br>• Create a DTS professional learning community;<br>• Generate DTS/CAREER connections;<br>• Strongly encourage DTS awardees to evaluate their activities and products;<br>• Reconsider the size of the award;<br>• Consider implementing a system to track awardees' future funding for activities that support the integration of research and education.<br><br>**Availability:** Available upon request. |

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| **The American Institutes for Research and the Wisconsin Center for Education Research (Sept. 2005),** ***Findings from the Formative Evaluation of the National Science Foundation's [Graduate Teaching Fellows in K-12 Education] GK-12 Program.*** | **Findings:**<br><br>• 89% of Fellows and 91% of teachers reported that the Fellows' communication skills improved either "somewhat" or "greatly/significantly" as a result of their K-12 activities.<br>• 93% of Fellows and 90% of teachers reported that the Fellows' teaching skills improved either "somewhat" or "greatly/significantly" as a result of their K-12 activities.<br>• Over three-quarters of teachers reported that improving the quality of their teaching (83%) or gaining content-area knowledge (79%) motivated them to a moderate or great extent to participate in the GK-12 program.<br>• Three-quarters of surveyed teachers reported that their content knowledge in STEM subjects increased as a result of working with the Fellows by a "moderate" or "great" extent. These findings were substantiated by reports from interviewed teachers. The Fellows' work in the classrooms was reported as key to this increase in teachers' content knowledge.<br>• 91% of teachers indicated that Fellows provided enriched learning experiences and opportunities for their students to a "moderate" or "great" extent.<br>• 86% of teachers reported that students learned more science (or technology, engineering, or mathematics) content than they would have if the Fellow had not been there.<br>• School staff reported that the university was more accessible, and that teachers were more connected to university resources and faculty than they were prior to GK-12.<br>• Surveyed district staff reported greater district involvement with the university after the GK-12 Program was implemented than before implementation.<br><br>**Recommendations:**<br>(The following recommendations have been extracted from the final GK-12 evaluation technical report.)<br><br>1. Recommendations for the GK-12 program<br>• Consider whether the support of undergraduate students is an appropriate and efficient use of program funds. [In FY 2006, undergraduate fellowships were dropped from the program. Fellowship stipends are available exclusively for STEM graduate students.]<br>• Provide practical and actionable information and advice about effective and efficient ways to operate projects and to promote their sustainability to PIs and individuals interested in developing university-K-12 partnerships programs.<br>• Provide more guidance to sites on how they can better evaluate the success of their projects<br>• Provide more guidance to sites on how they can better evaluate the success of their projects [Specific guidelines about reporting and project evaluation have been developed, shared with the PIs and included in the program solicitation.] |

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| | 2. Recommendations for future evaluation work<br>• The GK-12 program should consider developing surveys to assess the prevalence and distribution of critical partnership and/or institutionalization behaviors in the GK-12 program<br>• A longitudinal study of Fellows could provide valuable information about the long-term effects of GK-12 participation on Fellows.<br>• Further research could explore whether GK-12 is reaching underserved populations.<br><br>**Availability:** Forthcoming on the contractor's web site. |

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| **Abt Associates, Inc. (2006),** ***Final Report on the Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship [IGERT] Program.*** **[NSF 06-17]** | **Findings:**<br><br>IMPACTS ON STUDENTS: *The IGERT program is providing graduate students with significant interdisciplinary experiences as well as professional and personal skills for their future careers.*<br>▪ IGERT students consistently report greater opportunities than their non-IGERT peers to learn about other disciplines (86% compared to 55%), interact with faculty and students from other disciplines (50% compared to 22%), and work on projects involving multiple disciplines (76% compared to 42%).<br>▪ IGERT students receive more training than non-IGERT students in teamwork (66% compared to 50%), presentation (51% compared to 42%), and communication skills (50% compared to 22%), and are nearly twice as likely as non-IGERT peers to have received formal training in research ethics (74% compared to 39%).<br>▪ IGERT students report more opportunities than their non-IGERT peers to conduct off-campus internships (29% compared to 15%) and interact with people outside their home institutions (e.g., faculty from other universities, 48% compared to 34%) and outside academia (e.g., industrial scientists, 22% compared to 14%).<br><br>IMPACTS ON FACULTY: *The IGERT program is promoting a fertile environment for faculty to engage in interdisciplinary teaching and research, and providing faculty with stimulating professional experiences to which they willingly devote substantial time.*<br>▪ While interdisciplinary activities are common among all faculty surveyed, IGERT faculty and department chairs report an additional shift towards more interdisciplinary work as a result of their participation in the IGERT program.<br>▪ IGERT faculty team-teach in greater frequencies than non-IGERT faculty with colleagues outside their departments (42% compared to 28%) and mentor graduate students from other disciplines (67% compared to 47%).<br>▪ More IGERT faculty than non-IGERT faculty publish and present their research in journals (63% compared to 48%) and conferences (60% compared to 44%) outside their home disciplines, and are more likely to work on research projects (90% compared to 78%) and co-author proposals (86% compared to 64%) with colleagues from other disciplines.<br>▪ About half of IGERT faculty report learning new research techniques, exploring research that would not otherwise be funded, or being in a better position to win new grants as a result of IGERT.<br><br>IMPACTS ON INSTITUTIONS: *The IGERT program is helping to advance interdisciplinary graduate education in host institutions as well as catalyzing changes in graduate education beyond them.*<br>▪ Project PIs report that IGERT projects have stimulated policy changes for interdisciplinary coursework (68%) and teaching (34%), the revision of degree requirements (49%), and the creation of new degrees and certificates |

(23% respectively), as well as increases in university support for interdisciplinary education in general.
- Faculty members and department chairs perceive stronger departmental and institutional support for interdisciplinary research at IGERT institutions than non-IGERT institutions.
- Many PIs and administrators report that other departments or programs at their home institutions have already adopted IGERT program elements.

IMPACTS ON RECRUITMENT: *The IGERT program has the potential to increase the number of U.S. citizens currently enrolled in STEM doctoral programs.*
- IGERT faculty report an increased ability to recruit more and better academically qualified individuals to their programs.
- IGERT PIs and faculty members report recruiting high quality students, including those students for whom the availability of an IGERT program was a factor in choosing to attend graduate school.
- The IGERT program has recruited women and students from underrepresented minority groups in science and engineering programs at rates equal to national averages, and will seek further increases in these rates of recruitment.

**Recommendations:**

DIRECTIONS FOR FUTURE RESEARCH

The IGERT program represents a substantial investment in domestic graduate education, and new projects continue to be funded each year. As such NSF, the program community, and graduate education at large can benefit from continued evaluation and assessment of the IGERT program. As individuals begin graduating in larger numbers from IGERT projects, and grant funding draws to a close for many projects, there are several topics of investigation that might be of interest to the NSF and the graduate education community.

- *Assessment of Diversity Enhancement*—To enhance access to STEM doctoral education for populations traditionally underrepresented in science (such as minority groups and women), many IGERT projects have begun establishing recruitment relationships with programs or institutions that target individuals typically underrepresented in STEM fields. Future research could examine successful recruitment strategies, and the IGERT program's ability over time to recruit higher proportions of individuals from these groups.
- *Assessment of IGERT Graduate Career Outcomes*—A longitudinal study of the career outcomes of IGERT graduates, to learn about their chosen career pathways, professional productivity and accomplishments, would be an important measure of the long-term impact of the IGERT program.

- *Assessment of IGERT Institutional Impacts*—As the IGERT program evolves there will be opportunities to learn about continued institutional culture change and the lasting institutionalization of program elements. There are several possible methods of studying such impacts. First, to learn more about the impact of IGERT projects on their host institutions, individuals external to the IGERT project but within the same institution could provide a useful perspective on IGERT and its impact. Second, long-term institutional impacts and project sustainability can be examined after a project's funding has ended. Third, future studies could collect data from other points in time, enabling a longitudinal analysis of institutional support and enabling conclusions to be drawn about the ways in which IGERT projects effect lasting change in their universities.
- *Assessment of the IGERT Model of Interdisciplinary Graduate Education*—Future evaluation work should examine the IGERT model of graduate education itself. In what ways are IGERT activities "interdisciplinary" or "integrated"? What do these terms mean on IGERT campuses? How can the IGERT program help develop a broader understanding of what it means to engage in integrated and interdisciplinary graduate education? How does the IGERT program compare to other interdisciplinary graduate education programs as an effective means of reaching the goals of the IGERT program?

**Availability:** www.nsf.gov/pubs/2006/nsf0617/nsf0617.pdf

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| **Westat, Inc. (June 2006),** ***Analysis of a Sample of Projects Funded Under the [Informal Science Education] ISE Program.*** | **Findings:**<br><br>MUSEUM PROJECTS—Museum exhibit projects used formal interviews (i.e., exit interviews), observation, external reviewers, tracking studies, surveys (teacher, student, and visitor), and focus groups to measure effectiveness. Oftentimes, tracking studies were used during the formative stages of the exhibit to inform placement and content.<br>▪ Numbers of visitors ranged from 25,000 to over a million. *1,2,3 Ready, Set, Go! Math for Young Children and Families* used a parent survey to understand how the exhibit impacted their children.<br>▪ The *Alien Stingers Exhibit* reported summative evaluation results from exit interviews with 423 randomly selected visitor groups. Findings show that the exhibit "changed perceptions of jellies, addressed visitors' concerns about stinging, increased visitors' ability to articulate any value that jellies and coral have for ocean ecosystems, and created positive associations for visitors concerning scientific inquiry generally."<br><br>TELEVISION, RADIO, AND WEBCAST SHOW PROJECTS—Television, radio, and Webcast projects utilized administrative records (website hits), external records (independent ratings, number of viewers), focus groups, telephone interviews, pre/post-testing of viewers, observation, and chat logs to ascertain the impact of their programs. Oftentimes, projects were considered successful if a show garnered a large segment of the market share, viewers enjoyed the show, and viewers acquired new knowledge from the show.<br>▪ *Science News for Local TV and Spanish Stations* found that viewership varied depending on the topic.<br>o health related topics averaged 3.5 million viewers<br>o technology related topics averaged 2.1 million viewers,<br>o physics related topics averaged .5 million viewers,<br>o all stories combined averaged 1.2 million viewers.<br>▪ *DragonflyTV* found that 95 percent of the children understood the premise of the program, and 80 percent wanted to try their own science projects.<br>▪ *Zoom* offered findings involving children's acquisition of knowledge, the involvement of parents in the children's science activities, and level of engagement in science activities after viewing the show. Overall, the project found that children who watched the show were more likely to engage in their own science activities.<br><br>SCIENCE / MATH PROGRAMS FOR YOUTH—Science and/or math programs for youth projects used web, telephone, and in-person surveys of parents, teachers, and participants to assess program success. Administrative records were also used to ascertain if programs were meeting their target underserved audiences. Measures of success were often reported in terms of participation rates and satisfaction of parents/students/teachers.<br>▪ The number of participants in science/math programs for youths ranged from 107 to more than 6 million<br>▪ *Wonderwise 4-H* project used a web survey to assess the program's impact on the participants. Many students pointed out that "the activities and videos affected the youth's perceptions of a career in science or that youth indicated an interested in or intention of becoming a scientist." A significant portion of the adult leaders stated that "by seeing minority women who have families, and who are also scientists, youth recognized that they, too, could become scientists one day as well." |

RESEARCH / PROGRAMS FOR PROFESSIONALS—Research and/or educational programs for professionals often used formal interviews, external evaluations, mail surveys, and informal conversations to obtain feedback about the success of their research or program. The surveys usually assessed the usefulness of information presented and participant satisfaction. For projects designed to explore research questions, sometimes pre- and post-testing were used as a method to test hypotheses.

- Conference and Proceedings: *Best Practices in Science Exhibition Development*, held at the Exploratorium in San Francisco, California, provided professional development to over 50 exhibit developers and generated a publication for the entire field.
- *Mother Goose Cares about Math and Science: An Integrated Course of Science and Mathematics for Child Care Providers* provided training for over 600 child care professionals.

FILM PROJECTS—Film projects used administrative records (number of attendees), pre/post-testing, external evaluation, surveys (telephone and in-person), and critical reviews to assess the success of their productions.

- *Coral Reef Adventure* reported an estimated 5.08 million viewers. The *Coral Reef Adventure* found that on a 10-point knowledge test, average scores increased from five to eight correct answers after people had viewed the film.
- The *Jane Goodall Project* found that students who watched the film did better than a control group on a test designed to measure student learning about wild chimpanzee behavior.

**Recommendations**

The ISE program staff will need to assess the impact of new guidelines in the solicitation, which require projects to demonstrate impact on the ISE field, innovation, and collaboration. Specifically, future evaluation activities should assess the degree to which:

- projects have become "audience-driven" vs. "content-driven" and are developing clear and appropriate mechanisms/approaches for evaluating progress and strategic impacts;
- project approaches build upon previous research and advance "the-state-of-the-art" in informal science education;
- new research methods and measures (developed by selected projects) serve to inform other future project evaluations.

**Availability:** Forthcoming on contractor's web site**.**

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| **The Urban Institute (Nov. 2005),** ***Final Report on the Evaluation of the National Science Foundation Louis Stokes Alliances for Minority Participation Program*****.** | **Findings:**<br><br>INSTITUTIONAL OUTCOMES—Project staff members who were interviewed at participating institutions of higher education believe that involvement in the program enables institutions to retain and graduate more STEM students by substantially expanding these institutions' capacity to develop and support STEM student talent. Staff members also believe that LSAMP had an impact on participating institutions by changing the institutional culture, policies, and practices to encourage the recruitment, retention, and graduation of underrepresented minorities in STEM majors.<br><br>NATIONAL COMPARISON—LSAMP student outcomes and those of STEM graduates nationally and LSAMP graduates' progress in the STEM pipeline was compared with that of nationally representative samples of underrepresented minorities and white and Asian students (using longitudinal data from NSF's National Survey of Recent College Graduates). Analyses revealed that LSAMP participants pursued post-bachelor's coursework, enrolled in graduate programs, and completed advanced degrees at greater rates than did national comparison groups. The difference in graduate school enrollment and completion is largely due to the significantly higher percentage of LSAMP students pursuing and completing degrees in STEM fields. In terms of the final phase in the STEM pipeline, LSAMP participants were observed joining the STEM workforce in proportions similar to those of national samples.<br><br>STUDENT OUTCOMES<br>▪ 80% of LSAMP students took further coursework after completing their bachelor's degree, compared with about 60 % of comparison URM and white and Asian students.<br>▪ 66% of LSAMP participants pursued graduate degrees (compared to 45% among the comparison groups.<br>▪ LSAMP participants are about 50 % more likely to pursue an MA or a PhD than are those in either comparison group.<br>▪ 38% of all LSAMP students pursued graduate degrees in STEM, compared with 20 to 22 % among the comparison groups.<br>▪ About 45% of LSAMP students completed graduate degrees, while this was true of about 20 % of national URM and white and Asian bachelor's degree holders.<br>▪ 25% of LSAMP participants completed a graduate degree in STEM compared to only 9% in either comparison group.<br>▪ Restricting this comparison to those respondents who completed a degree shows that LSAMP students are still more likely to have completed a graduate degree in STEM (57%) than are comparison URMs (43%) or whites and Asians (51%).<br>▪ LSAMP students in general were slightly more likely to complete a degree in STEM (25% of all LSAMP participants) than in a non-STEM field (19% of all LSAMP).<br>▪ Almost 70% of completed master's degrees were in a STEM field, as were nearly 90% of completed PhDs. As expected, given the NSF definition of STEM, the exception to this trend was professional degrees; over 80% of completed professional degrees were awarded in a non-STEM field. |

**Recommendations:**

1. *Increase data collection efforts*. LSAMP Alliances should collect the following additional data on Level I participants :

- Undergraduate retention and attrition information about participants so that the program's success in retaining participants may be assessed.
- Tracking information that may be used to follow up on participants in order to ascertain whether or not they remain in the STEM career track by enrolling in a STEM graduate program and/or entering the S&E workforce.

2. *Strengthen the focus on community college students*. In light of the program's success in retaining in the STEM pipeline underrepresented minority students who begin their college education in community colleges, LSAMP should place added emphasis on strengthening and expanding the community college component of the program. Community colleges enroll more than half of all underrepresented minority students in postsecondary education and thus provide a promising source of potential STEM students.
3. *Expand the program to offer graduate school tuition and support to LSAMP graduates.* LSAMP graduates who did not continue taking courses after completing a bachelor's degree cited financially related factors as reasons for not doing so. The need to work and other financial burdens figured prominently among the most important barriers to LSAMP students' enrollment in graduate education, and these factors were cited by a significantly higher percentage of LSAMP graduates than their peers in both comparison groups. Given LSAMP's success in preparing participants to enter and complete graduate degrees, extending the program's offerings to include financial incentives to encourage these students to enter graduate STEM programs seems a worthwhile investment.
4. *Emphasize successful factors in selecting sites to receive LSAMP awards*. In awarding LSAMP grants, the program should continue to consider three criteria of utmost importance in identifying potentially successful applicants:
(1) evidence of institutional and faculty support; (2) history of, or plans for, a strong collaborative relationship among partners; and (3) well-defined plan and the capacity to provide the integrative services that comprise the LSAMP model.
5. *Replicate and expand the LSAMP program*. Given LSAMP's proven success, it is important that efforts to replicate and disseminate the model be increased. The LSAMP model, unlike most intervention efforts for increasing URM participation in STEM, lays the foundation for systemic institutional change. It does so, in large part, by synergistic efforts of institutional partners who can collaborate and share resources, information, and experiences.

**Availability:** www.urban.org/UploadedPDF/411301_LSAMP_report_appen.pdf

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| **U.S. Office of Personnel Management [FY2006], *The Federal Cyber Service: Scholarship for Service [SFS] Baseline Evaluation Report.*** | **Findings:**<br><br>IMPLEMENTATION<br><br>• The SFS program first enrolled students in 2001 and to date has accepted a total of 730 students in 30 universities; 443 students have graduated. Student placement has improved from 81% in 2003 to 93% in 2005. The cumulative placement rate is 88%.<br><br>NSF FUNDING TO UNIVERSITIES FOR SCHOLARSHIPS<br><br>• To date, $77,768,791 in scholarship funds has been distributed to universities designated by the National Security Agency (NSA) and the Department of Homeland Security (DHS) as Centers of Academic Excellence in Information Assurance Education. Most PIs are satisfied with the adequacy of funding for scholarships. However, some problems related to compensation for time devoted to SFS, as well as some inequities in the geographic distribution of funds relative to the cost-of-living, remain.<br><br>• Based on data provided by the PIs, 75% of SFS students have GPAs above 3.5, indicating that the program attracts high-quality students.<br><br>• Survey results of current students indicate that 57% had a formal or informal mentor in their university; 44% said they had a mentor during their internships. Two-thirds of SFS graduates agreed that mentoring had contributed to their career success.<br><br>• Retention of qualified Cyber Service candidates in Federal service remains a challenge. Survey results show that turnover intention was relatively high among graduates, with 43% indicating that they were considering leaving their jobs. This is higher than the average of 31% for Federal employees with tenure of three years or less who responded to the 2004 Government-wide Federal Human Capital Survey.<br>• Survey comments indicate considerable unhappiness with the lengthy Federal hiring and security clearance process.<br><br>OVERALL PARTICIPANT SATISFACTION<br><br>• Overall satisfaction with the program was high. About 80% of students and graduates expressed satisfaction, compared with 78% of PIs. IT supervisors of SFS interns and graduates were most satisfied (89%).<br><br>**Recommendations**<br><br>DIRECTIONS FOR FUTURE RESEARCH<br><br>Future evaluation of the SFS program should include investigations into the following areas:<br>• Retention of SFS participants in targeted government positions;<br>• Diversity of SFS graduates relative to the Federal IT workforce;<br>• Effectiveness of ongoing SFS program marketing efforts;<br>• How scholarships are funded in CAEIAEs;<br>• Procedures for placement of students in internships;<br>• Issues related to security clearance, internships and Federal job placement.<br><br>**Availability:** www.sfs.opm.gov/ |

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| **Horizon Research, Inc. (November, 2005),** ***Lessons from a Decade of Mathematics and Science Reform: A Capstone Report for the Local Systemic Change through Teacher Enhancement Initiative [Teacher Enhancement] TE Program*** | The decade-long, Local Systemic Change (LSC) Initiative was a component of NSF's Teacher Enhancement program. All LSC projects participated in a standardized CORE program evaluation. Data collection included observations of 2,400 professional development (PD) sessions and 1,620 mathematics and science lessons, as well as 75,000 teacher questionnaires; 17,380 principal questionnaires; and 1,782 teacher interviews. LSC-developed classroom observation protocols are used nationally, beyond the LSC, to evaluate instruction and help the education community develop a vision of effective mathematics and science instruction. A number of project-based research studies addressed issues related to district-wide professional development and student achievement.<br><br>**Impact:**<br>• The 88 LSC projects (representing a nearly $250 million investment) involved approximately 70,000 teachers in roughly 4,000 schools, in 467 districts across the United States. An estimated 2,142,000 students received instruction from LSC-treated teachers each year.<br>• The program portfolio studies strategies in a variety of contexts: **(a) content area**-K-8 science [38], secondary science [6], K-8 mathematics [18], secondary mathematics [14], elementary mathematics/ science [6], K-12 science [1], and K-12 mathematics [5]; **(b) student demographics—**white [48%], African-American [23%], Hispanic [21%], Asian [6%], American Indian/Alaskan Native [1%], other [1%]; and **(c) community-type-**urban [49%], suburban [25%], rural [13%], towns/small cities [13%].<br>**Findings:**<br>• PD that addresses content and pedagogy in the context of district-selected, high-quality materials results in higher quality classroom instruction.<br>• IMPACT ON PROFESSIONAL DEVELOPMENT: The quality of LSC-PD increased significantly over time in creating a PD culture conducive to teacher learning; improving preparation of PD providers; and preparing teachers' use of high-quality materials and related pedagogy in classrooms.<br>• IMPACT ON TEACHERS AND TEACHING: Teachers' attitudes toward reform and perceptions of their content and pedagogical preparedness to teach science and mathematics improved with increased participation with LSC PD. LSC PD resulted in: **(a)** improved lesson quality; **(b)** increased time spent on science/mathematics instruction in elementary grades; **(c)** enhanced quality of content; **(d)** more frequent use of investigative practices, questioning, and sense making; and **(e)** classroom cultures better promoting intellectual rigor and student engagement. Improvements in classroom instruction was positively correlated with hours of LSC-supported PD.<br>• IMPACT ON WIDESPREAD USE OF HIGH-QUALITY MATERIALS: PD around district-selected, high-quality materials increases their classroom use by participating teachers and reinforces curriculum adoption decisions.<br><br>LSC PD positively impacted preparedness to teach and actual classroom practice in science and mathematics most markedly through 80 hours of participation. Evident regardless of teachers' content preparation, this helped narrow initial differences between teachers with strong and weak content preparation in terms of comfort level with science/mathematics teaching. |

- IMPACT ON INSTITUTIONALIZATION OF PD SYSTEMS AS A CONTEXT FOR IMPROVEMENT: Evidence of sustainability manifested across projects by **(a)** cadres of master teachers with strong commitment to district-based PD; **(b)** partnerships of K-12 systems and university faculty leading to new courses for veteran and future teachers; **(c)** district-based materials management systems to distribute/replenish curricula/instruction kits; **(d)** alignment of financial resources, policies, and vision; and **(e)** alignment of teacher evaluation with district vision for mathematics and science teaching and learning.

**Recommendations:**

- Principles for effective, system-wide PD should include: **(a)** PD providers with in-depth content understanding and expertise in K-12 mathematics and science education; **(b)** supportive and collegial PD cultures facilitating teacher learning; **(c)** providing experiences that deepen teachers' knowledge of the mathematics/science content in curriculum and related pedagogy; **(d)** providing teachers opportunities to explore and become conversant with high-quality instructional materials and the appropriate pedagogy for using these materials in their classrooms; and **(e)** providing teachers support in content, pedagogy, and materials over the course of implementation.
- LSC's PD goal of 130 hours per teacher was reached by only 18 percent of teachers, although LSCs provided more PD than would have been reached with comparable funding. Programs need to attend to **(a)** teacher turnover (mobility across schools/content area, retirement, resignation, staff downsizing, reduction in classroom size); **(b)** securing state-/district-supported PD days; **(c)** levels of adoption of selected instructional materials and high stakes assessments; and **(d)** sheltering teacher workforce from changes in externally-set PD priorities over time.
- District-wide, PD-based reform requires strategies for **(a)** Increasing preparation of PD providers in areas posing difficulties for teachers (e.g., content, questioning, closure); **(b)** increasing time for teachers' content development; **(c)** increasing on-going individual and small group opportunities through increased school support and formal structure; **(d)** actively engaging principals and school administrators to secure resources and sustain efforts; and **(e)** managing turnover, entry of new teachers, and creating incentives beyond "pioneer" teachers.
- In addition to program evaluation required of participating projects from the inception of an initiative, develop a robust research agenda to increase the knowledge-based around critical program goals and design elements. Qualitative and quantitative research findings should explore multiple aspects of student impact (e.g., achievement, increased course-taking, advanced course-taking), teacher impact (e.g., content knowledge, increased class time devoted to science and mathematics, use of selected curricula), and sustainability within systems after funding ceases.

**Availability:** www.horizon-research.com/reports/2006/capstone.php

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| ***International Assessment of Research and Development in Systems Biology (2005)*** | **Findings**<br><br>The interest generated by the need to integrate molecular data into a systems approach stimulated events over the last five to seven years in the U.S. and more recently elsewhere where large investments in systems biology began to be made by national entities and research institutions.<br><br>The lead position of the U.S. is reflected in the larger number of active groups, greater number of educational programs underway, and the more diverse and growing funding base. There is evidence of rapid development outside of the U.S. Overall, the picture is of an active field in the early stages of explosive growth.<br><br>Models for data production and data storage in systems biology are highly variable, ranging from large centers with massive accumulations of high-throughput data, to small databases. Whichever model is used, the absence of data standards that permit groups other than the producer to use, analyze, and evaluate the results is clearly a significant barrier to progress. This is an international issue and must be solved by broad collaborative interactions.<br>The future of systems biology will depend on three critical elements: education of a new generation of scientists who have both biological and mathematical training; the availability of funding that operates outside of disciplinary boundaries; and the availability of supportive infrastructure that can accommodate the needs of an intrinsically interdisciplinary research area.<br><br>**Recommendations:**<br><br>None<br><br>**Availability:** www.wtec.org/reports.htm |

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| ***International Assessment of Research and Development in Micromanufacturing*** | **Findings**<br><br>The U.S. gets high marks for nanotechnology R&D, but emphasis in the U.S. on micromanufacturing R&D is lagging far behind the rest of the world. This will undoubtedly have serious long-term implications, since it is well-recognized that micromanufacturing will be a critical enabling technology in bridging the gap between nanoscience and technology developments and their realization in useful products and processes. The U.S. gets particularly low marks for government funding of micromanufacturing R&D and the development and nurturing of industry, government, and university interactions and collaborations. On this latter point, Europe appears to be very strong, particularly as these partnerships work to refine and fine-tune developments for industry adaptation and commercialization.<br><br>**Recommendations:**<br><br>None<br><br>**Availability:** www.wtec.org/micromfg/workshop/proceedings/Entire-Proceedings.pdf |

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| ***Building a Better Delivery System: A New Engineering/Health Care Partnership*** | **Findings:**<br><br>A partnership between health care professionals and engineers is critical to transform the U.S. health care sector. This can be accomplished via a systems engineering analysis approach to health care delivery. Statistical process controls, queuing theory, quality function deployment, failure-mode effects analysis, modeling and simulation and human factors engineering have been adapted to applications in health care delivery and used to improve the performance of discrete care processes, units and departments. Very few health care professionals or administrators are equipped to think analytically about health care delivery as a system or to appreciate the relevance of systems-engineering tools, however. The widespread use of systems-engineering tools will require determined efforts on the part of health care providers, the engineering community, state and federal governments, private insurers, large employers and other stakeholders.<br><br>**Recommendations:**<br><br>• Private insurers, large employers and public players including the Federal Center for Medicare and Medicaid Services and state Medicaid programs should provide more incentives for healthcare providers to use system tools to improve care quality and efficiency of care delivery.<br>• Outreach and dissemination efforts that have used or promoted systems-engineering tools in healthcare delivery should be expanded, integrated into existing regulatory and accreditation frameworks and reviewed to determine whether, and if how, better coordination might make their collective impact stronger.<br>• The use and diffusion of systems engineering tools in health care delivery should be promoted by a National Institutes of Health Library of Medicine website that provides patients and clinicians with information about, and access to systems engineering tools for healthcare.<br>• Federal research and mission agencies should increase support for research to advance the application and utility of systems engineering in health care delivery. In addition, federal agencies and private institutions should support the development of systems engineering curriculum tools to train individual patients and care providers.<br>• Research and development in information and communication technologies for health care delivery is necessary and should be supported in such areas as voice-recognition systems and human-information/communication technology system interfaces.<br>• Public and private support for research on the development of very small, low-powered biocompatibility devices which are essential for improving health care delivery. Engineering research should focus on defining architecture capable of incorporating date from these microsystems into the wider health care network and into developing interface standards and protocols to implement a larger network.<br>• The federal government, in partnership with the private sector, academic institutions and state governments should establish multidisciplinary centers of higher learning to address the quality and productivity challenges facing the nation's health care delivery system. A lead agency should be identified to ensure adequate, stable funding<br>• Health care providers and educators should ensure that future health care professionals have a basic understanding of how systems engineering and information/communication tools work and their potential benefits. In turn, health care issues should be introduced into the engineering curriculum at all levels. Business curriculums should use health care related examples to train future health care administrators in relevant issues. Fellowship programs should be created by federal mission agencies and private sector foundations in health systems engineering and management.<br><br>**Availability:** www.nationalacademies.org/onpi/030909643X.pdf |

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| ***Instrumentation and Metrology for Nanotechnology*** | **Findings:**<br><br>Instrumentation and metrology are integral to the emerging nanotechnology enterprise, and crosscut all areas of the National Nanotechnology Initiative. Advances in fundamental nanoscience, design of new nanomaterials, and ultimately manufacturing of new nanotechnology-based products all depend on the capability to accurately and reproducibly measure properties and performance characteristics at the nanoscale.<br><br>**Recommendations:**<br><br>• Develop a national technology roadmap for nanotechnology for instrumentation and metrology<br>• Develop strong educational programs and leverage federal laboratories that address the development of measurement infrastructure and advanced measurement instrumentation<br>• Coordinate funding of educational programs with agencies to provide effective support for program areas of joint interest<br>• Leverage national laboratories' user facilities to foster the development of new measurement techniques and development of a national user facility for nanotechnology<br>• Foster the development of consortia co-funded by government and industry tasked to bridge the gap for the development of sector-specific instrumentation of nanometrology for nanomanufacturing<br>• Invest in integrated computational methods to develop predictive and assessment tools for nanometrology and nanomanufacturing<br><br>**Availability:** www.nano.gov/NNI_Instrumentation_Metrology_rpt.pdf |

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| ***2005 Survey of Nanotechnology in U.S. Manufacturing Industry – Trends and Strategies*** | **Findings:**<br><br>Many innovations in new nanomaterials and product forms are in commercial development across the board; however there is a cautious move towards advanced generation nano-products. The near-term trend is primarily in "designer" (application-specific) passive nanomaterials with tighter size distributions, consistency and functionality as a result of improved processes, uniformity and yields. Nanotechnology has historically followed and will continue to follow an evolutionary path, with many incremental steps, demonstrating new applications (near term) in the next 3-5 years in passive applications. In combination, these small steps will result in broad and significant impact (near term) on system miniaturization, reliability, durability, efficiency, safety, comfort, productivity, and performance. This evolutionary impact can be accelerated by public-private, strategically focused research and development (R&D) and entrepreneurial initiatives.<br><br>**Recommendations:**<br>▪ Collaborative R&D advances to reduce and combine process steps and develop new equipment to improve product yields.<br>▪ Government incentives for private R&D Investments and investment in pre-competitive R&D.<br>▪ Promote and facilitate supplier-end user partnerships to respond to intellectual property concerns and long market entry time.<br>▪ Streamline process to partner with academia & National Labs.<br>▪ Streamline permit/product approvals at government agencies and allow for broader dissemination of findings to address regulatory or safety concerns.<br>▪ Retrain Tech Workforce in Basic Science/Testing/QC and attract students to science & engineering careers to increase workforce.<br><br>**Availability:**<br>**www.ncms.org/publications/PDF/05NCMSNanotechnologySurveyAbstract.pdf** |

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| ***Facing Hazards and Disasters: Understanding Human Dimensions,*** Committee on Disaster Research in the Social Sciences, Future Challenges and Opportunities, Division on Earth and Life Sciences, National Research Council | **Recommendations:**<br><br>• Comparative research should be conducted to refine and measure core components of social vulnerability and resilience to hazards of all types, to address the special requirements of confronting disasters caused by terrorist acts, and to advancing knowledge about mitigation, preparedness, response, and recovery related to disasters having catastrophic physical and social impacts.<br>• Strategic planning and institution building are needed to address issues related to the management and sharing of data on hazards and disasters (hazards and disaster informatics), sustain the momentum of interdisciplinary research, advance the utilization of social science findings, and sustain the hazards and disaster research workforce.<br>• NSF and DHS should jointly support the comparative research, strategic planning, and institution building called for in Summary Recommendations 1-2.<br><br>**Availability:** **newton.nap.edu/catalog/11671.html#orgs** |

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| ***Simulation-Based Engineering Science: Revolutionizing Engineering Science through Simulation (2006)*** | **Findings:**<br><br>SBES is a discipline indispensable to the nation's continued leadership in science and engineering. It is central to advances in biomedicine, nanomanufacturing, homeland security, microelectronics, energy and environmental sciences, advanced materials, and product development. There is ample evidence that developments in these new disciplines could significantly impact virtually every aspect of human experience.<br><br>Formidable challenges stand in the way of progress in SBES research. These challenges involve resolving open problems associated with multiscale and multi-physics modeling, real-time integration of simulation methods with measurement systems, model validation and verification, handling large data, and visualization. Significantly, one of those challenges is education of the next generation of engineers and scientists in the theory and practices of SBES.<br><br>There is strong evidence that our nation's leadership in computational engineering and science, particularly in areas key to Simulation-Based Engineering Science, is rapidly eroding. Because competing nations worldwide have increased their investments in research, the U.S. has seen a steady reduction in its proportion of scientific advances relative to that of Europe and Asia. Any reversal of those trends will require changes in our educational system as well as changes in how basic research is funded in the U.S.<br><br>**Availability:** **www.nsf.gov/publications/pub_summ.jsp?ods_key=sbes0506** |

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| ***Report on NSF Tribal Colleges Workshop (2006)*** | **Recommendations:**<br><br>*National Science Foundation:*<br>• Incorporate a funding structure similar to that used by the Tribal Colleges and University (TCUP) Program that accounts for the unique needs and differences in preparation of the individual TCUs.<br>• Improve the physical infrastructure for supporting NSF pre-engineering and engineering degree programs including teaching and research labs and some technology infrastructure to support common distance based efforts.<br>• Establish "Centers of Excellence" or "Collaborative Centers" that capitalize on the strengths of individual TCUs with the intention of disseminating and sharing expertise and best practices, related to STEM student retention, developmental education, and engineering programs.<br>• Encourage collaboration between TCUs and NSF to better define the broader impact statement in solicitations that encourage mutually beneficial partnerships between TCUs and mainstream institutions.<br><br>*Tribal Colleges & Universities:*<br>• Develop a strategy for recruiting and retaining faculty with experience in engineering.<br>• With NSF's support, organize SWAT or technical assistance teams to coordinate activities such as: curriculum alignment between TCUs and mainstream institutions; common distance based course development and delivery; navigating the ABET accreditation process; and to find common solutions related to engineering programs at TCUs.<br>• Support faculty professional development, and provide release time for faculty research in order to improve faculty retention.<br>• Develop mutually beneficial matriculation programs to transfer students completing pre-engineering programs at TCUs to mainstreams institutions that offer four year engineering degrees<br>• Build bridges and understanding of engineering between tribal governing bodies and TCUs.<br>• Develop mutually beneficial programs with K-12 schools with the intention of improving the math and science background of students entering TCUs.<br>• Develop common standards for coursework among regional TCUs and four-year engineering degree granting institutions by aligning STEM course descriptions to aid in articulation and transfers and to encourage the sharing of TCU faculty and resources for common distance based curriculum.<br>• Offer culturally appropriate curriculum that capitalizes on the incorporation of indigenous knowledge in engineering programs.<br>• Form an *ad hoc* committee related to pre-engineering and engineering activities and an accompanying website that will be used as a portal for disseminating ideas, opportunities and facilitating collaboration.<br>• Refine and disseminate successful models of adult recruitment, remediation, and retention in math, science, and engineering courses and degree programs.<br>• Stimulate the interest of K-12 students in the areas of engineering by developing culturally relevant applications of engineering that are offered using informal methodologies of instruction as well as locations.<br><br>**Availability:** **www.nsf.gov/attachments/106803/public/TCU_Report_Final.doc** |

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| ***Controlling the Quantum World***<br><br>***Committee on AMO2010, National Research Council*** | **Scope:**<br>Atomic, molecular, and optical (AMO) science demonstrates powerfully the ties of fundamental physics to society. Its very name reflects three of 20th century physics' greatest advances: the establishment of the atom as a building block of matter; the development of quantum mechanics, which made it possible to understand the inner workings of atoms and molecules; and the invention of the laser.<br><br>The purpose of this report is to identify the most promising future opportunities in AMO science based on what is known at this time. Building on these findings, the report describes the most fertile avenues for the next decade's research in this field.<br><br>**Findings**<br>This report concludes that research in AMO science and technology is thriving. It identifies, from among the many important and relevant issues in AMO science, six broad grand challenges that succinctly describe key scientific opportunities available to AMO science:<br>• Revolutionary new methods to measure the nature of space and time with extremely high precision have emerged within the last decade from a convergence of technologies in the control of the coherence of ultrafast lasers and ultracold atoms. This new capability creates unprecedented new research opportunities.<br>• Ultracold AMO physics was the most spectacularly successful new AMO research area of the past decade and led to the development of coherent quantum gases. This new field is poised to make major contributions to resolving important fundamental problems in condensed matter science and in plasma physics, bringing with it new interdisciplinary opportunities.<br>• High-intensity and short-wavelength sources such as new x-ray free-electron lasers promise significant advances in AMO science, condensed matter physics and materials research, chemistry, medicine, and defense-related science.<br>• Ultrafast quantum control will unveil the internal motion of atoms within molecules, and of electrons within atoms, to a degree thought impossible only a decade ago. This is sparking a revolution in the imaging and coherent control of quantum processes and will be among the most fruitful new areas of AMO science in the next 10 years.<br>• Quantum engineering on the nanoscale of tens to hundreds of atomic diameters has led to new opportunities for atom-by-atom control of quantum structures using the techniques of AMO science. There are compelling opportunities in both molecular science and photon science that are expected to have far-reaching societal applications.<br>• Quantum information is a rapidly growing research area in AMO science and one that faces special challenges owing to its potential application in data security and encryption. Multiple approaches to quantum computing and communication are likely to be fruitful in the coming decade, and open international exchange of people and information is critical in order to realize the maximum benefit.<br>**Recommendations:**<br><br>Recommendation: In view of the critical importance of the physical sciences to national economic strength, health care, defense, and domestic security, the federal government should embark on a substantially increased investment program to improve education in the physical sciences and mathematics at all levels and to strengthen significantly the research effort. |

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| ***Controlling the Quantum World***<br><br>***Committee on AMO2010, National Research Council*** | Recommendation. AMO science will continue to make exceptional contributions to many areas of science and technology. The federal government should therefore support programs in AMO science across disciplinary boundaries and through a multiplicity of agencies.<br><br>Recommendation. Given the critical role of theoretical research in AMO science, the funding agencies should reexamine their portfolios in this area to ensure that the effort is at proper strength in workforce and funding levels.<br><br>Recommendation. The federal government should implement incentives to encourage more American students, especially women and minorities, to study the physical sciences and take up careers in the field. It should continue to attract foreign students to study physical sciences and strongly encourage them to continue their scientific careers in the United States.<br><br>**Availability:** www.nap.edu/catalog/11705.html |
| ***Revealing the Hidden Nature of Space and Time: Charting the Course for Elementary Particle Physics***<br><br>***Committee on Elementary Particle Physics in the 21st Century, National Research Council*** | **Scope:**<br>A national discussion about the future of U.S. global leadership in science, technology, and innovation has been unfolding over the past few years. In October 2005, echoing widespread concerns, the National Academies report *Rising Above the Gathering Storm* outlined a program designed to enhance the U.S. science and technology enterprise so that the nation can sustain its cultural vitality, continue to provide leadership, and successfully compete, prosper, and be secure in an increasingly globalized world. In particular, the report identified basic research in the physical sciences as a key underpinning of the nation's strategic strengths. Against this broader backdrop, the work of the Committee on Elementary Particle Physics in the 21st Century took on a special significance. By recognizing the need for U.S. leadership in particle physics, and by articulating an approach to ensuring that leadership, this report offers a compelling opportunity for action in the national discussion of the U.S. role in science and technology.<br><br>**Findings**<br>The committee arrived at several strong conclusions regarding both particle physics and the U.S. role in this global scientific and technological enterprise:<br><br>Particle physics plays an essential role in the broader enterprise of the physical sciences. It inspires U.S. students, attracts talent from around the world, and drives critical intellectual and technological advances in other fields.<br><br>Although setting priorities is essential, it also is critical to maintain a diverse portfolio of activities in particle physics, from theory to accelerator R&D to the construction and support of new experimental facilities. The committee believes that accelerators will remain an essential component of the program, since some critical scientific questions cannot be explored in any other manner. |

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| ***Revealing the Hidden Nature of Space and Time: Charting the Course for Elementary Particle Physics***<br><br>***Committee on Elementary Particle Physics in the 21st Century, National Research Council*** | The field of elementary particle physics is entering an era of unprecedented potential. New experimental facilities, including accelerators, space based experiments, underground laboratories, and critical precision measurements of various kinds, offer a variety of ways to explore the hidden nature of matter, energy, space, and time. The availability of technologies that can explore directly an energy regime known as the Terascale is especially exciting. The direct exploration of the Terascale could be the next important step toward resolving questions that human beings have asked for millennia: What are the origins of mass? Can the basic forces of nature be unified? How did the universe begin? How will it evolve in the future? Moreover, at Terascale energies, formerly separate questions in cosmology and particle physics become connected, bridging the sciences of the very large and the very small in the quest to reveal the hidden nature of space and time.<br><br>**Recommendations:**<br><br>• The results of the committee's analysis have led to its chief recommendation. **The United States should remain globally competitive in elementary particle physics by playing a leading role in the worldwide effort to aggressively study Terascale physics.**<br><br>• To implement the committee's chief recommendation, the Department of Energy and the National Science Foundation should work together to achieve the following objectives in priority order:<br><br>• Fully exploit the opportunities afforded by the construction of the Large Hadron Collider (LHC) at the European Center for Nuclear Research (CERN).<br><br>• Plan and initiate a comprehensive program to become the world-leading center for research and development on the science and technology of a linear collider, and do what is necessary to mount a compelling bid to build the proposed International Linear Collider on U.S. soil.<br><br>• Expand the program in particle astrophysics and pursue an internationally coordinated, staged program in neutrino physics.<br><br>**Availability:** www.nap.edu/catalog/11641.html |

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| ***Recommendations to the Department of Energy and the National Science Foundation on a U.S. Program of Reactor- and Accelerator-based Neutrino Oscillation Experiments***<br><br>***DOE/NSF Nuclear Science Advisory Committee*** | **Scope:**<br><br>NuSAG, the Neutrino Scientific Assessment Group, has been charged by the High Energy Physics Advisory Panel and the Nuclear Science Advisory Committee of the Department of Energy and National Science Foundation "to make recommendations on the specific experiments that should form part of the broad U.S. neutrino science program." One of the charges, dealing with a program in neutrino-less double beta decay, was the subject of NuSAG's first report. The experiments before NuSAG under the remaining two charges, both of which are addressed in this report, are proposals for U.S. participation in the next phase of the worldwide program in neutrino oscillations. This program includes both accelerator- and reactor-based experiments, and its goal is the complete exploration of three-neutrino mixing.<br><br>**Findings**<br><br>The worldwide program to study neutrino oscillations is in progress. The U.S. has been a major participant in this from the beginning, and is currently at the forefront, with running experiments that will bring the next major results. A global planning effort has developed a comprehensive set of proposed measurements that together have the potential to fully determine the mixing matrix that parametrizes 3-neutrino mixing The experiments before NuSAG are the first phase of a program designed to perform all of these measurements, subject only to the limitation imposed by $\sin^2 2\theta_{13}$. Accelerator and reactor experiments play complementary roles in this comprehensive study of neutrino mixing, and currently proposed reactor- and accelerator-based experiments have similar reach in sensitivity to oscillations.<br><br>Construction of experiments in the next round of the global program has begun: in Japan, on a new accelerator-based neutrino beam aimed at the existing Super-K detector (T2K), and in France on an improved reactor experiment (Double Chooz). The U.S. has the opportunity to share the leading role in the global effort with Japan, both by mounting critical experiments and by playing a major role in experiments abroad. The Double Chooz and T2K experiments now under construction will extend the sensitivity to non-zero $\sin^2 2\theta_{13}$ by factors of six and 20, respectively. However, they will be unable to. observe CP violation or determine the mass hierarchy, and, even if *e*ν disappearance or $\nu_\mu \rightarrow \nu_e$ oscillation is seen, would be unable to determine the value of $\sin^2 2\theta_{13}$ precisely or resolve the two-fold ambiguity in $\theta_{23}$. Even if the beam power in T2K is increased, there is only limited potential for observing CP violation and none for determining the mass hierarchy. The NOvA and Braidwood or Daya Bay experiments could bring all of these capabilities for a substantial range of the unknown parameters. observe CP violation or determine the mass hierarchy, and, even if *e*ν disappearance or $\nu_\mu \rightarrow \nu_e$ oscillation is seen, would be unable to determine the value of $\sin^2 2\theta_{13}$ precisely or resolve the two-fold ambiguity in $\theta_{23}$ |

The neutrino oscillation program can proceed step-by-step. Accelerator-based experiments re-use an existing large detector (T2K with Super-K) and neutrino beam (NOvA with the NuMI beam), each of which represents an enormous investment. First-round observations would indicate if and how beams or detectors should be upgraded. While additional sensitivity is possible with upgraded accelerator beams and detectors, the reactor proposals already push systematic errors using all the tricks they can muster, and no second phase for them is anticipated.

**Recommendations:**

*6.1 General recommendations*

6.1.1 The United States can and should be a leader of the worldwide experimental program in neutrino oscillations.

6.1.2 The U.S. program should include both accelerator- and reactor-based experiments.

*6.2 Recommendations on accelerator-based experiments*

6.2.1 The U.S. should conduct the NOvA experiment at Fermilab. The first phase of this experiment can compete successfully with the Japanese T2K program. If justified by Phase-1 results, both NOvA and T2K have potential later phases. The combination of the two programs is considerably more powerful than either alone, due to their different baselines. Particularly notable is NOvA's sensitivity to the mass hierarchy, unique among the experiments studied for this report.

6.2.2 The U.S. should continue to play an important role in the Japanese neutrino program. This is a cost-effective element of the U.S. program and beneficial to the worldwide program. The U.S. participation in the T2K program should focus in the short term on the B280 effort. This is crucial to bringing the T2K experiment on line. The T2K 2KM project brings improved systematics that would be necessary in later phases of the T2K program. In the initial oscillation search, it would bolster confidence in an observation, especially if NOvA were not underway. U.S. participation on an appropriate time scale is supported if possible.

6.2.3 The U.S. R&D program in Liquid Argon TPC's should be supported at a level that can establish if the technology is scalable to the 10-30 kiloton range. If workable, this technology will come into its own in the later phases of the long-baseline program.

*6.3 Recommendations on reactor experiments*

6.3.1 The United States should mount one multi-detector reactor experiment sensitive to $e$ disappearance down to $\sin^2 2\theta_{13} \sim 0.01$.

6.3.2 Braidwood and Daya Bay have both made a good case that they could achieve the desired sensitivity, given their current level of technical maturity. The Braidwood experiment has somewhat more sensitivity due to the reduced systematic limitations associated with its simpler geometry. NuSAG did not carry out any detailed review of the costs presented by the two collaborations. Based on the information given us, the Braidwood estimate is further developed than Daya Bay's. It is likely that the cost sharing between the U.S. and China will lead to a lower cost to the U.S. program for Daya Bay. However, until this cost sharing is better defined, it is impossible to determine the relative cost of the two experiments. Understanding that such a determination is necessary, NuSAG strongly recommends that this happen as quickly as possible, with timely R&D funding to further understanding of costs and schedules.

6.3.3 Although it cannot perform its measurements to the sensitivity required by the broader program and thus has lower scientific priority than the larger reactor experiment, U.S. participation in Double Chooz is encouraged because of its relatively low cost and the opportunity to make early improvements in sensitivity to $e$ disappearance.

**Availability:** www.sc.doe.gov/henp/np/nsac/nsac.html

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| ***Report of the HEPAP Subpanel on the Assessment of Advanced Accelerator Research and Development***<br><br>***High Energy Physics Advisory Panel (HEPAP)*** | **Scope:** The EPP2010 report from the National Research Council highlighted the importance of accelerators and accelerator R&D as a critical element of a world-competitive US particle physics program. Recognizing this importance, the DOE Office of High Energy Physics (OHEP) and the NSF Directorate of Mathematical and Physical Sciences charged the HEPAP Subpanel on Advanced Accelerator R&D to undertake a comprehensive assessment of all aspects of the OHEP and NSF accelerator R&D programs, addressing issues of relevance to national goals, stewardship, scope, quality, relevance, resources, management and training.<br><br>**Findings**<br>The remarkable discoveries over more than 50 years of particle physics were made possible because of progress and innovation in accelerator science and technology. Today, accelerators are also critical to other programs in the Office of Science and the national scientific enterprise, and they can significantly impact the economy, health, and security. The future of accelerator-based science and applications will be limited unless new ideas and new accelerator directions are developed. Likewise, the demands for trained accelerator professionals far exceed what can be provided by today's limited educational opportunities. The subpanel finds that there is an urgent need to strengthen accelerator science, technology and education in the US in order to address long-term needs of particle physics, other sciences and the nation.<br><br>**Recommendations:**<br>The subpanel endorses the importance of this stewardship responsibility and recommends that the mission statement of OHEP should be modified to include the following: "The Office of High Energy Physics (OHEP) provides program planning, oversight and funding for research in fundamental accelerator science and technology.<br>The subpanel recommends that APPI [NSF Accelerator Physics and Physics Instrumentation] should be established and funded.<br>The subpanel recommends that an Accelerator Science Graduate Fellowship program in the DOE and NSF should be given high priority.<br>The subpanel recommends that this accelerator science support be protected at both the agencies and the laboratories to maintain stable levels of funding.<br><br>The subpanel also recommends that the percentage of the OHEP budget assigned for long-term accelerator science should be 5% in FY07, and increased gradually and smoothly to 6% over the next ten year period.<br><br>To strengthen the management of medium and long-term accelerator R&D in OHEP, the subpanel recommends that these programs be subject to a yearly review by a broad-based committee of accelerator scientists, including members who are cognizant of the possible longer-term accelerator needs of the other Office of Science and NSF programs. This committee should be appointed with overlapping terms to assure continuity.<br><br>**Availability:** www.er.doe.gov/hep/hepap_reports.shtm |

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| ***Workshop on Building Strong Academic Chemistry Departments Through Gender Equity*** | **Scope:** A large percentage of the potential science, engineering, and mathematics workforce, consisting of women and underrepresented minorities, remains untapped. It is in the best interests of the U.S. to ensure that the workforce be filled with the best talent available.<br><br>To begin to address these concerns, officials of the National Science Foundation (NSF), Department of Energy (DOE), and National Institutes of Health (NIH) approached leaders of the chemistry community with the idea of bringing together the chairs of the major research-oriented academic chemistry departments. A year of planning by academic leaders and government agency representatives culminated in a workshop titled "Building Strong Academic Chemistry Departments through Gender Equity." Participants included 55 chemistry department chairs and/or representatives from the major research universities and 60 other academic, government, and national chemistry leaders. The workshop, held from January 29 to January 31, 2006, in Arlington, Virginia, began by examining the underlying causes of the gender gap in chemistry departments throughout the country, proceeded through several breakout sessions that discussed and analyzed these factors, and concluded with a set of specific recommendations for action to remedy the problem. Participation by the agency directors responsible for research support for chemistry and department chairs ensured that the people responsible for the future of academic chemistry could participate in coming to a consensus about the nature of the problem and the way toward a solution.<br><br>**Recommendations to funding agencies:**<br><br>A key role can be played by funding agencies, whose resources and broad overview can optimize the coordination, calibration, and monitoring of procedures to ensure gender equity in the awarding of research grants.<br><br>*Develop policies to ensure gender equity in proposal review through:*<br><br>• instituting procedures for training of reviewers and grantees on diversity issues<br>• modifications of peer review processes where necessary to ensure gender equity<br>• securing Title IX compliance by accumulating data and tracking, as in NSF's ADVANCE programs, including surveys of lab space and resources<br>• fostering gender equity in highly visible Federal programs such as national labs, large research centers, and prestigious awards<br><br>**Availability:**<br>www.chem.harvard.edu/groups/friend/GenderEquityWorkshop/GenderEquity.pdf |

National Science Foundation
WHERE DISCOVERIES BEGIN

# National Science Foundation

# Government Performance and Results Act (GPRA) and Program Assessment Rating Tool (PART)

## Performance Measurement Validation and Verification

FY 2006 Final Report

October 23, 2006

IBM

# 1 Executive Summary

The National Science Foundation (NSF or the Foundation), as a federal agency, is subject to the performance reporting requirements of the Government Performance and Results Act (GPRA). In addition, NSF measures its programmatic performance using the Office of Management and Budget's Program Assessment Rating Tool (PART). These performance reporting requirements hold Federal agencies accountable for providing detailed information on their progress in meeting performance objectives. Accordingly, NSF measures itself against a series of GPRA and PART goals to help the agency achieve its mission and objectives.

Government Accountability Office (GAO) auditing standards require Federal agencies to provide confidence that the policies and procedures underlying performance reporting are complete, accurate, and consistent. As such, NSF asked IBM Global Business Services to assess the validity of the data and reported results of its performance goals and to verify the reliability of the methods used to collect, process, maintain and report data for these performance measurement goals and objectives.[1] In this report, we detail the results of our review of NSF's GPRA and PART processes and results for FY 2006. We conducted a preliminary review after the third quarter and the formal review after the end of the fiscal year.

NSF measures its annual performance against the four Strategic Outcome Goals of Ideas, Tools, People, and Organizational Excellence and 22 other performance goals. As of the end of FY 2006, we were able to verify the reliability of the processes and validate the accuracy of all four Strategic Outcome Goals as well as 21 of the 22 annual performance goals. Although we were able to only partially verify the reliability of the process for the remaining goal, we believe that NSF's reported outcome for this goal is consistent with the data collected.

Based on this comprehensive review, IBM has confidence in the systems, policies, and procedures used by NSF to generate the described performance measures. We strongly believe that NSF continues to take concerted steps to improve the quality of their systems and data on a yearly basis.

## 1.1 Assessment Approach

The 26 goals fall under two main categories of review; quantitative goals under either first time review or updated review and qualitative goals receiving an update review. We describe the assessment for each category as follows:

### 1.1.1 Review of Quantitative GPRA/PART Goals

Our review of the processes and results consisted of the following actions:

- Assessed the accuracy of NSF's performance data and reported outcomes of performance goals and indicators
- Described the reliability of the processes NSF uses to collect, process, maintain, and report data
- Reviewed the system controls to confirm that quality input results in quality output
- Created detailed process descriptions and process maps for those goals being reviewed for the first time
- Identified changes to processes and data for those goals receiving an update review

We applied GAO's *Guide to Assessing Agency Annual Performance Plans* (GAO/GGD-10.1.20) to guide our review. We did not consider the appropriateness of NSF's performance goals or indicators in our assessment of the validity

[1] GAO defines "verification" as a means to check or test performance data in order to reduce the risk of using data that contains significant errors. GAO defines "validation" as a way to test data to ensure that no error creates significant bias.

of NSF's reported results. Rather, our validation is based strictly on whether NSF achieved or did not achieve its performance goals based on the indicators established by NSF.

### 1.1.2 Update Review of Qualitative Strategic Outcome Goals and AC/GPA Process

A key component of NSF's assessment of its Strategic Outcome Goals (Ideas, Tools, People, and Organizational Excellence) is the Advisory Committee for GPRA Performance Assessment (AC/GPA), a group of independent experts who meet annually to review NSF's performance and advise the NSF Director on the Foundation's achievement on a series of indicators associated with the Strategic Outcome Goals.

In our fourth year of assessing the AC/GPA process, we once again assessed and observed the process to verify and validate that the process is sufficiently reliable to yield a valid conclusion on NSF's achievement in its Strategic Outcomes. To provide for a thorough and complete assessment, NSF once again supplied us with unrestricted access to the AC/GPA meetings, performance information, NSF staff, and Committee members. Since the last AC/GPA meeting in FY 2005, NSF has implemented a number of improvements to the efficiency and quality of the process. Our assessment was based on a comprehensive review of the following actions:

- Evaluated the background information: NSF Five-Year Strategic Plan, FY 2006 NSF Budget, FY 2005 AC/GPA report, FY 2006 AC/GPA guidance and agenda, and supplemental information located on the AC/GPA website.
- Attended the Business and Operations Advisory Committee meeting.
- Attended the AC/GPA meeting: We observed the two-day AC/GPA meeting, June 22-23, 2006, including committee and subgroup sessions.
- Documented changes to the AC/GPA process: Based on our review of background information, observations of the AC/GPA meeting, and discussion with staff and committee members, we identified changes to the AC/GPA process from FY 2005.
- Assessed the AC/GPA process: We assessed the quality of the AC/GPA process, with particular focus on changes since FY 2005. Our assessment was based on a number of criteria, such as the quality of the performance information, documentation and transparency of the process, improvements made from last year, and the expertise and independence of the AC/GPA membership.
- Validated the AC/GPA performance assessment: Based on the quality of the AC/GPA processes, we reached a conclusion on the validity of the AC/GPA's assessment of NSF's performance against its Strategic Outcome Goals.

## 1.2 Results and Recommendations by Performance Goal

At the end of FY 2006, we were able to verify the reliability of the AC/GPA process and performance data. Further, based on the strength of these processes, we validate the reasonableness of the AC/GPA's conclusion that NSF had demonstrated significant achievement in all the indicators for the Strategic Outcome Goals of Ideas, Tools, and People and the Merit Review indicator for the Organizational Excellence Goal.

Of the 22 other GPRA and PART performance goals we reviewed, we were able to verify the reliability of the processes and validate the accuracy or reasonableness of the results for 21 goals. We were able to partially verify the reliability of the process that NSF uses for the reporting of the remaining PART goal. For the majority of the reviewed goals, we can verify that NSF relies on sound business processes, system and application controls, and manual checks of system queries to produce valid and accurate results.

We summarize the results of our review for each performance goal in the following tables. In the "Process Verified" column, a "yes" indicates that we were able to verify the reliability of NSF's processes to collect, process, maintain and report data. In the "Validation" column, a "yes" indicates that we were able to validate the accuracy or

reasonableness of NSF's reported results for the corresponding performance goal. Finally, where appropriate, we also summarize any significant observations, recommendations or issues for consideration we determined through our review of each goal. The full results of our review are discussed in greater detail in the balance of this report.

Quantitative Performance Goals Reviewed for the First Time in FY 2006

| Goal | Target | FY 2006 Q3 Result | FY 2006 Q4 Results | Process Verified | Results Validated | Comments |
|---|---|---|---|---|---|---|
| Percent of person-days planned for Antarctic research for which the program is able to provide the necessary research support. | Greater than 90% | No Results | 91.1% | Yes - Partial | Yes | Mandatory submission of surveys by PIs<br>Electronic submission of GPRA survey data into an NSF system<br>Develop ability for NSF to recalculate/validate performance measure results |
| Percent of construction cost and schedule variances of major projects as monitored by Earned Value Management (EVM) for Polar facilities. | Less than 8% | No Results | 13.4% | Yes | Yes | Weight the results for the three Polar projects based on a percentage of the total value |
| Percentage of Institutions proposals received from academic institutions not in the top 100 of NSF funding recipients. | 73% | 65.1% | 64.8% | Yes | Yes | None |
| Dwell time for Institutions PART program. | 70% | 72.3% | 74.1% | Yes | Yes | None |
| Percentage of Collaborations proposals received from academic institutions not in the top 100 of NSF funding recipients. | 63% | 57.9% | 58.4% | Yes | Yes | None |
| Dwell time for Collaborations PART program. | 70% | 75% | 77.7% | Yes | Yes | None |
| Percent of BE proposals with at least one female PI or co-PI for BE solicitation. | 53% | No Results | 32.5% | Yes | Yes | None |
| Percent of BE proposals with at least one minority PI or co-PI for BE solicitation. | 17% | No Results | 8.9% | Yes | Yes | None |
| Dwell time for BE PART program. | 70% | No Results | 99.3% | Yes | Yes | None |

Quantitative Performance Goals Receiving an Update Review in FY 2006

| Goal | Target | FY 2006 Q3 Result | FY 2006 Q4 Result | Process Verified | Results Validated | Comments |
|---|---|---|---|---|---|---|
| (Dwell Time) For 70% of proposals, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of receipt or deadline date | 70% | 80.8% | 78.4% | Yes | Yes | None |
| Percent of construction acquisition and upgrade projects with negative cost and schedule variances of less than 10% of the approved project plan. | 90% | No Results | 73% | Yes | Yes | None |
| Percent of operational facilities that keep scheduled operating time lost to less than 10% | 90% | No Results | 95% | Yes | Yes | None |
| Number of applicants for GRF from groups that are underrepresented in the science and engineering workforce. | Increase from 1,014 | No Results | 929 | Yes | Yes | None |
| Number of applications for CAREER awards from investigators at minority-serving institutions. | Increase from 93 | 110 | 232 | Yes | Yes | None |
| Number of graduate students funded through fellowships or traineeships from GRF IGERT, or GK-12. | 4,525 | No Results | 5,049 | Yes | Yes | None |
| Dwell time for Individuals PART program. | 70% | 86.4% | 85.5% | Yes | Yes | None |
| Number of users accessing National Nanofabrication Users Network/National Nanotechnology Infrastructure Network (NNUN/NNIN) and Network for Computational Nanotechnology (NCN) sites. | 12,500 | 15,401 | 20,374 | Yes | Yes | None |
| Number of nodes that comprise infrastructure. | 20 | 20 | 20 | Yes | Yes | None |
| Dwell time for Nano PART program. | 70% | 80.6% | 72.7% | Yes | Yes | None |

| Goal | Target | FY 2006 Q3 Result | FY 2006 Q4 Result | Process Verified | Results Validated | Comments |
|---|---|---|---|---|---|---|
| Percent of NS&E proposals with at least one female PI or co-PI. | 25% | 36.9% | 36.0% | Yes | Yes | None |
| Percent of NS&E proposals with at least one minority PI or co-PI. | 13% | 13.3% | 13.3% | Yes | Yes | None |
| Percent of NS&E proposals that are multi-investigator proposals. | 75% | 84.1% | 84.0% | Yes | Yes | None |

Strategic Outcome Goals and Indicators Receiving an Update Review in FY 2006

| Goal | FY 2006 Q3 Result | FY 2006 Q4 Result | Process Verified | Results Validated | Comments |
|---|---|---|---|---|---|
| Goal I: Ideas – Discovery across the frontier of science and engineering, connected to learning, innovation, and service to society<br>▪ Enable people who work at the forefront of discovery to make important and significant contributions to science and engineering knowledge<br>▪ Encourage collaborative research and education efforts – across organizations, disciplines, sectors and international boundaries<br>▪ Foster connections between discoveries and their use in the service of society<br>▪ Increase opportunities for underrepresented individuals and institutions to conduct high quality, competitive research and education activities<br>▪ Provide leadership in identifying and developing new research and education opportunities within and across science and engineering fields<br>▪ Accelerate progress in selected science and engineering areas of high priority by creating new integrative and cross-disciplinary knowledge and tools, and by providing people with new skills and perspectives | Achieved | Achieved | Yes | Yes | None |
| Goal T: Tools Goal – Broadly accessible, state-of-the-art science and engineering facilities, tools and other infrastructure that enable discovery, learning and innovation<br>▪ Expand opportunities for U.S. researchers, educators, and students at all levels to access state-of-the-art science and engineering facilities, tools, databases, and other infrastructure<br>▪ Provide leadership in the development, construction, and operation of major, next-generation facilities and other large research and education platforms<br>▪ Develop and deploy an advanced cyber-infrastructure to enable all fields of science and engineering to fully utilize state-of-the-art computation<br>▪ Provide for the collection and analysis of the scientific and technical resources of the U.S. and other nations to inform policy formulation and resource allocation<br>▪ Support research that advances instrument technology and leads to the development of next-generation research and education tools | Achieved | Achieved | Yes | Yes | None |

| Goal | FY 2006 Q3 Result | FY 2006 Q4 Result | Process Verified | Results Validated | Comments |
|---|---|---|---|---|---|
| Goal P: (People) – A diverse, competitive, and globally-engaging U.S. workforce of scientists, engineers, technologists and well-prepared citizens.<br>▪ Promote greater diversity in the science and engineering workforce through increased participation of underrepresented groups and institutions in all NSF programs and activities<br>▪ Support programs that attract and prepare U.S. students to be highly qualified members of the global science and engineering workforce, including providing opportunities for international study, collaborations and partnerships<br>▪ Develop the Nation's capability to provide K-12 and higher education faculty with opportunities for continuous learning and career development in science, technology, engineering and mathematics<br>▪ Promote public understanding and appreciation of science, technology, engineering, and mathematics, and build bridges between formal and informal science education<br>▪ Support innovative research on learning, teaching and mentoring that provides a scientific basis for improving science, technology, engineering and mathematics education at all levels | Achieved | Achieved | Yes | Yes | None |
| Goal O: Organizational Excellence Goal – An agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices<br>▪ Operate a credible, efficient merit review system<br>▪ Utilize and sustain broad access to new and emerging technologies for business application<br>▪ Develop a diverse, capable, motivated staff that operates with efficiency and integrity<br>▪ Develop and use performance assessment tools and measures to provide an environment of continuous improvement in NSF's intellectual investments as well as its management effectiveness | Achieved | Achieved | Yes | Yes | None |

# 2 Introduction and Background

In 1993, Congress passed GPRA to improve accountability and performance in the federal government. GPRA requires federal agencies to prepare five-year strategic plans that set the direction for their agencies and to develop annual performance plans that link daily managerial responsibilities to long-term strategic goals. Agencies must report annually on their success in meeting their annual performance goals. In 2002, the Office of Management and Budget (OMB) developed the PART process to provide a consistent approach to rating federal agency programs. Together, GPRA and PART serve to measure the performance of federal agencies and provide justification for annual budget requests.

Since NSF's mission is to fund long-term science and education research, it is impractical to link the outcome of their overall mission to their annual investment as the results may not yield an immediate return. Science and engineering research projects typically generate discoveries in an unrelated area, and it can take years to realize the impact of their discoveries. Assessing the impact of advances in science and engineering is inherently retrospective and is best performed using the qualitative judgment of experts.

NSF's goals are divided into two broad areas: overarching strategic outcome goals and annual performance goals. The long-term strategic outcome goals focus on Ideas, Tools, People, and Organizational Excellence and directly relate to the NSF Strategic Plan. Annual performance goals relate to the effectiveness of NSF activities and focus on procedures used to make awards, fund and manage capital projects, and otherwise provide services to customers.

U.S. GAO standards require a federal agency to "provide confidence that its performance information will be credible."[2] This report supports NSF's satisfaction of that requirement. We applied GAO's *Guide to Assessing Agency Annual Performance Plans* (GAO/GGD-10.1.20) to guide our verification and validation assessment. IBM was tasked to provide the following technical services:

- Assess whether NSF has provided sufficient information to permit an informed judgment by the reader of whether the performance data will be sufficiently free of bias and other significant error.
- Determine whether the verification and validation procedures and the data used by the agency are credible.

In this report, Verification entails assessing the reliability of the systems, processes and controls that underlie performance reporting. Validation entails recalculating or reconfirming performance results from the available data. Based on GAO guidance, we assessed whether NSF's processes to collect, process, maintain and report data meet the following criteria:

- Does the process provide for periodic review of collection, maintenance, and processing procedures to ensure they are consistently applied and continue to be adequate?
- Does the process provide for periodic sampling and review of data to ensure completeness, accuracy, and consistency?
- Does the process rely on independent audits or other established procedures for verifying and validating financial information when performance measures require the use of financial information?
- Does NSF address problems in verification and validation procedures, known to GAO or the agency?
- Does the agency recognize the potential impacts of data limitations should they exist?

[2] GAO/GGD-10.1.20 Guide to Assessing Agency Annual Performance Plans

## 2.1 Scope

Our assessment focused on specific NSF processes that support GPRA and PART reporting. This assessment was not an audit and, therefore, was not conducted in accordance with generally accepted government auditing standards. Rather, we followed GAO's *Guide to Assessing Agency Annual Performance Plans* (GAO/GGD-10.1.20) to conduct an independent verification and validation review of NSF's performance reporting processes and reported results as of the end of FY 2006. Specifically, this report:

- Defines performance goals and performance indicators.
- Assesses processes and procedures used to collect, process, maintain, and report on data used for the performance goals.
- Highlights procedural and organizational changes from FY 2005 to FY 2006.
- Describes steps management has taken to improve its processes and procedures.
- Validates the accuracy of NSF's reported results for its performance goals as of the third quarter (when available) and at the end of FY 2006.

We did not consider the appropriateness of NSF's performance goals or indicators in our assessment of the validity of NSF's reported results. Rather, our validation is based strictly on whether NSF achieved or did not achieve its performance goals based on the accuracy of the performance data and the reliability of NSF's processes. In accordance with GAO's assessment guide, we relied on previously conducted work and on agency sources to determine whether there were any known limitations with the data or data sources that would create doubt regarding the credibility of the information.

The FY 2006 goals under our review fall under three categories:

### 2.1.1 Quantitative Performance Goals Being Reviewed for the First Time in FY 2006

- Polar Goal: Percent of person-days planned for Antarctic research for which the program is able to provide the necessary research support.
- Polar Goal: Percent of construction cost and schedule variances of major projects as monitored by Earned Value Management for Polar Facilities.
- Research Institutions Goal: Percent of Institutions proposals received from academic institutions not in the top 100 of NSF funding recipients.
- Research Institutions Goal: Dwell time for Institutions PART Program.
- Research Collaborations Goal: Percent of Collaborations proposals received from academic institutions not in the top 100 of NSF funding recipients.
- Research Collaborations Goal: Dwell time for Collaborations PART Program.
- BE Goal: Percent of Bio-Complexity in the Environment (BE) proposals with at least one female PI or co-PI for BE solicitation.
- BE Goal: Percent of Bio-Complexity in the Environment (BE) proposals with at least one minority PI or co-PI for BE solicitation.
- BE Goal: Dwell time for BE PART Program.

### 2.1.2 Quantitative Performance Goals Receiving a Limited Update Review

- NSF Goal: (Dwell Time) For 70 percent of proposals, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or target date, or receipt date, whichever is later.

- Facilities Goal: Percent of construction, acquisition, and upgrade projects with negative cost and schedule variances of less than 10 percent of the approved project plan.
- Facilities Goal: Percent of operational facilities that keep scheduled operating time lost to less than 10%.
- Individuals Research Goal: Number of applicants for Graduate Research Fellowships (GRF) from groups that are underrepresented in the science and engineering workforce.
- Individuals Research Goal: Number of applicants for CAREER awards from investigators at minority-serving institutions (MSIs).
- Individuals Research Goal: Number of graduate students funded through fellowships or traineeships from Graduate Research Fellowships (GRF), Integrative Graduate Education and Research Traineeships (IGERT), or Graduate Teaching Fellowships (GK-12).
- Individuals Research Goal: Dwell time for Individuals PART Program.
- NS&E Goal: Percent of NS&E proposals with at least one female PI or Co-PI.
- NS&E Goal: Percent of NS&E proposals with at least one minority PI or Co-PI.
- NS&E Goal: Percent of NS&E proposals that are multi-investigator proposals.
- NS&E Goal: Number of users accessing National Nanofabrication Users Network/National Nanotechnology Infrastructure Network (NNUN/NNIN) and Network for Computational Nanotechnology (NCN) sites.
- NS&E Goal: Number of nodes that comprise infrastructure.
- NS&E Goal: Dwell time for Nano PART Program.

### 2.1.3 Qualitative Strategic Outcome Goals and Indicators Receiving an Update Review

- Ideas—enabling discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.
    - Enable people who work at the forefront of discovery to make important and significant contributions to science and engineering knowledge.
    - Encourage collaborative research and education efforts – across organizations, disciplines, sectors and international boundaries.
    - Foster connections between discoveries and their use in the service of society.
    - Increase opportunities for underrepresented individuals and institutions to conduct high quality, competitive research and education activities.
    - Provide leadership in identifying and developing new research and education opportunities within and across science and engineering fields.
    - Accelerate progress in selected science and engineering areas of high priority by creating new integrative and cross-disciplinary knowledge and tools, and by providing people with new skills and perspectives.
    - Support innovative research on learning and teaching that provides a scientific basis for improving science, technology, engineering and mathematics education at all levels.
- Tools—providing broadly accessible, state-of-the-art science and engineering facilities, tools and other infrastructure that enable discovery, learning and innovation.
    - Expand opportunities for U.S. researchers, educators, and students at all levels to access state-of-the-art science and engineering facilities, tools, databases, and other infrastructure.

- Provide leadership in the development, construction, and operation of major, next-generation facilities and other large research and education platforms.
- Develop and deploy an advanced cyber infrastructure to enable all fields of science and engineering to fully utilize state-of-the-art computation.
- Provide for the collection and analysis of the scientific and technical resources of the U.S. and other nations to inform policy formulation and resource allocation.
- Support research that advances instrument technology and leads to the development of next-generation research and education tools.

- People—providing a diverse, competitive, and globally-engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens.
  - Promote greater diversity in the science and engineering workforce through increased participation of underrepresented groups and institutions in all NSF programs and activities.
  - Support programs that attract and prepare U.S. students to be highly qualified members of the global science and engineering workforce, including providing opportunities for international study, collaborations and partnerships.
  - Develop the Nation's capability to provide K-12 and higher education faculty with opportunities for continuous learning and career development in science, technology, engineering and mathematics.
  - Promote public understanding and appreciation of science, technology, engineering, and mathematics, and build bridges between formal and informal science education.
- Organizational Excellence—providing an agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices.
  - Merit Review: Operate a credible, efficient merit review system.
  - Human Capital Management: Develop a diverse, capable, motivated staff that operates with efficiency and integrity.
  - Technology-enabled Business Processes: Utilize and sustain broad access to new and emerging technologies for business application.
  - Performance Assessment: Develop and use performance assessment tools and measures to provide an environment of continuous improvement in NSF's intellectual investments as well as its management effectiveness.

## 2.2 Approach

We followed a multi-step approach to determine if NSF has sufficient processes and procedures in place to validate and verify its performance. We tailored our approach to each category of goals and treated them as three unique tasks.

### 2.2.1 New Review of FY 2006 Quantitative Goals

We assessed the processes, data and systems of nine quantitative goals[3], which we reviewed for the first time in FY 2006. We performed the following steps to complete the verification and validation review:

- Confirmed performance measure definitions. To understand how NSF determines the outcome of its performance goals, we first confirmed specific definitions of terms used in the performance measures and indicators and the intent of the measures themselves. We documented this information in our report as a baseline to assess NSF's validation and verification procedures.
- Documented "as-is" process. We developed an understanding of the processes that NSF uses to compile performance measurement data. We interviewed NSF staff and read policies and procedures when available. We included both manual and electronic means of data collection in our review. We conducted our review based on four components identified by GAO as necessary to compute and report any performance measure:
  1. Collect performance data: the tasks yielding calculated and measured data.
  2. Process the measure: the tasks to derive or calculate the measure.
  3. Maintain performance results: the tasks to record and store performance measurement results.
  4. Report performance results: the tasks to report results.

  We documented each of these phases for each of the measures. The descriptions of these processes are located in the "Process Description" section for each goal. We used process maps, which can be found in the Appendix of this report, to document the current environment.
- Assess the quality of the policies and procedures used to develop the measures. We assessed the policies and procedures NSF uses to compile its performance data to determine if they are sufficiently designed and implemented to yield performance measures that are free of significant errors. Specifically, we evaluated whether or not the policies and procedures:
  1. Provide for periodic review of data collection, maintenance, and processing procedures by NSF to confirm that they are consistently applied and continue to be adequate.
  2. Provide for periodic sampling and review of data to confirm completeness, accuracy, and consistency.
  3. Rely on independent audits or other established procedures for verifying and validating financial information when performance measures use financial information.
  4. Address problems in validation and verification known to NSF.

  We identified and documented limitations in the process that could affect the accuracy of the data in the "Data Limitations" section for each goal. In the "Observations, Recommendations, and Conclusions" section for each

[3] Three of the quantitative goals contained a qualitative component, related to the effectiveness of NSF's merit review system, which was evaluated separately by the AC/GPA. We validated the results for this qualitative component as part of our review of the AC/GPA process and Strategic Outcome Goals.

goal, we document any internal controls NSF has instituted to assure data accuracy and, if applicable, opportunities for improvement. We also document our final assessment of each goal under review based on the NSF defined performance indicators.

- Reviewed system aspects of data quality. We reviewed information system controls to confirm data quality. We reviewed system algorithms that were used to calculate the measures and the procedures NSF used to confirm that the data in the system was current. We include our review in the "System Aspects of Data Quality" section.
- Validated and verified FY 2006 measures. After we documented the processes, we assessed whether the policies and procedures are sufficient to yield valid and verifiable results. When possible, we recalculated NSF's performance results for accuracy.[4] In other cases, we sampled data to determine whether internal processes are reliable to yield accurate numbers. We used both methods where possible. We included the results of our verification and validation in the "Verification and Validation Results" section for each goal.

### 2.2.2 Update Review of FY 2006 Quantitative Goals

In FY 2006, there were 13 quantitative goals[5] which involved data sources, systems and processes that we had reviewed in prior years. For these goals, NSF requested a limited "update" review to identify changes and improvements to the data and/or processes since our last review. We assessed the inputs, computations and outputs and recalculated or reconfirmed the results. Specifically, our review consisted of:

- Documentation of changes: We documented changes to the definitions, processes, data and/or calculations for each performance measure. We interviewed NSF staff and reviewed relevant background documentation. As a result of these interviews and analyses, we documented any actions that management has taken to strengthen the data and processes used to report performance results.
- Review of system and other internal controls: Building upon the initial interviews and background analysis, we identified changes to the system algorithms that were used to calculate the measures and the procedures used by NSF to derive the data. To assess the integrity of data inputs, we then verified that the system data is drawn from current and updated databases, files, and interfaces.
- Process verification: We verified the reliability of the processes used to collect, process, maintain, and report accurate data and results.
- Results validation: After we verified data quality, we recalculated or reconfirmed the results that NSF reported.[6] This recalculation provides a closer look at the algorithms and results for each measure.

### 2.2.3 Update Review of Strategic Outcome Goals and AC/GPA Process

NSF measures its overall performance as a Foundation using four Strategic Outcome Goals: Ideas, Tools, People, and Organizational Excellence. A key component of NSF's performance assessment in these areas is the AC/GPA, a group of independent experts who offer advice and recommendations to the NSF Director on NSF's achievement on a series of performance indicators related to these Strategic Outcome Goals.

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[4] For our third quarter review, NSF did not have complete data or results for some goals. For these goals, as of the third quarter of FY 2006, we were unable to conduct a complete verification and validation review.

[5] Two of the quantitative goals contained a qualitative component, related to the effectiveness of NSF's merit review system, which was evaluated separately by the AC/GPA. We validated the results for this qualitative component as part of our review of the AC/GPA process and Strategic Outcome Goals.

[6] For our third quarter review, NSF did not have complete data or results for some goals. For these goals, as of the third quarter of FY 2006, we were unable to conduct a complete verification and validation review.

We first assessed the AC/GPA process in FY 2003 with the purpose of verifying the reliability of the process and performance data and the validity of the AC/GPA's conclusions based on the strength of these processes. In FY 2006, NSF asked us to conduct an updated review, focusing on changes to the AC/GPA process since FY 2005. Our methodology consisted of:

- Review of background information: Including the NSF Five-Year Strategic Plan, FY 2005 AC/GPA report, AC/GPA guidance and agenda, and supplemental information located on the AC/GPA website.
- Attendance at the AC/GPA meeting: We observed the two-day AC/GPA meeting, held June 22-23, 2006, including committee and subgroup sessions.
- Attendance at the Committee for Business and Operations (AC/B&O) meeting: We attended the May 18-19, 2006 meetings of the AC/B&O, which is responsible for assessing three out of four indicators for Organizational Excellence.
- Discussions with NSF staff and AC/GPA members: We spoke with NSF staff and committee members to learn about the process and their first-hand experiences coordinating and participating in the AC/GPA.
- Documentation of the AC/GPA process with emphasis on changes from FY 2005: Based on our review of background information, observations of the AC/GPA meeting, and discussion with staff and committee members, we documented the FY 2006 AC/GPA process focusing on changes in the past year.
- Assessment of the AC/GPA process: We assessed the quality of the AC/GPA process based on a series of criteria, including:
    - *AC/GPA meeting coordination/planning*: Quality of NSF planning and preliminary review activities to maximize the effectiveness of the AC/GPA meeting and quality of the AC/GPA assessment.
    - *AC/GPA scope of review*: Expectations and extensiveness of the AC/GPA's review and assessment of NSF's performance.
    - *Membership*: Expertise, independence, and level of knowledge of the AC/GPA membership.
    - *Performance information*: Quality, timeliness, impartiality, and relevance of the information available to the AC/GPA to reach its conclusions.
    - *Independence*: Confidence that the Committee's judgment is objective and free from NSF influence.
    - *Determination of achievement*: The Committee's determination of "significant achievement" with respect to the annual performance indicators and Foundation-level comments.
    - *Documentation and transparency:* Extent to which the AC/GPA process and results are clear, visible and open to review and scrutiny.
    - *NSF's response to AC/GPA recommendation:* How NSF responded to the Committee's recommendations in its FY 2005 AC/GPA report to NSF.
- Validation of the AC/GPA performance assessment: Based on the quality of the AC/GPA processes, IBM reached a conclusion on the validity of the AC/GPA's assessment of NSF's performance against its Strategic Outcome Goals, as referenced in Section 6 of this report.

### 2.2.4 Limited System Aspects of Data Quality Review

We reviewed NSF's information systems - used in the collection, processing or maintenance of quantitative performance data - to evaluate whether adequate controls are in place to produce reliable data. Our assessment was a limited review based on discussions with NSF staff, as opposed to a full applications review.

Pursuant to GAO guidelines, we relied on previously conducted work and on departmental sources to determine whether there were any known problems with the data or data sources that would cast doubt on the credibility of the

information. Because we performed our initial review of these systems in prior years, our current review focused only on changes to the systems since our last assessment. The NSF systems and applications we reviewed were:

- Award
- Enterprise Information System (EIS)
- Financial Accounting System (FAS)
- FastLane (FL)
- Program Information Management System (PIMS)
- Proposal, PI, Panel, Budget and Reviewer System (PARS)

# OTHER FINANCIAL REPORTING INFORMATION

## Debt Collection Improvement Act of 1996

Net Accounts Receivable totaled $37,669 thousand at September 30, 2006. Of that amount, $37,530 thousand is due from other federal agencies. The remaining $139 thousand is due from the public. NSF fully participates in the Department of the Treasury Cross-Servicing Program. In accordance with the Debt Collection Improvement Act, this program allows NSF to refer debts that are delinquent more than 180 days to the Department of the Treasury for appropriate action to collect those accounts. In FY 2004 OMB issued M-04-10 Memorandum on Debt Collection Improvement Act Requirements which reminded agencies of their responsibility to comply with the policies for writing-off and closing-out debt. Based on this memo, NSF has now incorporated the policy of writing-off delinquent debt more than two years old. Additionally, NSF seeks Department of Justice concurrence for action on items over $100,000.

## Cash Management Improvement Act (CMIA)

In FY 2006, NSF had no awards covered under CMIA Treasury-State Agreements. NSF's FastLane system with grantee draws of cash make the timeliness of payments issue under the Act essentially not applicable to the agency. No interest payments were made in FY 2006.

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF
INSPECTOR GENERAL

October 16, 2006

**MEMORANDUM**

To: Dr. Steven C. Beering
Chair, National Science Board

Dr. Arden Bement
Director, National Science Foundation

From: Dr. Christine C. Boesz
for Inspector General, National Science Foundation

Subject: Management Challenges for NSF in FY 2007

In accordance with the Reports Consolidation Act of 2000, I am submitting our annual statement summarizing what the Office of Inspector General (OIG) considers to be the most serious management and performance challenges facing the National Science Foundation (NSF). We have compiled this list based on our audit and investigative work, general knowledge of the agency's operations, and the evaluative reports of others, such as the Government Accountability Office and NSF's various advisory committees, contractors, and staff.

This year's management challenges are organized under six broad issue areas: award administration; human capital; budget, cost and performance integration; information technology; U.S. Antarctic Program; and merit review. Ten challenges are drawn from last year's list, some of which reflect areas of fundamental program risk that are likely to require management's attention for years to come. One new management challenge appears on this year's list: enterprise architecture. We note that NSF continued to make progress this past year on several difficult challenges.

If you have any questions or need additional information, please call me at 703-292-7100.

**Award and Contract Administration**

*Post-award administration policies.* Since FY 2002, independent audits of NSF's financial statements have repeatedly cited weaknesses in the agency's monitoring of grantee institutions, after an award is made, as a major deficiency. In response, NSF has revamped its policies pertaining to post-award administration and has made continued progress in establishing a risk-based program for monitoring its 35,000 ongoing grants. In FY 2006, NSF initiated a new program for performing desk reviews of all high-risk institutions that did not receive site visits. The desk reviews extend NSF's monitoring program to all awardee institutions considered high-risk, closing a significant gap in its coverage. However, OIG is not yet able to evaluate the effectiveness of the post-award program NSF has implemented. It is too soon to assess the desk reviews, and the quality of the documentation associated with the site visits continues to be inconsistent.

Meanwhile, the monitoring of *programmatic* performance is also a concern. NSF provides limited guidance to program officers on how to oversee programmatic performance of awardees, and offers little or no formal training on the administrative and financial requirements contained in OMB Circulars or NSF grant conditions. An effective post-award monitoring program should ensure that 1) awardees are complying with award terms and conditions and federal regulations 2) adequate progress is being made toward achieving the objectives and milestones of the program; and 3) expenditures listed on NSF's financial statements are accurate.

Cost-sharing commitments by the institutions have become less of an issue since the National Science Board decided to eliminate non-statutory cost-sharing requirements in 2004, but commitments that pre-date that policy change continue to pose problems. Our most recent Semiannual Report, for example, described two school districts and a university that lacked systems to document and track a total of $42 million of claimed cost sharing. In addition, OIG investigations of two universities that falsely reported cost-sharing contributions were recently settled with substantial repayments of award funds to NSF. The challenge for NSF in the remaining cost-sharing obligations, as in the other aspects of post-award administration, is to ensure that awardees live up to their commitments.

*Management of large infrastructure projects.* NSF's administration of large, state-of-the-art infrastructure projects, such as telescopes and supercomputing databases, poses an unusual project management challenge. Two OIG audits that were issued in 2000 and 2002 found weaknesses in the financial controls surrounding the funding and operation of these projects.[1] Since then, NSF has steadily strengthened its oversight of large infrastructure projects. A Deputy Director for Large Facilities Projects was appointed in 2003, but until recently had trouble obtaining the staffing, resources and authority needed for the new Large Facility Projects Management & Oversight Office (LFP) to carry out its mandate of conducting post-award oversight of business operations, financial and internal control systems, and project management at large NSF-funded facilities. In the past year, the LFP has grown to include four permanent full-time staff. The agency has also implemented a system for tracking *budgeted* costs for Major

[1] Audit of the Financial Management of the Gemini Project, December, 2000, OIG 01-2001
Audit of Funding for Major Research Equipment and Facilities, May, 2002, OIG 02-2007

Research Equipment and Facilities Construction (MREFC) projects. However, NSF has not yet addressed OIG recommendations for a system that identifies, records and tracks the total costs of major equipment and facilities. In addition, corrective actions to ensure the appropriate use of the MREFC accounts. and the implementation of good project management methods is still incomplete.

In May 2006 NSF's Business and Operations Advisory Committee recommended, among other things, that NSF: 1) arrange for annual reviews of NSF-led large facilities by an expert group that includes outside peer consultants; 2) conduct formal risk assessments of each of its facilities; and 3) implement a process for identifying how the facility will meet future research needs and for projecting its eventual termination, along with the associated costs and legal requirements.[2] These recommendations are similar to those pertaining to post-award administration in past OIG reports and the independent audits of the agency's financial statements. Given the annual investment of more than $200 million in large research facilities and equipment, they remain a challenge for the NSF managers responsible for MREFC oversight.

*Contract Monitoring.* NSF does not adequately review public vouchers submitted by contractors who receive advance payments, according to the last two independent audits of NSF's financial statements. In both cases, this deficiency was identified as a reportable condition. The most recent audit identified significant gaps in NSF's policies pertaining to contract administration. In FY 2006, the agency obligated approximately $214 million through advance payments to three contractors, the largest being for logistical support of the United States Antarctic Program. Without a proper review, NSF's advance payments may be subject to error or impropriety. In fact, recent cost-incurred audits by the Defense Contract Audit Agency (DCAA) have identified $55 million in questioned costs over the past five years from just one contractor. Federal law requires that responsible officials check the public vouchers for accuracy and propriety to ensure that the reported costs are authorized under the contract. To correct the situation, NSF has contracted with DCAA to review vouchers submitted by its larger contractors on a regular basis. These reviews were initiated too late in the fiscal year to evaluate their effectiveness, so we will continue to identify contract monitoring as a management challenge.

*Promoting integrity.* OIG has experienced a doubling of allegations of research misconduct over the past decade, including an approximately seven-fold increase for plagiarism and a notable rise recently in fabrication allegations against graduate students and postdoctoral researchers. There has been a dramatic increase in the number of cases requiring investigation either by the affected institution or by OIG, and approximately 70 percent of the recent findings by NSF have been in cases involving foreign collaborations. These data are consistent with a study[3] published last year that found that one-third of NIH-supported researchers surveyed acknowledge engaging in activities that are best described as questionable research practices. The authors concluded that the "questionable practices . . . are striking in their breadth and prevalence." These practices can reasonably be expected to occur in research supported by other federal agencies, and the level of activity experienced in recent years by OIG indicates that NSF faces similar issues. The prevalence of such practices suggests that integrity in science is eroding. Since 1990, HHS has

[2] Report by the Facilities Subcommittee of the NSF Business and Operations Advisory Committee, June 10, 2006
[3] Martinson, B.C.; Anderson, M.S. and R. de Vries; Scientists behaving badly; *Nature:*Vol. 435 pp. 737-738, 9 June 2005.

had programs designed to encourage responsible conduct of research, and NSF has implemented similar instruction in selected programs. Since the early 1990's both HHS and NSF have had regulations for addressing allegations of research misconduct. NSF plays a vital role in the education of future generations of researchers and engineers. In light of what appears to be a growing challenge to the agency, NSF needs to implement a more comprehensive, agency-wide program to instill ethics and integrity at all levels of the scientific, engineering and education enterprise it supports.

**Human Capital**

*Workforce planning.* NSF reports that it has made progress in FY 2006 toward implementing an effective workforce planning process based on sound, objective criteria. The agency has drafted a three-year strategic workforce plan, and each Directorate created its own staffing plan during this year's budget planning cycle according to a methodology developed by a committee of managers. In addition, the Division of Human Resources is reportedly developing tools for prioritizing staffing needs and projecting turnover. During the past year the strain of NSF's workload actually eased a bit as the average number of proposals each program officer handled declined from 113 to 104, reflecting a slight increase in the number of program officers and a modest decrease in the number of proposals received.

Despite progress toward developing a comprehensive agency workforce plan, the management of NSF's growing workload continues to be one of the agency's most pressing challenges. The Advisory Committee for GPRA expressed concern in its annual report about the workload that program officers face and recommended that NSF examine ways to reduce unnecessary work.[4] NSF's growing workload was one of the primary reasons that the agency launched the Business Analysis initiative four years ago to review and reengineer NSF's core business processes. But as the initiative nears completion, OIG estimates that 75 percent of the improvement opportunities identified by the contractor for the merit review and award management business processes have not been acted on. Some of these proposals have the potential to alleviate workload pressures by rationalizing NSF's operations and improving customer service. The immediate challenge for NSF management is to determine which of these proposals have merit and are financially feasible, and then to implement those that will ensure the most efficient deployment of the workforce in the years ahead.

Another workforce planning issue is the extent to which NSF should use rotators from the research community to fill key program management positions. NSF has a longstanding practice of recruiting scientists, engineers, and educators from their home institutions or agencies to spend a few years at the Foundation. In FY 2005, approximately half of NSF's 400 program officers were rotators. While acknowledging their contributions to keeping NSF current on the latest research, we believe that their employment poses several administrative and management challenges for NSF. Rotators who serve at more senior levels lack institutional knowledge and are less likely to make long-term planning a priority. In addition, rotators require more frequent recruiting, hiring and training.

[4] Report of the Advisory Committee for GPRA Performance Assessment FY 2006, p. 57

Two reports issued in the past year have highlighted the importance of having permanent, experienced managers in senior positions. In its 2005 Report on NSF's Merit Review System, the National Science Board stated that "at the higher management levels, including the division director, experienced individuals need to oversee the complete system of the merit review process and be able to recruit the best program officers."[5] The Advisory Committee for GPRA commented that NSF "requires highly experienced program managers with a broader understanding of the operation of the Foundation and the evolution that it is undergoing. If NSF seeks to undertake activities such as identifying a portfolio of "transformative" research, the expertise of experienced program managers will play a critical role."[6] We believe that a significant challenge for NSF is to ensure a stable and experienced managerial corps. To attain that goal, it needs to give careful consideration to whether the agency would be better served by reserving specific management positions for permanent professional staff.

*Administrative infrastructure.* Issues related to administrative infrastructure and support continue to limit the size and effectiveness of NSF's workforce. Inadequate office space, tight travel funds, and flawed systems to support traveling and hiring actions place serious constraints on the staff's ability to perform its work. Office space limitations remain the most critical issue, impeding the recruitment of staff, the ability to obtain space for panels and meetings, and the capacity to store sensitive documents. In developing their departmental staffing plans this past year, NSF directorates informed the agency that insufficient office space restricted the number of people they could hire.

Travel funds are also inadequate for the purpose of properly overseeing existing awards. In addition, staff members have been hampered in making travel arrangements by recurring problems with *FedTraveler*, NSF's on-line system for booking and reimbursing official travel. The agency continues to work with the contractor responsible for the system on correcting them. In the past year, NSF has taken several actions aimed at improving performance in the area of human resource management so that hiring actions will be processed more quickly, but progress has been uneven. NSF needs to make allocating more funding for administrative resources a priority in order to maximize the effectiveness of staff.

**Budget, Cost and Performance Integration**

*Performance reporting.* The purpose of the Government Performance and Results Act is to improve the efficiency and effectiveness of federal programs by establishing a system to set goals for program performance and to measure results. However, the results of funding basic scientific research are difficult to measure in the short term, as the value of many research projects only becomes apparent over time. To assist in this endeavor, NSF convenes an Advisory Committee on GPRA (AC/GPRA) each year to assess progress in achieving its strategic goals. Last year's AC/GPRA assessment suggested that NSF could better demonstrate the relevance of its accomplishments to its outcome goals. This year's Committee was more specific, recommending that NSF's "nuggets" (selected success stories) include the specific activities and outcomes that are desired, and include more "measures of effectiveness." Among

[5] Report of the National Science Board on the National Science Foundation's Merit Review System, NSB-05-119, p.14

[6] Report of the Advisory Committee for GPRA Performance Assessment FY 2006, p.49, 52

other things it also recommended that NSF develop baselines to better demonstrate how the agency's efforts are contributing to positive change.

Communicating the results of scientific research is also key to furthering science and demonstrating the effects of federal funding. The Office of Science and Technology Policy recently affirmed that the administration regards the timely, complete and accurate communication of scientific information as an important aspect of public service. In the past two years, OIG has issued three reports that underscore the need to improve NSF's reporting of research results. In 2005, auditors found that approximately 47 percent of final and annual reports required by their NSF awards over a five-year period were submitted late or not at all. Moreover, 8 percent of the 43,000 *final* project reports were never submitted.[7] NSF agreed with the report's recommendations to strengthen project reporting and is in the process of developing a new project-reporting notification and tracking system.

Two related reports on disseminating the results of NSF-funded research to the public were issued during this past year. In February, OIG recommended that the agency make publication citations for each research project that it funds available on its website.[8] The agency agreed and is planning to make the citations available by July 2007. In September, a follow-on report assessed interest among NSF's stakeholders and managers in making even more information about research outcomes available to the public.[9] The auditors found that there was overwhelming interest in providing brief summaries of the results of each project NSF funds on the agency website. Significant support was also registered for posting conference proceedings, abstracts, and final project reports. NSF agreed that increased public access to the results of its research was desirable, and is working with other government agencies toward developing a standardized reporting template. The significant challenge for NSF is twofold: to develop a credible process for evaluating the impact of its overall effort, rather than relying on selected nuggets to suggest the success of its investments, and to ensure that the research community and the public have ready access to the scientific results.

*Cost information.* NSF does not maintain basic information about the cost of its operations that would enable managers and those responsible for its oversight to better assess the agency's past performance and make more informed decisions about its future. In recent years, NSF has enhanced its cost accounting system so it can track costs according to its strategic goals, as well as the ten investment categories that are subject to OMB evaluation. While the current system provides aggregated costs that are useful to assessing strategy, it does not track the costs of NSF's internal business processes and activities such as soliciting grants, conducting merit reviews, or performing post-award grant administration. Information about the cost-effectiveness and efficiency of an organization's workforce and work processes is critical to any effort to carry out such initiatives as business-process improvements or activity-based costing. We believe that management should consider the use of more detailed cost information as a tool for improving its business processes and maximizing limited resources.

[7] Audit of Project Reporting for NSF Awards, December 2004, OIG 05-2-006
[8] NSF's Policies on Public Access to the Results of NSF-Funded Research, February 2006, OIG 06-2-004
[9] Interest in NSF Providing More Research Results, September 2006, OIG 06-2-013

**Information Technology**

*Enterprise Architecture.* Enterprise architecture involves planning for organizational change using detailed models that demonstrate, in both business and technical terms, how an entity intends to transition from its current operations to a more optimal system in the future. It is widely accepted that a carefully designed enterprise architecture is vital to an organization's efforts to modernize and improve its IT environment. The Government Accountability Office (GAO) recently issued a report on the progress made by 27 federal departments and agencies toward establishing enterprise architecture programs. They found that NSF lags behind all but four of the agencies studied, satisfying just 52 percent of GAO's core elements for effective enterprise architecture management.[10] GAO recommended that NSF, as well as other federal agencies, implement a plan for fully satisfying each core element to ensure that there is a mature enterprise architecture program in place to guide future IT development.

**United States Antarctic Program**

*USAP long-term planning.* The United States Antarctic Program, which is managed by NSF, is responsible for the coordination and support of America's scientific research program in Antarctica. The USAP operates three scientific stations and provides researchers with logistical, operational, and laboratory support. Some 3500 researchers and support personnel annually participate in the USAP, which cost $295 million in FY 2006. Providing for the safety and well-being of so many in such an isolated, high-risk, and extreme environment has been a long-term management challenge for NSF.

A 2003 OIG audit report cited examples of aging USAP infrastructure and recommended that NSF provide a separate line item in its budget for the replenishment of its buildings and facilities according to a capital asset management plan, to ensure that the useful lives of buildings and equipment would not be stretched beyond the point where they become unsafe.[11] NSF responded that its current practices were adequate and that a dedicated fund would restrict needed financial flexibility. Two additional issues with long-term planning were raised last year by a Committee of Visitors report that recommended that the agency: 1) develop a long-term planning process to anticipate future research needs and the attendant logistical challenges before they reach the proposal stage; and 2) improve its projections of the actual costs of doing field and lab science to assure adequate planning. This past year NSF asked outside experts to analyze the USAP's expected logistics and infrastructure needs.

Information technology systems also play an essential life-support role in such a fragile environment. The evaluation report our office is required to prepare under the Federal Information Security Management Act (FISMA), noted that NSF needed to make improvements in the USAP operating platform and in disaster recovery.[12] The auditors believe that these weaknesses have the potential to adversely affect the well-being of the personnel, as well as the

[10] Leadership Remains Key to Establishing and Leveraging Architectures for Organizational Transformation, GAO-06-831, August 2006, p. 21
[11] Audit of Occupational Health & Safety and Medical Programs in the United States Antarctic Program, OIG 03-2-003, March 2003
[12] NSF Federal Information Security Management Act, 2006 Independent Evaluation Report

conduct of science, in Antarctica.[13] The risks inherent in the USAP program create a significant ongoing challenge for NSF.

**Merit Review**

*Broadening Participation.* Increasing the participation of women and minorities in the merit review process by adding more applicants, awardees, and reviewers from underrepresented groups is an important priority of NSF. Developing the unrealized potential of underrepresented groups will benefit the U.S. through expanded individual opportunities and enhanced national prosperity. However, in FY 2005, NSF overall received fewer proposals and made fewer awards than the previous year, and women and minorities were proportionately represented in that trend, although the rate of decline for the underrepresented groups was slightly less than that of the general population. The success rate (the percentage of proposals that NSF decides to fund) for both women and minorities remained the same as in FY 2004.

In the past NSF has had difficulty measuring the participation of underrepresented groups as reviewers, but has gradually increased the percentage of reviewers who report demographic information from 9 percent in 2002 to 22 percent in 2005. Among reviewers who voluntarily provided demographic information, 35 percent indicated that they were members of an underrepresented group, the same as last year. During the past year, the National Science Board issued a report on the Merit Review System that recommended that the agency seek to improve the information on traditionally underrepresented groups in the reviewer's database.[14] The Board's recommendation was affirmed by NSF's Advisory Committee for GPRA Performance Assessment, which suggested that NSF consider methods other than self declaration to collect more demographic data. The Committee also urged NSF to provide more conclusive evidence on whether it has indeed increased opportunities for underrepresented individuals and institutions. Because diversity is widely viewed as allowing for more creative ideas and better-informed decisions, resulting in more innovative research, the effort to broaden participation will continue to be an important challenge facing NSF.

[13] Ibid p. 1
[14] Report of the National Science Board on the National Science Foundation's Merit Review System, NSB-05-119, p. 15

**NATIONAL SCIENCE FOUNDATION**
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OFFICE OF THE
DIRECTOR

November 3, 2006

**MEMORANDUM**

**To:** Dr. Christine C. Boesz
Inspector General, NSF

**From:** Dr. Arden L. Bement, Jr.
Director, NSF

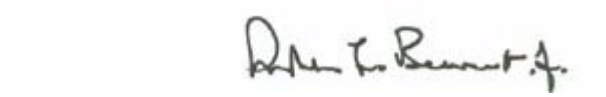
**Subject:** Response to the Inspector General's Memorandum
Management Challenges for NSF in 2007

Thank you for your memorandum of October 16, 2006 regarding potential management challenges the National Science Foundation (NSF) faces during the remainder of Fiscal Year (FY) 2007. In addition, thank you for your· acknowledgement of the significant progress NSF has made over this last fiscal year in meeting the FY 2006 management challenges, as highlighted below (see attachment).

A common theme across the last decade of management challenges has been the need for developing and investing in business models, policies and practices to further safeguard public funds while also furthering accomplishment of the NSF mission. This investment better assures a sound financial and administrative foundation for supporting basic research and education in science, engineering and mathematics, and guaranteeing a scientific workforce now and in the future.

Basic to responsible stewardship are internal controls essential to ensuring compliance with laws and regulations, reliable financial reporting, and the efficiency and effectiveness of NSF operations. Over the last year, NSF, like other Federal agencies, has invested in meeting the requirements of *Office of Management and Budget Circular A-123: Management's Responsibility for Internal Control,* the implementing guidance for the *Federal Managers' Financial Integrity Act of 1982.* NSF related activities and results are discussed in this *Performance and Accountability Report* in the Management's Discussion and Analysis, "Management Assurances" discussion.

NSF management accomplishments over this last year continue to contribute to NSF remaining well prepared to meet all challenges associated with carrying out its critical mission at the level of excellence NSF has maintained for over five decades.



Arden L. Bement,Jr.
Director

Attachment

cc: Chair, National Science Board

Attachment

NSF Management Challenges for 2006

**NATIONAL SCIENCE FOUNDATION**
**Progress during Fiscal Year 2006**
**On the 2006 Management Challenges**

Management Challenges are a means for an Office of the Inspector General (OIG) to articulate for its agency, the Executive Office, Congress and, most importantly, the taxpayers at large, the major strategic challenges facing federal executives as they implement their agencies' missions. These Challenges tend to be long range and strategic in nature, often requiring a continuous investment to mitigate their risks.

Each year, the National Science Foundation (NSF) Director receives the OIG's list of management challenges for the next fiscal year. In addition to receiving the challenges, the NSF Director provides a summary of NSF management's actions taken *over the last fiscal year* to address that year's challenges.

**FY 2006 Management Challenges**
**Issued by the Inspector General**
**In the FY 2005 PAR**

Award Administration
- *Post-award administration*
- *Large infrastructure projects*
- *Cost-sharing*
- *Promoting integrity*

Human Capital
- *Workforce planning*
- *NSF's non-permanent workforce*
- *Administrative infrastructure*

Budget, Cost, & Performance Integration
- *GPRA reporting*
- *Cost information*
- *Project Reporting*

Information Technology
- *Information security*

Procurement
- *Contract monitoring*

United States Antarctic Program
- *Long term planning*
- *Accounting for environmental liabilities*

Merit Review
- *Broadening participation*
- *Unfunded proposals*

## Summary of NSF Actions on 2006 Management Challenges

## Award Administration

Post-award Administration

- The Foundation continues to build out its cradle to grave oversight activities as part of its award portfolio management activities.
- NSF management expanded post-award oversight this Fiscal Year to include desk reviews for high risk awards that do not merit an on-site review during the current year.
- NSF is in the process of building out its Project Report module to improve capture of information able to be used in multiple ways. This will include status reports for the Principal Investigators / Awardees and NSF Program Officers.

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Large Infrastructure Projects

- The Large Facility Project Office (LFP) staff has increased every year since 2004; there are now a total of four FTEs on board, including the Deputy Director, consistent with the size of this type of office for other Federal Departments/Agencies with large facilities, including, for example, the Department of Energy.
- LFP is working to provide support to facilities projects by writing and editing publications, and will soon provide support for the LFP reviews and travel functions.
- The facilities tracking and reporting system for obligations became operational for current MREFC projects by the end December 2005. Currently, LFP is working with Directorate staff to complete the loading of all facilities into the tracking system.
- An online training system has been developed and is in the process of coming online as part of the NSF Academy's Learning Management System (LMS); this training is intended for Program Officers, Budget Officers, and other NSF staff who have responsibilities for financial tracking of facilities.
- *Project Science Workshop* is a training program designed specifically for large research projects. The workshop provides discussion and lessons learned from both project and agency personnel.

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Cost-sharing

In October 2004, the National Science Board eliminated program-specific cost sharing. As with all such changes, a prudent approach to implementation was mandated.

- All *previously issued* program solicitations specifying a cost sharing requirement continue to remain in effect until the solicitation is modified to remove this requirement.
- Through its internal clearance processes, NSF also has worked diligently with all program offices to remove cost sharing requirements in remaining solicitations and to ensure none are added to new solicitations.
- BFA's formal and informal internal and external outreach programs include discussions of this policy change and offer the opportunity for clarification.
- Existing cost sharing commitments are now included as factors in the overall NSF post-award oversight risk assessment model.
- Cost sharing is included as an important element in NSF's post award monitoring visits and any needed follow-up plans.
- NSF has made a number of important enhancements to NSF corporate electronic systems to facilitate the submission of requisite cost sharing reports.

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Promoting Integrity

NSF management continues to work with the science and engineering communities to heighten awareness of the various issues that affect the integrity of our country's science enterprise.

- Two specific examples of activities on this subject include:
  - The requirement of ethics training for all Science and Technology Centers and Engineering Research Centers.
  - Continuing discussions regarding ethics at Federal Demonstration Partnership meetings.
- NSF's emphasis on this topic has translated into numerous web-based courses including general information on ethics in science.
- In addition, the NSF merit review process and Committee of Visitors, who are convened to review all NSF programs on a regular cycle, provide opportunities for feedback and critical reflection on issues of integrity.

# Human Capital

Workforce Planning

Progress continues to be made in the development and implementation of an effective workforce planning process, as evidenced by the following examples:

- A committee of senior management from each Directorate and Office designed and implemented an operating workforce planning process in FY 2006.
- A 3-year strategic workforce plan was documented in FY 2006. The draft plan will be updated next year to align with NSF's Strategic Plan, and reviewed and updated annually.
- Each Directorate/Office created staffing plans for FY 2006 and FY 2007 based upon the methodology developed in the workforce planning process. These plans aided NSF's staffing efforts in FY 2006 and will be used as a baseline for FY 2007 efforts.
- The Directorate for Computer and Information Science and Engineering (CISE) piloted a workload demand analysis process which will be made available for use throughout the Foundation in FY 2007. This process will aid in anticipating future workload and help determine the appropriate mix of staff within a Directorate/Office.

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NSF's Non-permanent Workforce

During 2003, the National Academy of Public Administration studied, among other things, NSF's use of "non-permanent" employees. That report noted that NSF uses its "rotating" workforce in an appropriate manner." It also noted that the NSF understands the challenges of managing such a mixed workforce, part permanent--part temporary, and has managed this situation very well so far, and recommended no changes to the management of this situation.

NSF has always appreciated the ability and authority to recruit and hire the most capable scientists and engineers to oversee and manage its frontier science and engineering activities. NSF also understands the challenges that come with this authority, and continuously works to improve the orientation, the training, and the appreciation of associated responsibilities that come with federal employment and excellence in program management. One key to NSF's success is a continual and transparent exchange between the science community and the agency. NSF's ability to utilize rotators is essential to carrying out the agency mission.

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Administrative Infrastructure

To address the issue of adequate Human Resources Management administrative systems to hire new staff, the following actions were undertaken in FY 2006:

- Significantly expanded contract support to perform operational and processing work in order to focus permanent resources on strategic change and strategic partnerships.
- Created Human Resource service teams with specific customer account representatives to meet frequently with management officials in order to accurately define and meet recruitment needs.
- Established new "service agreement" approach to fill positions whereby the hiring office and HRM agree up front on recruiting steps and expected timeline to complete hiring action.
- Established and announced a number of open continuous positions to assure an ongoing supply of candidates for commonly filled positions.
- Implemented processes to improve the quality of questions used in Quick Hire announcements in order to make clearer distinctions between candidates.

## Budget, Cost, and Performance Integration

GPRA Reporting

NSF plans to continue gathering input from internal and external experts on performance as the agency transitions to a new strategic plan for FY 2006 – 2011, building on its prior reputation as a "model for the federal community."

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Cost Information

For the last five years, NSF has worked closely with the Office of Management and Budget (OMB) to adopt meaningful and useful efficiency measures in conjunction with the PART exercise and in developing a Budget, Cost, and Performance Integration Plan to meet requirements associated with the President's Management Agenda (PMA). For example:

- NSF has received a successful "Green" rating for its Budget and Performance Integration Initiative since 2005.
- NSF is the only agency (with more than one program evaluated) to receive "Effective" ratings in every PART program.

NSF has found that information on NSF's administrative costs is most valuable when gathered at aggregated levels.

- This is driven by the NSF investment of about 94 percent of its funding in its programs, and is presented in the NSF budget and tracked via the Statement of Net Cost which has been concurred with by OMB.
- NSF continues to balance its development of databanks against the actual use of such data and against the investments needed to deliver such information.
- To date, NSF has been successful in maintaining a reasonable and relevant balance at the aggregated level of detail that effectively meets senior management and OMB needs.

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Project Reporting

During the last year, NSF has strengthened its supporting systems to better ensure each awardee and Principal Investigator complies with the requirement to file annual progress reports and final project reports. The NSF also has demonstrated leadership on this issue by leading an effort through the National Science and Technology Council by establishing a federal-wide template for project reporting.

NSF is moving toward an integrated, comprehensive solution to address remaining issues with the progress reporting system. Accomplishments include:

- Updating and clarifying NSF policy statements regarding progress reporting.
- The development of a new web-base project reporting notification and tracking system.

## Information Technology

Information Security

Each year, NSF's security position is evaluated continuously through security reviews, self-assessments, audits, service recovery, vulnerability testing, and certification. NSF has taken the following actions to enhance security:

- Increased integration of the United States Antarctic Program into the NSF Security Program.

- Improved business continuity planning.
- Invested in and improved IT vulnerability management and automated security patch management.
- Improved IT security scanning processes.
- Continued refinement and integration of security into project life cycle.
- Updated security policies / procedures to reflect new security requirements.
- By mid-September, over 93 per cent of NSF employees/contractors had completed required IT Security Training; completion of this training requirement is necessary to maintain access to various NSF secured applications.

## Procurement

During this Fiscal Year, NSF enhanced its contract support by initiating vendor reviews of its three largest contracts.

## The United States Antarctic Program

Long-Range Planning and Environmental Reporting

During FY 2006, NSF:

- Created a new Section within the Office of Polar Programs (OPP) to address environmental, health and safety issues at the policy and oversight level for both Antarctic and Arctic research.
- Tasked an external group of experts to advise on the logistics and infrastructure needed to maintain the present effort and to consider modifications that would enable research in new geographical regions or on new subjects.
- Requested, in the FY 2007 budget to Congress, funding to begin implementing the resulting recommendations.

## NSF Merit Review

Broadening Participation

Broadening participation in the science and engineering enterprise continues to be a major issue as the Federal government seeks to improve and expand its science and engineering workforce. Because NSF values the perspectives of various people in determining how best to invest in a balanced science and engineering research and education portfolio, the Foundation continues to seek the advice and guidance of a diversity of individuals on its Advisory Committees and Committee of Visitors as well as review panels. NSF cannot, however, require ethnicity, gender, or disability information from reviewers. The Foundation does ask reviewers to voluntarily self identify to help NSF improve data collection regarding reviewer demographics.

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Unfunded Proposals

NSF seeks always the proper balance between proposals funded, and award size and duration, given available resources. NSF is unable to fund many excellent science, engineering and education proposals due to funding constraints. This is a challenge for NSF, and the Nation.

# PATENTS AND INVENTIONS RESULTING FROM NSF SUPPORT

The following information about inventions is being reported in compliance with Section 3(f) of the National Science Foundation Act of 1950, as amended [42 U.S.C. 1862(f)]. There were 1,189 NSF invention disclosures reported to the Foundation either directly or through NIH's iEdison database during FY 2006. Rights to these inventions were allocated in accordance with Chapter 18 of Title 35 of the United States Code, commonly called the "Bayh-Dole Act."

# LIST OF ACRONYMS

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|---|---|
| AC | Advisory Committee |
| AC/GPA | Advisory Committee for GPRA Performance Assessment |
| ACI | American Competitiveness Initiative |
| AGEP | Alliances for Graduate Education and the Professoriate |
| ALMA | Atacama Large Millimeter Array |
| AM&O | Award Management & Oversight |
| AODP | Adaptive On-Board Data Processing |
| APIC | Accountability and Performance Integration Council |
| APPI | NSF Accelerator Physics and Physics Instrumentation |
| AUI | Associated Universities Incorporated |
| AURA | Associated Universities for Research in Astronomy |
| BE | Biocomplexity in the Environment |
| BFA | Office of Budget, Finance, and Award Management |
| BPI | Budget and Performance Integration |
| CAREER | Faculty Early Career Development |
| CCF | Division of Computing and Communication Foundations |
| CCLI | Course Curriculum and Laboratory Improvement |
| CCR | Central Contractor Registration |
| CEOSE | Committee on Equal Opportunities in Science and Engineering |
| CERN | European Center for Nuclear Research |
| CFOC | Chief Financial Officer Council |
| CGAC | Common Government Accounting Code |
| CIHO | Cash and Investments Held Outside of the Treasury |
| CIP | Construction in Progress |
| CLT | Centers for Learning and Teaching |
| CMIA | Cash Management Improvement Act |
| COO | Chief Operating Officer |
| COSI | Center of Science and Industry |
| COTR | Contracting Officer's Technical Representative |
| COV | Committee of Visitors |
| CPU | Central Processing Unit |
| CREST | Centers for Research Excellence In Science and Technology |
| CSBF | Columbia Scientific Balloon Facility |
| CSEMS | Computer Science, Engineering, and Mathematics Scholarship |
| CSRS | Civil Service Retirement System |
| DCAA | Defense Contract Audit Agency |
| DCCA | Division of Contracts and Complex Agreements |
| DCIA | Debt Collection Improvement Act |
| DD | Deputy Director |
| DHS | Department of Homeland Security |
| DIAS | Division of Institution and Award Support |
| DNA | Deoxyribonucleic Acid |
| DOE | Department of Energy |
| DOI | Department of the Interior |
| DOL | Department of Labor |
| DTS | Distinguished Teaching Scholars |
| ECCS | Electrical, Communications and Cyber Systems |
| EDDA | Environmental Due Diligence Audit |
| EDS | Electronic Data Systems |
| EEC | Engineering Education and Centers |
| EFRI | Emerging Frontiers in Research and Innovation |
| EFT | Electronic Fund Transfer |
| EIP | Erroneous and Improper Payments Grant Workshop |
| EIS | Enterprise Information System |
| EPA | Environmental Protection Agency |
| EPSCoR | Experimental Program to Stimulate Competitive Research |
| ERC | Engineering Research Center |
| ESIE | Elementary, Secondary and Informal Science Education |
| EVM | Earned Value Management |
| FACA | Federal Advisory Committee Act |
| FAS | Financial Accounting System |
| FASAB | Federal Accounting Standards Advisory Board |
| FCTR | Federal Cash Transaction Report |
| FECA | Federal Employees Compensation Act |
| FERS | Federal Employees Retirement System |
| FFMIA | Federal Financial Management Improvement Act of 1996 |
| FFR | Federal Financial Report |
| FFRDC | Federally Funded Research and Development Center |

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| FISMA | Federal Information Security Management Act |
| FL | FastLane |
| FMFIA | Federal Managers' Financial Integrity Act of 1982 |
| FMLOB | Financial Management Line of Business |
| FTE | Full-time Equivalency |
| FY | Fiscal Year |
| GAAP | Generally Accepted Accounting Principles |
| GAO | Government Accountability Office |
| GFRS | Government-wide Financial Reporting System |
| GK-12 | Graduate Teaching Fellows in K-12 Education |
| GMLoB | Grants Management Line of Business |
| GOALI | Grant Opportunities for Academic Liaison with Industry |
| GPA | GPRA Performance Assessment |
| GPRA | Government Performance and Results Act |
| GPS | Global Positioning System |
| GRF | Graduate Research Fellowships |
| GRFP | Graduate Research Fellowships Program |
| GSA | Government Services Administration |
| GWA | Government-wide Accounting |
| HBCU | Historically Black Colleges and Universities |
| HEPAP | High Energy Physics Advisory Panel |
| HHS | Health and Human Services |
| HRM | Human Resource Management |
| I/UCRC | Industry/University Cooperative Research Centers |
| IBM | IBM Business Global Business Services |
| IGERT | Integrative Graduate Education and Research Traineeships |
| IIP | Industrial Innovation and Partnerships |
| IIS | Information and Intelligent Systems Division (CISE) |
| IPIA | Improper Payments Information Act of 2002 |
| ISE | Informal Science Education |
| IT | Information Technology |
| ITR | Information Technology Research |
| LACP | League of American Communications Professionals |
| LFP | Large Facility Projects Management & Oversight Office |
| LHC | Large Hadron Collider |
| LMS | Learning Management System |
| LSAMP | Louis Stokes Alliances for Minority Participation |
| LSC | Local Systemic Change |
| LTER | Long Term Ecological Research |
| MASC | Multinational *Arabidopsis* Steering Committee |
| MATE | Marine Advanced Technology Education |
| MEMS | Microelectromechanical Systems |
| MR | Merit Review |
| MREFC | Major Research Equipment and Facilities Construction |
| MSI | Minority Serving Institutions |
| MSP | Math and Science Partnerships |
| MTS | Federal Measurement Tracking System |
| NAIC | National Astronomy and Ionosphere Center |
| NAPA | National Academy of Public Administration |
| NASA | National Aeronautics and Space Administration |
| NCAR | National Center for Atmospheric Research |
| NCN | Network for Computational Nanotechnology |
| NEES | Network for Earthquake Engineering Simulation |
| NEMS | Nanoelectromechanical systems |
| NIH | National Institutes of Health |
| NNI | National Nanotechnology Infrastructure |
| NNIN | National Nanotechnology Infrastructure Network |
| NNUN | National Nanofabrication Users Network |
| NOAO | National Optical Astronomy Observatory |
| NPGI | National Plant Genome Initiative |
| NRAO | National Radio Astronomy Observatory |
| NSA | National Security Administration |
| NSB | National Science Board |
| NSBF | National Scientific Balloon Facility |
| NSF | National Science Foundation |
| NSO | National Solar Observatory |
| NSTC | National Science and Technology Council |
| NSTG | Neutron Science TeraGrid Gateway |
| OE | Organizational Excellence |
| OHEP | Office of High Energy Physics |
| OIG | Office of Inspector General |

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|---|---|
| OIRM | Office of Information and Resource Management |
| OLC | Oglala Lakota College |
| OMB | Office of Management and Budget |
| OPM | United States Office of Personnel Management |
| OSTP | Office of Science and Technology Policy |
| PAR | Performance and Accountability Report |
| PARS | Proposal and Reviewer System |
| PART | Program Assessment Rating Tool |
| PECASE | Presidential Early Career Awards for Scientists and Engineers |
| PFI | Partnership for Innovation |
| PI | Principal Investigator |
| PIMS | Program Information Management System |
| PMA | President's Management Agenda |
| PP&E | Property, Plant and Equipment |
| PPD | Programs for Persons with Disabilities |
| R&RA | Research and Related Activities Appropriation |
| RAPD | Research to Aid Persons with Disabilities |
| ROV | Remotely Operated Vehicle |
| RPSC | Raytheon Polar Services Company |
| SAT | Senior Assessment Team |
| SAUV | Solar Autonomous Underwater Vehicle |
| SBES | Simulation-Based Engineering Science |
| SBIR | Small Business Innovation Research |
| SBR | Statement of Budgetary Resources |
| SFFAS | Statement of Federal Financial Accounting Standards |
| SFS | Scholarship for Service |
| SMaRT | Senior Management RoundTable |
| SMC | Senior Management Council |
| SMETE | Science, Mathematics, Engineering and Technology Education |
| SNS | Spallation Neutron Source |
| SPSM | South Pole Station Modernization |
| SRS | Division of Science Resources Statistics |
| SSP | Shared Service Provider |
| STC | Science and Technology Center |
| STEM | Science, Technology, Engineering and Mathematics |
| STEP | Systemic Teacher Excellence Preparation |
| TAIR | The *Arabidopsis* Information Resource |
| TBSR | Total Business Systems Review |
| TCU | Tribal Colleges and Universities |
| TCUP | Tribal Colleges and Universities Program |
| UCAR | University Corporation for Atmospheric Research |
| UCLA | University of California, Los Angeles |
| UCSD | University of California, San Diego |
| USAID | U.S. Agency for International Development |
| USAP | U.S. Antarctic Program |