PERFORMANCE SUMMARY AND HIGHLIGHTS[9]

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. Performance assessment at NSF is guided by the Government Performance and Results Act of 1993 (GPRA),[10] OMB's PART,[11] and by NSF's *FY 2003–2008 Strategic Plan*.[12]

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 from investments 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 of 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.

The Foundation 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 2005 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. NSF established an AC for GPRA Performance Assessment (AC/GPA) comprised of experts in various disciplines and fields of science, engineering, mathematics, and education to provide advice and recommendations to the NSF Director regarding the Foundation'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 findings as one critical input.

This year, the AC/GPA met on June 16 and 17, 2005, to review a collection of over 900 outstanding accomplishments—or "nuggets"—compiled by NSF program officers. In prior years,

[9] This discussion presents highlights of NSF's FY 2005 Government Performance and Results Act of 1993 (GPRA) results and pertinent issues. For a comprehensive discussion of each of NSF's FY 2005 GPRA performance goals and PART measures, see Chapter II, *Performance*.

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

[11] For more information about the Program Assessment Rating Tool (PART), visit www.whitehouse.gov/omb/part/ and *www.whitehouse.gov/omb/budget/fy2006/pma/nsf.pdf*.

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

the AC/GPA, which includes experts in statistics and performance assessment, has had thorough discussions about the sampling technique used for compiling the nuggets. The approach to nugget collection is a type of nonprobabilistic sampling, commonly referred to as "judgmental" or "purposeful" sampling. This type of sampling is 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 agencywide 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 nuggets when, in fact, we actually achieved our goals. That is, the Committee could conclude that NSF did not show sufficient achievement based upon 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 nuggets 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[13], 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 verification and validation of GPRA and PART data can be found on page I-13 and in Chapter II.

FY 2005 GPRA Results

NSF's Strategic Plan outlines four overarching strategic outcome goals—*Ideas, Tools, People,* and *Organizational Excellence. Ideas, Tools,* and *People* are mission-oriented strategic 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. NSF also tracks 17 other performance goals, which include performance measures from PART evaluations and goals that target award size, duration, and dwell time (time-to-decision) related to the effectiveness and efficiency of the agency's activities. A future concern continues to be proposal volume. Significant increases in proposal volume could affect timeliness of decisions and the willingness of the research and education communities to volunteer their time to perform reviews and serve on panels.

In FY 2005, NSF achieved all four strategic outcome goals[14] and 14 of 17 (82%) of our other performance goals. Overall, NSF achieved 86 percent of our annual performance goals. In the last five years, NSF's achievement of goals has ranged from a low of 64 percent in FY 2000 to a high of 90 percent in FY 2004. Selected results are presented in *Figure 6.*

[13] Not all investigator project reports were available to the Committee either because they were late or had not been submitted. A recent OIG audit determined that over a five-year period, approximately 47 percent of required final and annual reports were submitted late or not at all. Of 43,000 final project reports, 8 percent were never submitted and 53 percent were submitted an average of 5 months late. NSF is taking steps to ensure the timely submission of all such reports in the future.

[14] For the *People* goal, the AC/GPA concluded that one performance indicator was not achieved. The Committee noted regarding the trend in *People* funding that "[t]his trend should be monitored carefully by the AC/GPA because it could have an adverse impact on NSF's ability to demonstrate significant achievement in the future. See Chapter II for a comprehensive discussion of NSF's performance goals.

Figure 6.

Selected FY 2005 Performance Goals and Results

Strategic Outcome Goals	Results
IDEAS: Advancing the frontiers of science and engineering ensure 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 2001 ● FY 2002 ● FY 2003 ● FY 2004 ● FY 2005
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 2001 ● FY 2002 ● FY 2003 ● FY 2004 ● FY 2005
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 2001 ● FY 2002 ● FY 2003 ● FY 2004 ● FY 2005
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
Other Performance Goals	**Results**
AWARD SIZE: Increase average annualized award size for research grants to $140,000.	● FY 2001 ● FY 2002 ● FY 2003 ● FY 2004 ● FY 2005
AWARD DURATION: Increase average duration of research grants to 3 years. NSF is not successful for this goal. Progress on this goal is budget dependent. Program Directors must balance competing requirements: increasing award size, increasing duration of awards, and/or making more awards. NSF will continue to focus on increasing award size and duration, together with recovering from recent declines in success rates, as permitted within budget constraints. The performance goal was set at an approximate target level, and the deviation from that level is slight. There was no effect on overall program or activity performance.	■ FY 2001 ■ FY 2002 ■ FY 2003 ■ FY 2004 ■ FY 2005
CUSTOMER SERVICE/TIME-TO-DECISION: Inform applicants about funding decisions within 6 months of receipt for 70 percent of proposals.	■ FY 2001 ● FY 2002 ● FY 2003 ● FY 2004 ● FY 2005

KEY

● *Goal was achieved.*

■ *Goal was not achieved.*

The impact and success 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 "Smart" Bio-Nanotube:** Materials scientists working with biologists at the University of California, Santa Barbara have developed "smart" bio-nanotubes—with open or closed ends—that could be developed for drug or gene delivery applications. The nanotubes are "smart" because in the future they could be designed to encapsulate and then open up to deliver a drug or gene in a particular location in the body. The scientists found that by manipulating the electrical charges of lipid bi-layer membranes and microtubules from cells, they could create open or closed bio-nanotubes, or nanoscale capsules.

▶ **Of Microbes and Mars:** Researchers at the University of Arizona in Tucson have discovered life beneath the parched surface soil of one of the driest places on Earth—Chile's Atacama Desert. Their finding may influence how scientists look for life in a similarly extreme location—Mars. The similarities between the Atacama and Mars are striking. The surface of Mars has apparently been dry for millions or even billions of years. But the driest "absolute desert" region of the Atacama is not much moister; it rains there about once every 20 years, although no one measures it. In fact, the desiccated vista of dirt and rocks is so Mars-like that the National Aeronautics and Space Administration (NASA) uses the area as a model for the Red Planet. Despite its inhospitable qualities, a team of NSF-funded scientists has discovered microbial life about a foot below the rough terrain. This finding contradicts a previous report asserting that the Atacama's absolute desert is too dry to support life and is essentially sterile. These findings suggest that how researchers search for evidence of life on the Red Planet may affect whether they find it or not.

▶ **Really Old Bones:** A team of Indiana University anthropologists has excavated fossils of early humans in Gona, in the Afar region of Ethiopia, which they believe come from nine individuals of the species *Ardipithecus ramidus* who lived between 4.3 and 4.5 million years ago. "While biomolecular evidence helps us to date the timing of major events in the evolution of apes and humans, there is no substitute for fossils when it comes to trying to picture the anatomy and behavioral capabilities of our early relatives," notes NSF Program Officer Mark Weiss. "The late Miocene-early Pliocene is a particularly important era as it was roughly at that time that our ancestors and those of the chimpanzee parted company. Each new fossil helps to tell a bit more of the story of these early stages in human origins." Several Ethiopian dig sites have yielded hominid fossils from that time period. The Gona site was previously known for the excavation of the oldest stone tools ever discovered. Plant and animal fossils indicate that these early humans lived in a low-lying area with swamps, springs, streams, and volcanic centers, with a mosaic of woodlands and grasslands.

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. All four NSF programs that were evaluated for the FY 2005 PART process — *Individuals, Facilities, Information Technology Research, and Nanoscale Science and Engineering* — received the highest rating of "Effective." Of the more than 600 federal programs that have been evaluated by PART, only 15 percent have been rated as effective. Moreover, all of NSF's priority areas and programs under the current strategic plan that have undergone PART evaluation to date 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 Research and Development (R&D) Criteria.

Figure 7. NSF PART Evaluations Investment Category/ Priority Area	Budget Year	Result
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/budget/fy2006/pma/nsf.pdf*

NSF completed eight out of the nine PART assessment recommendations for the FY 2005 PARTs, resulting in continued high performance, as shown in the "effective" program ratings. The only remaining improvement from the FY 2005 PARTs is to strengthen project management and performance for facilities. In response, NSF achieved its goal for facilities operation for the first time in FY 2005. Since NSF did not achieve its facilities goal regarding cost and schedule in FY 2005, projects funded by the Major Research Equipment and Facilities Construction (MREFC) appropriation will be required to provide quarterly financial reporting, comparing budgeted expenditures to actual expenditures for each Work Breakdown Schedule (WBS) identified in their construction project as described in the approved Project Execution Plan. MREFC projects will also be required to provide quarterly status reports with a graph of cumulative earned value for the construction of the overall project. NSF will include language in the cooperative agreement for each MREFC awardee to be completed by the end of FY 2006.

Data Verification and Validation

For the sixth consecutive year, NSF engaged an independent, external consulting firm, IBM Business Consulting Services (IBM), to verify and validate the reported results of the agency's annual performance goals. The assessment is based on guidance established by GAO's *Guide to Assessing Agency Annual Performance Plans (GAO/GGD-10.1.20)*. IBM validated the accuracy of NSF's performance data and reported outcomes of performance goals and indicators; verified the reliability of the processes used to collect, process, maintain, and report data; reviewed system and other internal controls to confirm that quality input resulted in quality output; documented and assessed the COV process of two qualitative goals being reviewed for the first time; and

documented any changes to processes and data for those goals undergoing an updated review. IBM's final report included the following: [15]

> *Overall, we conclude that NSF continues to make a concerted effort to report its performance results accurately and has effective systems, policies, and procedures to promote data quality. NSF relies on sound business policies, internal controls, and manual checks of system queries to report performance and maintains adequate documentation of processes and data for an effective verification and validation review.*
>
> *Based on our review, we verified the adequacy of the processes and data to yield valid and reliable results for all 21 goals under review.*

About its review of the work of the AC/GPA, IBM included the following in their final report:

> *We once again verify and validate that the AC/GPA process is sufficiently robust and reliable to yield a valid conclusion on NSF's achievement in its Strategic Outcome Goals. The process involves a robust collection of performance information, reviewed qualitatively by a highly qualified and diverse Committee of science experts, with sufficient documentation and transparency to assure accountability and confidence in the AC/GPA's assessment.*
>
> *…we did assess the process NSF used to provide information and guidance to the Committee; the quality of the performance information; the Committee's qualifications and independence; and how the Committee performed its work. Based on our observations, we verify that this process is appropriate and leads to a proper determination of results by the Committee.*

Integration of Budget, Performance, and Cost

NSF's *FY 2003–2008 Strategic Plan* establishes a framework that aligns and integrates NSF's performance goals with programmatic activities and budget.[16] As shown on the Strategic Goal Structure chart (*Figure 8*), all programmatic activities are aligned to an "investment category" and one of the four strategic goals of *Ideas, Tools, People* and *Organizational Excellence*. We are able to track budgetary resources, obligations, and expenditures and identify the full cost of its programs. (See following discussion on *Organizational Excellence*, which explains the allocation of overhead to develop the full cost of programs.) In December 2004, OMB recognized our integration of budget, performance, and cost and upgraded our Budget and Performance Integration Initiative to a successful "Green" rating.

NSF's *Statement of Net Cost*[17] reports the full cost of each of the strategic goals of *Ideas, Tools,* and *People* and the ten primary programmatic activities (the "investment categories") that are associated with these three strategic goals. It is these investment categories, along with NSF's priority areas,[18] that are the primary programs that undergo OMB's PART review.

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[15] *NSF Government Performance and Results Act (GPRA) and Program Assessment Rating Tool (PART) Performance Measurement Verification and Validation, FY 2005 Final Report*, October 2005.
[16] NSF's FY 2005 and FY 2006 Budget Requests are available at www.nsf.gov/about/budget/.
[17] For a detailed discussion of the Statement of Net Cost, see Financial Statement Note 10 (page III-45).
[18] NSF's FY 2005 priority areas are: *Biocomplexity in the Environment; Nanoscale Science and Engineering; Mathematical Sciences;* and *Human and Social Dynamics.*

Figure 9 shows NSF's FY 2005 obligations for the four strategic outcome goals: $2.74 billion for *Ideas;* $1.40 billion for *Tools;* $1.06 billion for *People;* and $0.28 billion 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 10* shows the FY 2005 obligations for *Ideas, Tools,* and *People* with *Organizational Excellence* allocated to the ten investment categories by Congressional appropriation.

Figure 8.

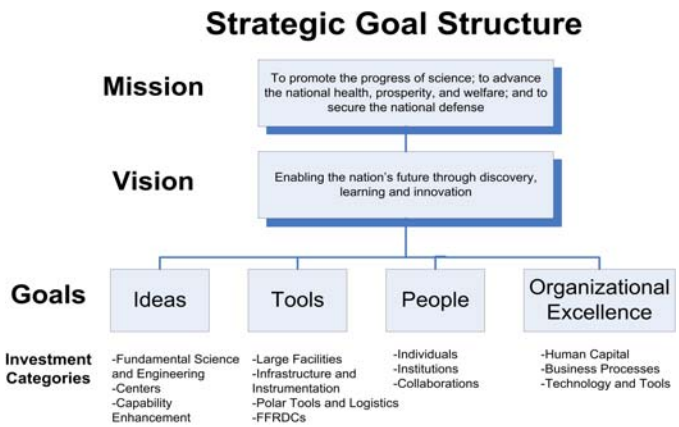
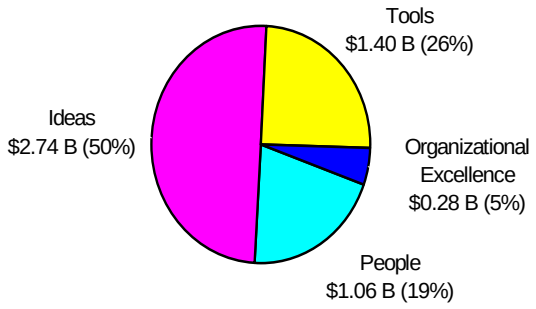


Figure 9.

FY 2005 Budget Obligations, $5.48 billion*



*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. These indirect investments are important to the attainment of the Foundation'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.

Figure 10.

FY 2005 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	2,212.9	60.5	0.0	96.9	1.6	4.4	2,376.3
Centers	238.7	0.0	0.0	10.2	0.2	0.5	249.5
Capability Enhancements	140.2	109.7	0.0	10.6	0.2	0.5	261.2
TOOLS							
Large Facilities	327.3	0.0	148.3	20.3	0.3	0.9	497.2
Infrastructure & Instrumentation	452.4	17.9	0.0	20.0	0.3	0.9	491.6
Polar Tools, Facilities & Logistics	263.4	0.0	16.9	11.9	0.2	0.5	293.0
FFRDC's	183.6	0.0	0.0	7.8	0.1	0.4	191.9
PEOPLE							
Individuals	350.1	176.7	0.0	22.4	0.4	1.0	550.6
Institutions	34.6	112.0	0.0	6.2	0.1	0.3	153.2
Collaborations	31.5	366.8	0.0	17.0	0.3	0.8	416.3
TOTAL	$4,234.8	$843.5	$165.1	$223.4	$3.6	$10.2	$5,480.8 **

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 $5,480.8M plus Donation Account ($30.3M), H1-B Nonimmigrant Petitioner Receipts ($25.9M), Reimbursable Authority ($111.8M), and appropriation with expired obligation authority in FY 2005 ($5.1M) equals total obligations incurred as shown on the Statement of Budgetary Resources ($5,653.9M).

FFRDC: Federally Funded Research and Development Centers

Totals may not add due to rounding.