MEASURING PERFORMANCE

Right: 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, NSF-funded researcher Eric Weeks and his colleagues 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 it is for a material to spread, flow, or compress—especially in confined spaces.

The Emory researchers have used activities involving "squishy materials" to interest schoolchildren in science. In the photo on the right, on a field trip to Dr. Weeks' laboratory, students watch as Dr. Denis Semwogerere demonstrates the properties of these materials. The laboratory has hosted groups from kindergarten through eighth grade, providing a variety of 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.

For more information:

www.physics.emory.edu/~weeks/squishy

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 this process provide stakeholders and taxpayers with vital information about the return on their investment. In FY 2006, performance assessment was guided by the Government Performance and Results Act of 1993 (GPRA), by OMB's Program Assessment Rating Tool (PART), and by NSF's *FY 2003–2008 Strategic Plan*. GPRA requires federal agencies to develop a strategic plan, establish annual performance goals, and report on the progress made toward achieving these goals.

NSF's *FY 2003–2008 Strategic Plan* outlined four overarching strategic outcome goals: Ideas, Tools, People, and Organizational Excellence. The Ideas, Tools, and People goals are aligned with a set of investment categories that account for 100 percent of NSF's programmatic activities. These investment categories are the programs that OMB has reviewed using the PART. The Organizational Excellence goal focuses on NSF's administration and management activities and the five PMA initiatives.

Assessing Long-Term Research

For NSF, linking outcomes to annual investments is difficult because the results from investments in basic research and education can be unpredictable. Science and engineering research projects can generate discoveries in unrelated areas, and it can take years to recognize discoveries and their impact. NSF has developed an alternative OMB-approved assessment process based on evaluation by external experts. The academic research community has used such evaluation for many years. NSF itself has used panels of external experts for decades and, over time, has developed a comprehensive process for conducting productive evaluations.

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). The Foundation relies on the judgment of these external experts to maintain high standards of program management, to provide advice on continuous improvement of performance, and to ensure openness to the research and education community served by the Foundation.

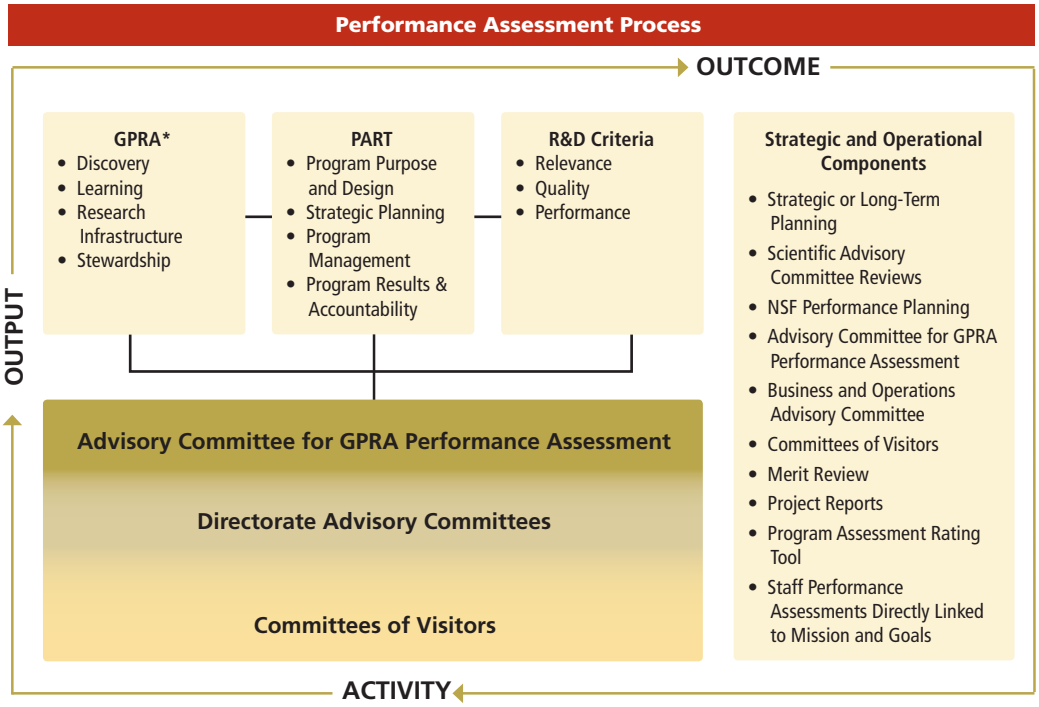
For more information:

NSF FY 2006–2011 Strategic Plan
www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0648

NSF FY 2006 Performance and Accountability Report
www.nsf.gov/publications/pub_summ.jsp?ods_key=par

President's Management Agenda
www.whitehouse.gov/omb/budintegration/pma_index.html

Program Assessment Rating Tool (PART)
www.expectmore.gov



GPRA: The Government Performance and Results Act of 1993; *PART:* Program Assessment Rating Tool; *R&D:* Research and Development

* The new strategic outcome goals of Discovery, Learning, Research Infrastructure, and Stewardship align with the Ideas, People, Tools, and Organizational Excellence goals from the previous strategic plan.

COVs are responsible for evaluating and reporting on one-third of NSF's programs every year. These reports serve as important input for the Advisory Committee for GPRA Performance Assessment (AC/GPA), which is responsible for conducting an annual evaluation of NSF's strategic outcome goals. In addition, COV reports provide important information for evaluation of NSF's PART programs. The program assessment process is depicted in the chart above.

PART Evaluations

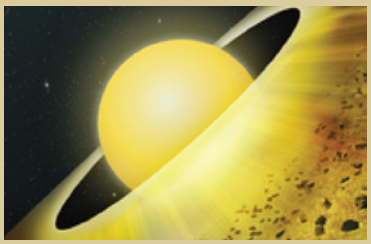
In 2002, OMB developed the PART, a systematic method for assessing the performance of program activities across the federal government. Each year, about 20 percent of an agency's programs undergo PART review. As indicated in the chart on the right, all NSF programs that have been evaluated under the FY 2006 strategic plan have received the highest "Effective" rating. Of the more than 800 federal programs that have been evaluated to date, the PART has rated only 15 percent as effective.

NSF PART Evaluations

Investment Category/Priority Area	Budget Year	Result
IDEAS		
Fundamental Science and Engineering	FY 2007	Effective
FFRDC*	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

**FFRDC: Federally Funded Research and Development Centers*
For more information, visit www.whitehouse.gov/omb/expectmore.

PLANET UNDER CONSTRUCTION



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. 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.

For more information:

www.nrao.edu/pr/2005/twhydrae/

IMPROVING COMMUNICATION

NSF-supported researcher Alexandra Duel-Hallen of North Carolina State University and her colleagues have developed a suite of adaptive tools to improve the capacity and quality of wireless communication. Channels change rapidly in mobile communications; most transmitters and receivers are not optimized for the onditions they encounter, and the devices cannot exploit the full potential of the wireless channel. The new tools predict information about a fading wireless channel to allow 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 telephones. 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.

For more information:

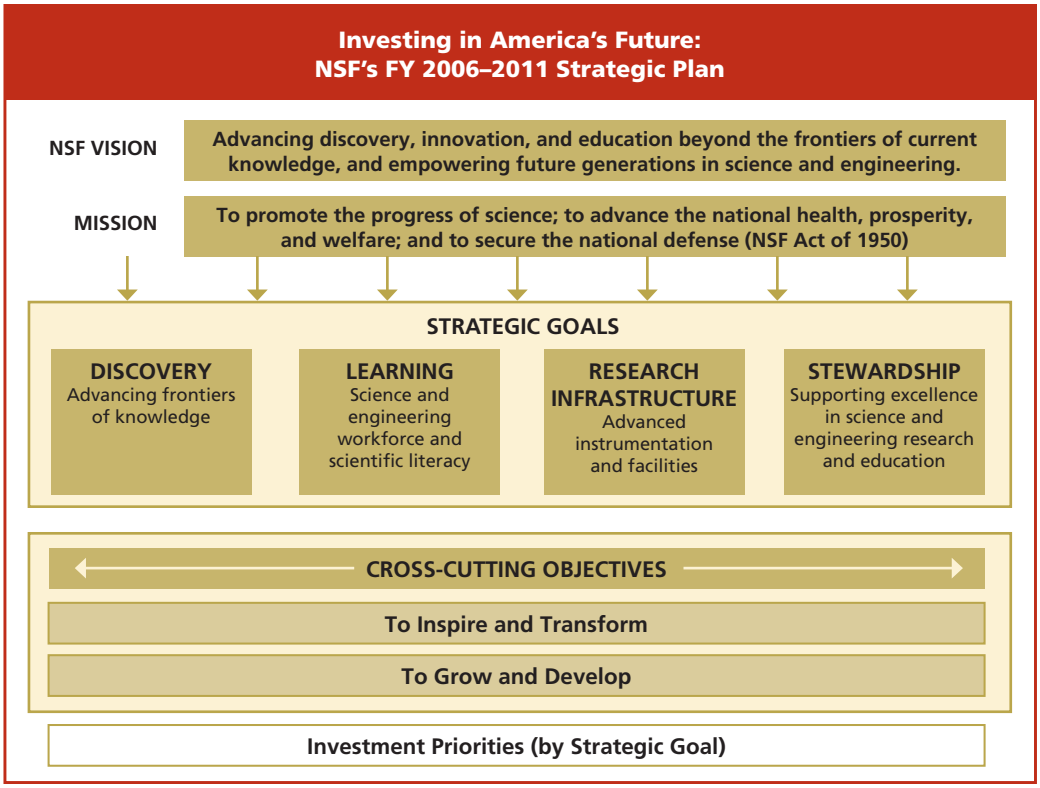
www.physics.ncsu.edu/optics/wireless/wireless.html

Investing in America's Future: NSF's New Strategic Plan

On September 30, 2006, NSF released a new strategic plan that will guide programmatic activities for the next five years. The new strategic plan was developed through a collaborative process that involved significant input from staff, the research and education community, and other key stakeholders, including Congress and OMB. The plan outlines four interrelated goals—Discovery, Learning, Research Infrastructure, and Stewardship—that provide an integrated strategy for delivering new knowledge at the frontiers, meeting vital national needs, and achieving the NSF vision.

The new goals align with the previous strategic goals—Ideas, People, Tools, and Organizational Excellence—and the three strategic priorities in the National Science Board's *2020 Vision for the National Science Foundation*. The Stewardship goal aims for excellence in science and engineering research and education through a capable and responsive organization.

The framework of the new strategic plan is shown below. Two objectives cut across the four strategic goals: "To Inspire and Transform" and "To Grow and Develop." The plan also establishes well-defined priorities for allocating investment funds and internal resources.



FY 2006 Performance Scorecard

NSF's FY 2006 performance activities were guided by the *FY 2003–2008 Strategic Plan*. NSF's FY 2006 performance goals fall into two broad areas:

Strategic Outcome Goals focus on the long-term results of NSF grants and programs. They represent what the Foundation seeks to accomplish with its investments in science and engineering research and education. The results from NSF awards illustrate the success of the Foundation's investments. In a transparent public process, the AC/GPA uses input from grantee project reports, COV reports, and highlights from NSF-funded research to assess the Foundation's

annual progress toward achieving each of the long-term Strategic Outcome Goals. In the sidebars throughout this report are examples illustrating the impact and success of NSF's long-term investments in Ideas, Tools, and People that were reported in FY 2006.

Annual Performance Goals include performance measures from NSF's PART evaluations, as well as time-to-decision and facilities construction and operations goals related to agency effectiveness and efficiency.

In FY 2006, NSF achieved 19 of 26 performance goals (73 percent), including all four strategic outcome goals. A list of NSF's FY 2006 performance goals and results follows. For a more comprehensive discussion of each goal, see NSF's *FY 2006 Performance and Accountability Report*.

FY 2001–2006 Performance Results: 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%)
Other 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%)

FY 2006 Performance Goals and Results

Strategic Outcome Goals

Performance Goal	Performance Indicator	Result
IDEAS: Discovery across the frontier of science and engineering, connected to learning, innovation, and service to society	NSF's performance is successful when, in the aggregate, results reported in FY 2006 demonstrate significant achievement in the majority of the following performance indicators: • Contributions—Enable people who work at the forefront of discovery to make important and significant contributions to science and engineering knowledge. • Collaborations—Encourage collaborative research and education efforts across organizations, disciplines, sectors, and international boundaries. • Connections—Foster connections between discoveries and their use in the service of society. • Underrepresented Individuals and Institutions—Increase opportunities for underrepresented individuals and institutions to conduct high quality, competitive research and education. • Identifying New Opportunities—Provide leadership in identifying and developing new research and education opportunities within and across science and engineering fields. • Cross-disciplinary—Accelerate progress in selected high-priority science and engineering areas by creating new integrative and cross-disciplinary knowledge and tools and by providing people with new skills and perspectives. • 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. **Explanation of result:** Assessments by external experts determined that NSF has demonstrated significant achievement in each of the performance indicators associated with this goal.	

SERVING FIRST RESPONDERS

The NSF-funded High Performance Wireless Research and Education Network (HPWREN) is a prototype system now operating in California's San Diego and Riverside counties.

HPWREN is partly intended as a testbed for several of NSF's large-scale sensor network initiatives. These include EarthScope, the Ocean Observatories Initiative, the National Ecological Observatory Network, and the Network for Earthquake Engineering Simulation.

At the same time, however, HPWREN is a working system, with multiple remote sites that are providing high-speed Internet access to field scientists in a variety of disciplines. Recently, astronomers from around the world used HPWREN to analyze the flood of data produced by a 161-megapixel camera at the Palomar Observatory—and in the process, discovered a "tenth planet" in our solar system. Other remote HPWREN nodes include seismometers and ecological sensors.

HPWREN also serves the first-responder community. For example, the California Department of Forestry and Fire Protection routinely accesses HPWREN's mountaintop cameras and sensors to monitor the notoriously fire-prone region. And firefighters at the scene of a blaze can rapidly deploy a wireless HPWREN node to access maps, aerial imagery, and telemetry data.

HPWREN also provides educational opportunities for rural Native American learning centers and schools in the area.

For more information:

www.nsf.gov/news/news_summ.jsp?cntn_id=107121&org=NSF&from=news

FY 2006 Performance Goals and Results

Strategic Outcome Goals

Performance Goal	Performance Indicator	Result
TOOLS: Broadly accessible state-of-the-art science and engineering facilities, tools, and other infrastructure that enable discovery, learning, and innovation.	NSF's performance is successful when, in the aggregate, results reported in FY 2006 demonstrate significant achievement in the majority of the following performance indicators: • Expand Access—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. • 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. • Cyberinfrastructure—Develop and deploy an advanced cyberinfrastructure to enable all fields of science and engineering to fully utilize state-of-the-art computation. • Data Collection/Analysis—Provide for the collection and analysis of the scientific and technical resources of the United States and other nations to inform policy formulation and resource allocation. • Instrument Technology—Support research that advances instrument technology and leads to the development of next-generation research and education tools. **Explanation of result:** Assessments by external experts determined that NSF has demonstrated significant achievement in each of the performance indicators associated with this goal.	●
PEOPLE: A diverse, competitive, and globally engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens.	NSF's performance is successful when, in the aggregate, results reported in FY 2006 demonstrate significant achievement in the majority of the following performance indicators: • Greater Diversity—Promote greater diversity in the science and engineering workforce through increased participation of underrepresented groups in NSF activities. • Global S&E Workforce—Support programs that attract and prepare U.S. students to be highly qualified members of the global science and engineering workforce; programs should include opportunities for international study, collaborations, and partnerships. • 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. • Public Understanding of Science—Promote public understanding and appreciation of science, technology, engineering, and mathematics. **Explanation of result:** Assessments by external experts determined that NSF has demonstrated significant achievement in each of the performance indicators associated with this goal.	●
ORGANIZATIONAL EXCELLENCE: An agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices.	NSF's performance is successful when, in the aggregate, results reported in FY 2006 demonstrate significant achievement in the majority of the following performance indicators: • Human Capital Management—Develop a diverse, capable, motivated staff that operates with efficiency and integrity. • Technology-enabled Business Process—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. • Merit Review—Operate a credible, efficient merit review system. **Explanation of result:** Assessments by external experts determined that NSF has demonstrated significant achievement in each of the performance indicators associated with this goal.	●

FY 2006 Performance Goals and Results		
Annual Performance Goals		
Performance Area	**Performance Goal**	**Result**
Time-to-Decision	For 70 percent of proposals, inform applicants about funding decisions within 6 months of proposal receipt or deadline or target date, whichever is later, while maintaining a credible and efficient competitive merit review system.	●
Facilities Construction, Acquisition, and Upgrades	Keep negative cost and schedule variances at less than 10 percent of the approved project plan for 90 percent of construction, acquisition, and upgrading projects. **Explanation of result:** Three of 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.	■
Facilities Operation and Management	Keep operating time lost due to unscheduled downtime to less than 10 percent of the total scheduled operating time for 90 percent of operational facilities.	●
Polar Research Support	Provide the necessary research support for Antarctic researchers at least 90 percent of the time. [Research support includes lab operation; facilities engineering, maintenance, and construction; communications operations; remote field camp support; cargo and passenger transportation; and housing management and janitorial services.]	●
Polar Research Facilities	Keep the construction cost and schedule variances of major Polar facilities projects as monitored by Earned Value Management at 8 percent or less. **Explanation of result:** 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 that caused cost increases and schedule delays.	■
Graduate Research Fellowships: Broadening Participation	Increase the number of Graduate Research Fellowship applicants from groups that are underrepresented in the science and engineering workforce to 1,014 in FY 2006. **Explanation of result:** 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 increased. 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.	■
CAREER Award: Broadening Participation	Increase the number of applicants for CAREER (Faculty Early Career Development) awards from minority-serving institutions to 93 in FY 2006.	●
U.S. Students Receiving Fellowships	Increase the number of recipients of Graduate Research Fellowships, Integrative Graduate Education and Research Traineeships, and Graduate Teaching Fellows in K–12 Education to 4,525.	●
Individual Researchers: Time-to-Decision	For 70 percent of proposals submitted to the Individuals Program, inform applicants about funding decisions within 6 months of proposal receipt or deadline or target date, whichever is later, while maintaining a credible and efficient competitive merit review system.	●

IMPROVING ACHIEVEMENT

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.

Many of 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 above are students in the Oglala Lakota College robotics project.

For more information:

www.nsf.gov/about/partners/states/sd.jsp

FY 2006 Performance Goals and Results

Annual Performance Goals

Performance Area	Performance Goal	Result
Research Institutions: Proposals from Outside the Top 100 Institutions NSF Funds	Increase the percentage of proposals received from academic institutions not in the top 100 of NSF funding recipients to 73 percent. **Explanation of result:** 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.	■
Research Institutions: Time-to-Decision	For 70 percent of proposals submitted to the Research Institutions Program, inform applicants about funding decisions within 6 months of proposal receipt or deadline or target date, whichever is later, while maintaining a credible and efficient competitive merit review system.	●
Research Collaborations: Proposals from Outside the Top 100 Institutions NSF Funds	Increase the percentage of Research Collaborations proposals received from academic institutions not in the top 100 of NSF funding recipients to 63 percent. **Explanation of result:** 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.	■
Research Collaborations: Time-to-Decision	For 70 percent of proposals submitted to the Research Collaborations Program, inform applicants about funding decisions within 6 months of proposal receipt or deadline or target date, whichever is later, while maintaining a credible and efficient competitive merit review system.	●
Nanotechnology Network Users	Establish an infrastructure to improve access to nanotechnology facilities and services thereby increasing the number of users. For FY 2006, increase the number of users to 12,500, from 4,000 in FY 2005.	●
Nanotechnology Network Nodes	Support and enhance the nanotechnology infrastructure through increasing the number of nodes within the nanotechnology networks funded by NSF from 14 in FY 2005 to 20 in FY 2006.	●
Nanoscale Science and Engineering (S&E): Time-to-Decision	For 70 percent of proposals submitted to the Nanoscale Science and Engineering Program, inform applicants about funding decisions within 6 months of proposal receipt or deadline or target date, whichever is later, while maintaining a credible and efficient competitive merit review system.	●
Nanoscale S&E: Proposals with Female Investigators	Maintain the percentage of proposals to the Nanoscale Science and Engineering Program with female principal or co-principal investigators at 25 percent.	●
Nanoscale S&E: Proposals with Minority Investigators	Maintain the percentage of Nanoscale Science and Engineering proposals from minority and/or underrepresented principal or co-principal investigators at 13 percent.	●
Nanoscale S&E: Proposals with Multiple Investigators	Maintain the percentage of Nanoscale Science and Engineering proposals that are multi-investigator proposals at 75 percent.	●

FY 2006 Performance Goals and Results		
Annual Performance Goals		
Performance Area	**Performance Goal**	**Result**
Biocomplexity in the Environment (BE): Proposals with Female Investigators	Maintain the percentage of proposals to the BE Program with at least one female principal or co-principal investigator at 53 percent. **Explanation of result:** The BE 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.	■
Biocomplexity in the Environment: Proposals with Minority Investigators	Maintain the percentage of proposals to the BE Program from minority investigators at 17 percent. **Explanation of result:** The BE 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.	■
Biocomplexity in the Environment: Time-to-Decision	For 70 percent of proposals submitted to the BE Program, inform applicants about funding decisions within 6 months of proposal receipt or deadline or target date, whichever is later, while maintaining a credible and efficient competitive merit review system.	●

Note: Green indicates goal was achieved; red indicates goal was not achieved.