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.

---

[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

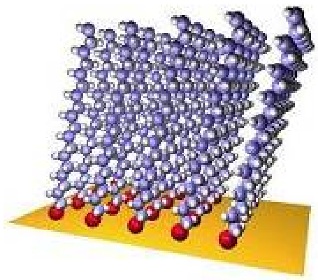
100 funded by NSF. The other two goals that were not achieved addressed the construction of large research facilities. For a more detailed discussion of each of NSF's FY 2006 GPRA performance goals, see Chapter II. Selected FY 2006 performance goals are presented in Figure 6 below.

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

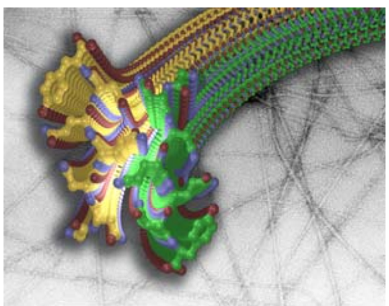
Strategic Outcome Goals	Results
IDEAS: Advancing the frontiers of science and engineering ensures that America maintains its global leadership. Investments in Ideas build the intellectual capital and fundamental knowledge that drive technological innovation, spur economic growth, increase national security, and improve the quality of life for humankind around the globe.	● FY 2002 ● FY 2003 ● FY 2004 ● FY 2005 ● 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 ● FY 2003 ● FY 2004 ● FY 2005 ● 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 ● FY 2003 ● FY 2004 ● FY 2005 ● 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 ● FY 2005 ● 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 ● FY 2003 ● FY 2004 ● FY 2005 ● 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.) **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 ● FY 2005 ■ 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/.

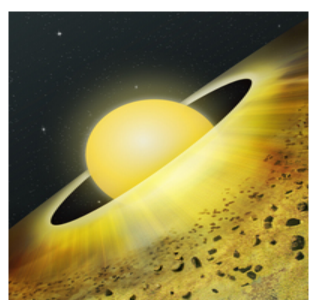


▶ **A Novel Approach to Storing Hydrogen:** Developing alternative fuels for transportation is key to achieving greater energy self-sufficiency in the United States. Hydrogen-fueled cars offer a potential option but there are major challenges in efficiently storing and distributing the fuel. Researchers 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.*

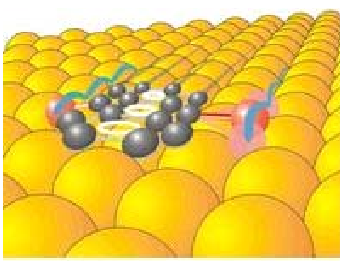
▶ **Zipped Structure May Explain Protein Clumping in Brain Disorders:** After years of intense research, David Eisenberg and his team at the University of California, Los Angeles (UCLA), along with international colleagues, have discovered the three-dimensional structure of a miniscule—yet mighty—region 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.*

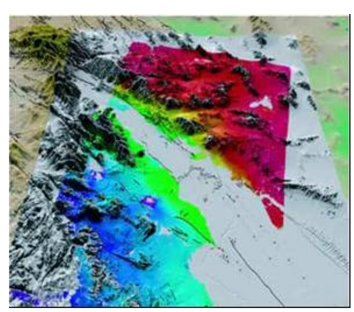
▶ **International Physics Young Ambassador Symposium:** More than 100 "physics young ambassadors" between the ages of 10 and 16 from 21 countries on five continents, winners of the International Physics Talent Search, met in Taipei, Taiwan, to share the physics experience. The International Physics Talent 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.



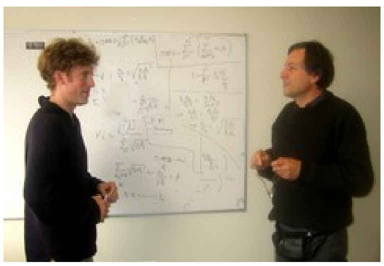
Propelled by two sulfur (red) atoms as feet, DTA "walks" across the surface setting step in front of step and never veering off course. *Credit: Ludwig Bartelis, UC–Riverside.*

▶ **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

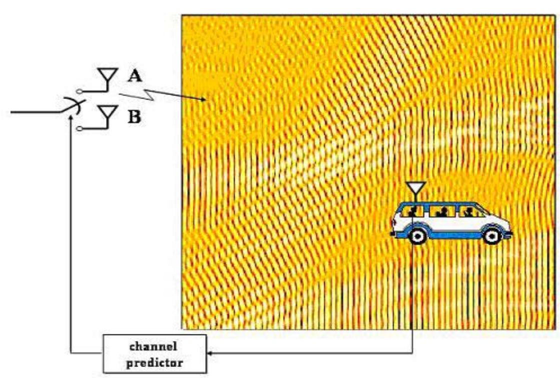


researchers had believed. Fialko used remote sensing techniques like GPS and satellite radar data, geologic records, and seismic data to observe strain buildup along the southern part of the fault. He found evidence that the southern San Andreas has accumulated about six to eight meters of slip "deficit." 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.)*

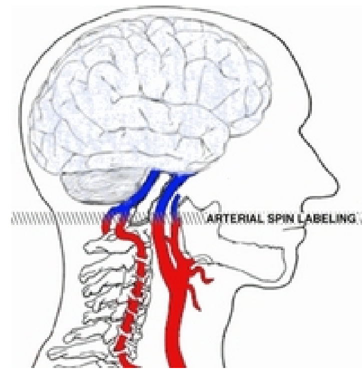
▶ **New Tools Improve Quality of Service for Wireless Customers:** Researchers have developed a suite of adaptive tools that can improve both the capacity and quality of wireless communication service. Channels change rapidly in mobile radio communications; most transmitters and receivers today are not 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



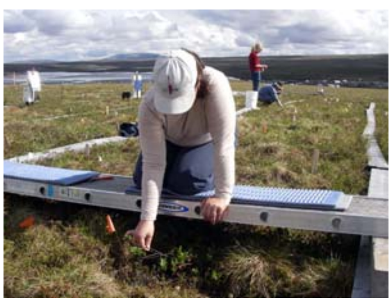
New wireless communication tools will improve the quality of service for consumers. *Credit: Alexandra Duel Hallen.*

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.

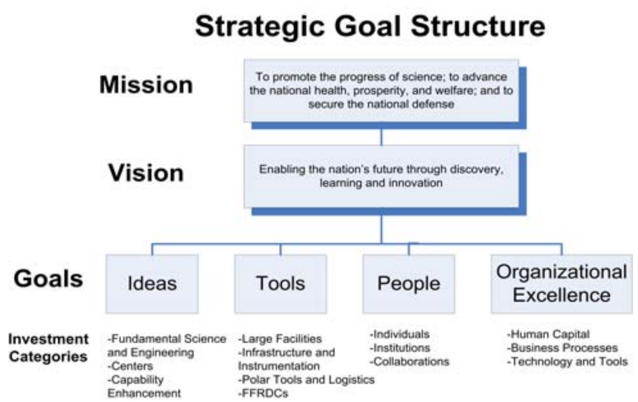
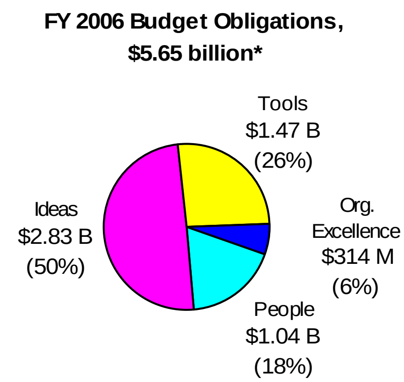


Figure 8.



*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.