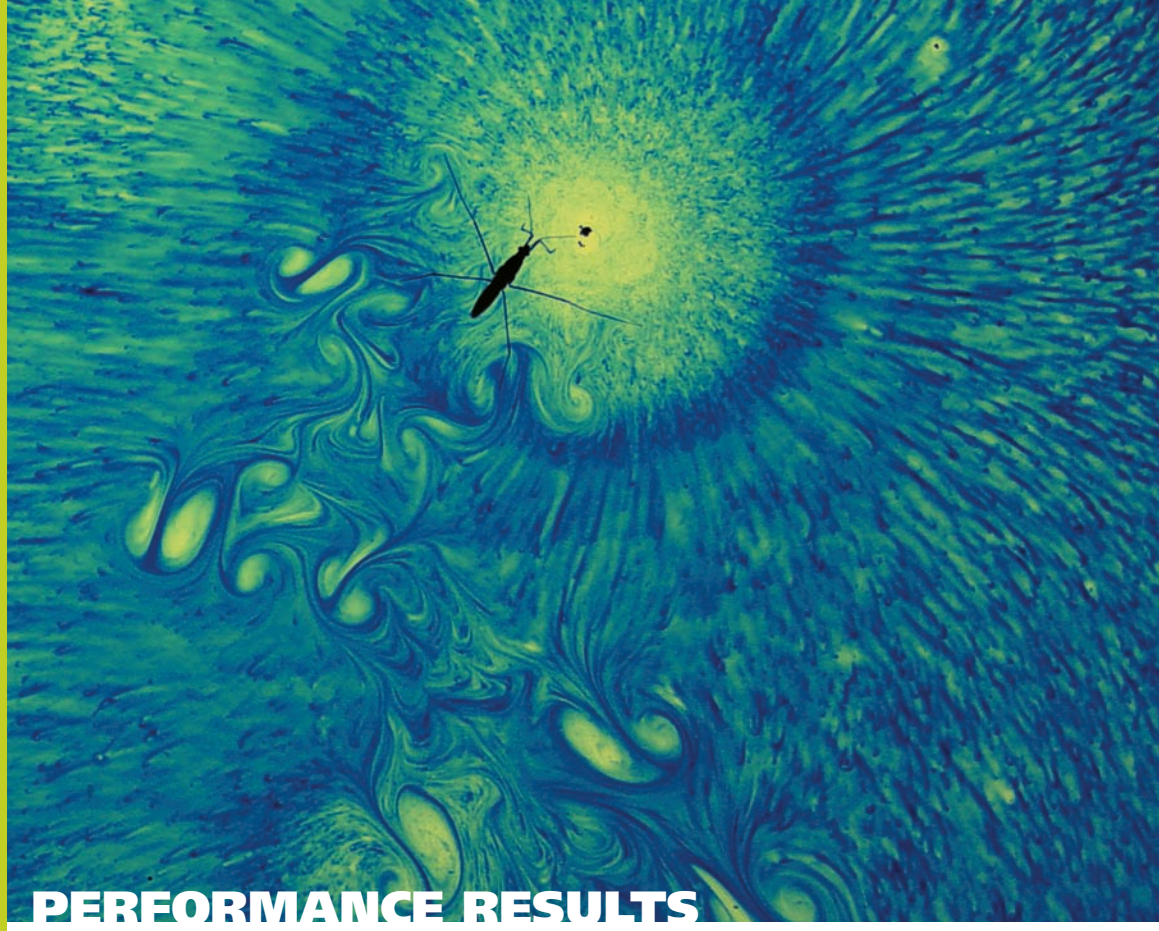


PERFORMANCE RESULTS

Right: As part of his research on fluid mechanics, John Bush, a mathematician at the Massachusetts Institute of Technology (MIT), conducted dye studies to determine the nature of the propulsion mechanism of the water strider (*Geris remigis*), a common water-walking insect. In the past, it was believed that water striders develop momentum using the tiny waves they generate as they flap their legs across the water's surface. With support from the National Science Foundation, Bush and his team of researchers used high-speed video and blue-dyed water to track the movement of water striders. Bush's studies show that the water strider propels itself by driving its central pair of legs in a sculling motion. In order for it to move, it must transfer momentum to the underlying fluid.

Fluid mechanics is responsible for most of the transport and mixing that takes place in the environment, in industrial processes, in vehicles, and in living organisms. Fluid flow of blood makes life possible by transporting oxygen, carbon dioxide, nutrients, and heat through the body. In the environment, fluid motion is responsible for moving atmospheric pollutants and smog from place to place and for weather patterns. Efficient fluid motion reduces the energy required to power aircraft, ships, and automobiles, and to pump oil through pipelines. In industrial processes, fluid mechanics often controls production rates, product uniformity, and pollutant emissions. The ultimate goal of research in fluid mechanics is to enable prediction of fluid behavior, which directly leads to better design of products such as aircraft engines, pharmaceuticals and biomedical devices, and air conditioning and ventilation systems.

Credit: John Bush, MIT

For more information:

www.nsf.gov/news/mmg/mmg_disp.cfm?med_id=51972&from=search_list

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 NSF investments.

Performance assessment at NSF is guided by the Government Performance and Results Act of 1993 (GPRA), OMB's Performance Assessment Rating Tool (PART), and *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 those goals.

NSF's Strategic Plan outlines the Foundation's programmatic framework and goal structure, which is depicted in the Strategic Goal Structure chart on page 9. NSF has 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. The Organizational Excellence goal focuses on NSF's administrative and management activities and the five PMA initiatives.

PART Evaluations

In 2002, OMB developed the PART as 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. Four NSF programs were evaluated for the 2005 assessment year: Facilities, Individuals, Information Technology and Research, and Nanoscale Science and Engineering. Each program received the highest overall rating of "Effective." All programs and priority areas under NSF's current strategic plan, including the four evaluated for the 2005 assessment year, have received the highest rating of "Effective." Of the nearly 800 federal programs that have been evaluated to date, only 15 percent have been assessed as effective. These outstanding results reflect the importance of NSF's competitive awards process in ensuring quality, relevance, and performance—all key components of the Administration's Research and Development (R&D) Investment Criteria.

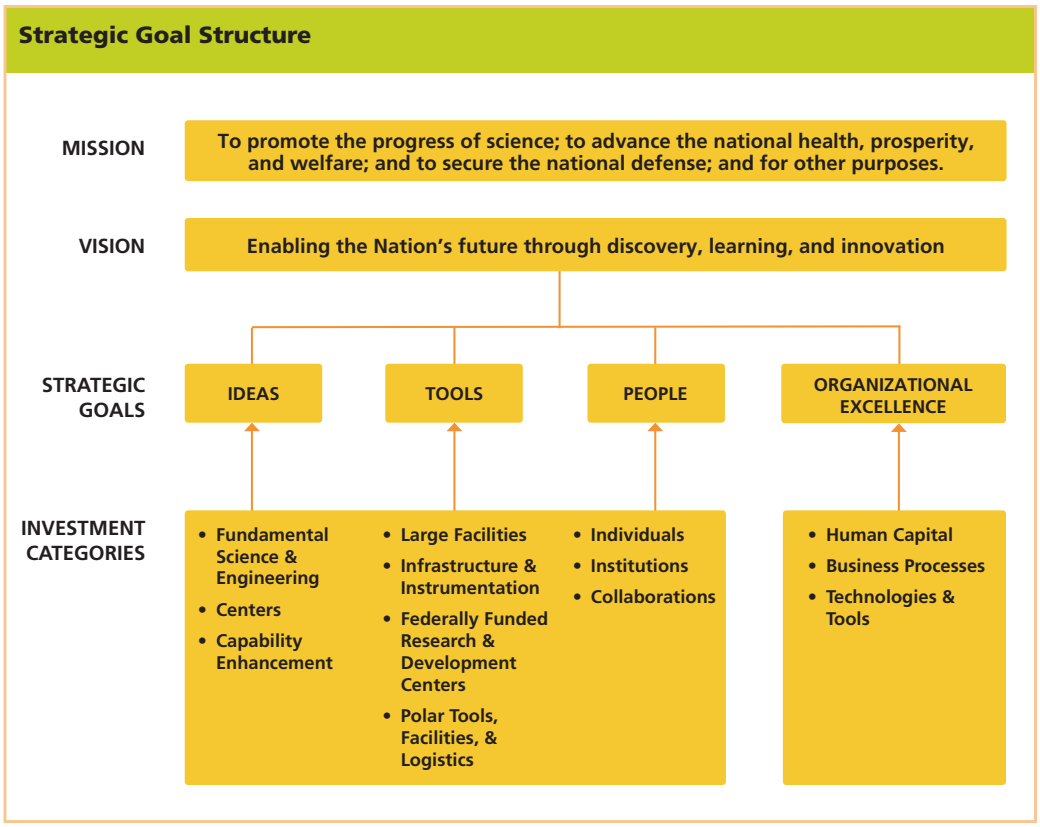
For more information:

NSF FY 2003–2008 Strategic Plan
www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04201

NSF FY 2005 Performance and Accountability Report
www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0601

President's Management Agenda
www.whitehouse.gov/results/agenda/scorecard.html

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



Assessing Long-Term Research

For NSF, linking outcomes to annual investments is difficult 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. NSF has developed an alternative OMB-approved assessment process based on external expert evaluation. The academic research community has used external expert evaluation for many years. NSF itself has used external expert panels for decades and, over time, has developed a comprehensive process for conducting external 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, provide advice for continuous improvement of performance, and ensure openness to the research and education community served by the Foundation.

COVs are responsible for evaluating one-third of NSF's programs each year. COV reports address many aspects of the Administration's R&D criteria and 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.

ROBOTS IN OPERATING ROOMS

A team of National Science Foundation-funded engineers and surgeons at Robotic Surgical Tech, Inc., have developed a robotic surgical assistant known as "Penelope." Through the use of a robotic arm, voice-recognition technology, and artificial intelligence techniques, Penelope can respond to a surgeon's request for an instrument—often by anticipating the surgeon's needs and having the instruments ready in advance. The robot can also keep track of what has been used so far, helping to ensure that nothing is accidentally left inside the patient. Penelope made its clinical debut in June 2005 at New York-Presbyterian/The Allen Pavilion, where it participated in a simple excision of a small benign cyst.

For more information:

www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=100673&org=NSF

GLOBAL BIODIVERSITY

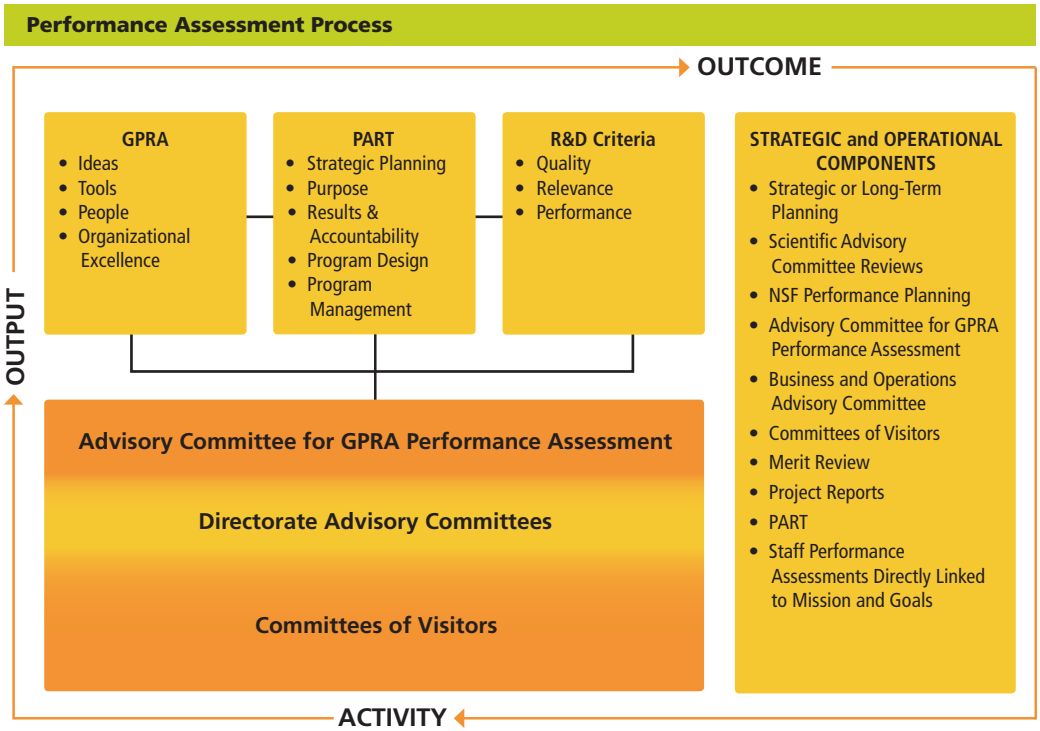
February 2004 marked the online debut of the National Science Foundation-supported Global Biodiversity Information Facility (GBIF), a database of scientific information on worldwide biodiversity. The Web portal gives access to more than 130 sources of information about the world's natural history collections, herbaria, and other databases at the click of a mouse.

Users can search the database by location, type of organism by scientific or common name, or other observational data and retrieve lists sorted by country. One important goal of the project is to digitize and make available data on organisms—often collected by researchers from developed countries—originating in developing countries, where such databases are generally scarce. In all, the GBIF provides access to more than 77 million records.

For more information:

www.gbif.org

NSF's program assessment process is depicted in the chart below.



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

FY 2005 Performance Scorecard

For FY 2005, NSF's performance goals fall into two broad areas: Strategic Outcome Goals and Other Performance Goals.

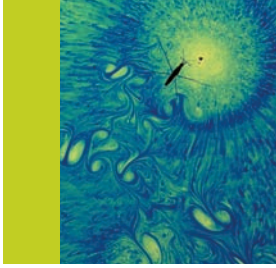
Strategic Outcome Goals focus on the long-term results of NSF grants and programs. They represent what the Foundation seeks to accomplish with its investments in science and engineering research and education. The results from NSF awards illustrate the success of the Foundation's investments. In a transparent 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.

Other Performance Goals include performance measures included in NSF's PART evaluations as well as award size, duration, and time-to-decision goals related to agency effectiveness and efficiency.

In FY 2005, NSF achieved 18 of 21 performance goals (86 percent), including all four Strategic Outcome Goals. A list of NSF's FY 2005 performance goals and results begins on the next page. For a more comprehensive discussion, see NSF's *FY 2005 Performance and Accountability Report*.

FY 2001 to FY 2005 Performance Results: Goals Achieved

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Strategic Outcome Goals	4 of 5 (80%)	4 of 4 (100%)	4 of 4 (100%)	4 of 4 (100%)	4 of 4 (100%)
Other Performance Goals	11 of 18 (61%)	14 of 19 (74%)	10 of 16 (63%)	23 of 26 (88%)	14 of 17 (82%)
TOTAL	15 of 23 (65%)	18 of 23 (78%)	14 of 20 (70%)	27 of 30 (90%)	18 of 21 (86%)



FY 2005 PERFORMANCE GOALS AND RESULTS		
PERFORMANCE AREA	**PERFORMANCE GOAL/INDICATOR**	**RESULT**
STRATEGIC OUTCOME GOAL 1: IDEAS—Discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.		
IDEAS **Strategic Outcome Goal**	NSF will demonstrate significant achievement for the majority of the following performance indicators: • Enable people who work at the forefront of discovery to make important and significant contributions to science and engineering knowledge. • Encourage collaborative research and education efforts across organizations, disciplines, sectors, and international boundaries. • Foster connections between discoveries and their use in the service of society. • Increase opportunities for underrepresented individuals and institutions to conduct high-quality, competitive research and education. • Provide leadership in identifying and developing new research and education opportunities within and across science and engineering fields. • 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. **Explanation of result:** Assessments by external experts determined that NSF has demonstrated significant achievement in each of the performance indicators associated with this goal.	
Research Award Size	Maintain the average annual size of new research grants at $140,000.	
Research Award Duration	Increase the average duration of new research grants to 3.0 years. **Explanation of result:** The FY 2005 result was 2.96 years.	
Multidisciplinary: Multi-Investigator Nanoscale Proposals	Foster collaboration among investigators in Nanoscale Science and Engineering (NS&E) by maintaining the percentage of multi-investigator NS&E proposals at 75 percent.	
Information Technology Research (ITR)	Ensure that ITR grantees are meaningfully and effectively collaborating across disciplines of science and engineering. **Performance measure:** Qualitative assessment by external experts, the ITR Committee of Visitors.	
STRATEGIC OUTCOME GOAL 2: TOOLS—Broadly accessible state-of-the-art science and engineering facilities, tools, and other infrastructure that enable discovery, learning, and innovation.		
TOOLS **Strategic Outcome Goal**	NSF will demonstrate significant achievement in the majority of the following indicators: • Expand opportunities for U.S. researchers, educators, and students at all levels to access state-of-the-art science and engineering facilities, tools, databases, and other infrastructure. • Provide leadership in the development, construction, and operation of major, next-generation facilities and other large research and education platforms. • Develop and deploy an advanced cyberinfrastructure to enable all fields of science and engineering to fully utilize state-of-the-art computation. • Provide for the collection and analysis of the scientific and technical resources of the United States and other nations to inform policy formulation and resource allocation. • Support research that advances instrument technology and leads to the development of next-generation research and education tools. **Explanation of result:** Assessment by external experts determined that NSF has demonstrated significant achievement in each of the performance indicators associated with this goal.	

FIREFLIES, NEURONS, AND THE MILLENNIUM BRIDGE

National Science Foundation-supported mathematicians have helped solve the strange case of the Millennium Bridge. This sleekly designed, pedestrian-only suspension bridge was the first new bridge constructed across London's Thames River in more than 100 years.

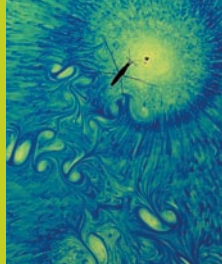
The large crowds that tried the bridge encountered swaying motions much larger than architects and engineers had anticipated or could explain. Steven Strogatz (Cornell University), Edward Ott (University of Maryland), and their collaborators in the United Kingdom and Germany recently advanced a convincing solution. Drawing on mathematical ideas originally used to describe the collective synchronization of independent biological oscillators such as fireflies and neurons, the researchers were able to explain how pedestrians were spontaneously falling into step with the bridge's small vibrations, thus amplifying those vibrations well beyond what the standard engineering analyses had predicted. Their analysis even explained the curious fact that the Millennium Bridge was steady with 150 pedestrians but swayed when foot traffic exceeded 160.

The bridge was closed for several months after the June 2001 opening while experiments were conducted and dampers were installed between the bridge deck and the supporting piers to tame side-to-side motion. The refitted bridge is now a model of stability and has become a well-used landmark.

For more information:

www.news.cornell.edu/stories/Nov05/Strogatz.millennium.lg.html

FY 2005 PERFORMANCE GOALS AND RESULTS		
PERFORMANCE AREA	**PERFORMANCE GOAL/INDICATOR**	**RESULT**
Construction and Upgrading of Facilities	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:** In FY 2005, 79 percent of facilities (15 of 19) achieved this goal.	🔴
Operation and Management of Facilities	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.	🟢
Nanotechnology Network Users	Support at least 4,000 users of the National Nanofabrication Users Network/National Nanotechnology Infrastructure Network (NNUN/NNIN) and the Network for Computational Nanotechnology sites.	🟢
NNIN Nodes	Support the national nanotechnology infrastructure by maintaining at least 14 National Nanotechnology Infrastructure Network nodes.	🟢
Information Technology Research (ITR)	Support significant research on software design and quality; scalable information infrastructure, high-end computing, and the socio-economic impacts of information technology. Also, support IT workforce development. **Explanation of result:** According to the ITR Committee of Visitors report, NSF achieved this goal.	🟢
STRATEGIC OUTCOME GOAL 3: PEOPLE—A diverse, competitive, and globally engaged U.S. workforce of scientists, engineers, technologists, and well-informed citizens.		
PEOPLE **Strategic Outcome Goal**	NSF will demonstrate significant achievement in the majority of the following performance indicators: • Promote greater diversity in the science and engineering workforce through increased participation of underrepresented groups in NSF activities. • 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. • Develop the Nation's capability to provide K–12 and higher education faculty with opportunities for continuous learning and career development in science, technology, engineering, and mathematics. • Promote public understanding and appreciation of science, technology, engineering, and mathematics and build bridges between formal and informal science education. • Support innovative research on learning, teaching, and education that provides a scientific basis for improving science, technology, engineering, and mathematics education at all levels. **Explanation of result:** Assessment by external experts determined that NSF has demonstrated significant achievement for a majority of the performance indicators associated with this goal.	🟢
U.S. Students Receiving Fellowships	Increase the number of recipients of Graduate Research Fellowships (GRF), Integrative Graduate Education and Research Traineeships, or Graduate Teaching Fellows in K–12 Education from 3,681 in FY 2004 to 4,600 in FY 2005.	🟢



FY 2005 PERFORMANCE GOALS AND RESULTS		
PERFORMANCE AREA	**PERFORMANCE GOAL/INDICATOR**	**RESULT**
Graduate Fellowships: Broadening Participation	Increase the number of GRF applicants from groups that are underrepresented in the science and engineering workforce from the FY 2004 level of 1,099.	
CAREER Award: Broadening Participation	Increase the number of applicants for CAREER (Faculty Early Career Development) awards from minority-serving institutions from the FY 2004 level of 82.	
Nanoscale Proposals with Female Principal Investigators	Ensure that at least 25 percent of the Nanoscale Science and Engineering proposals include at least one female principal investigator (PI) or co-PI.	
Nanoscale Proposals with Minority Investigators	Increase the percentage of NS&E proposals with at least one minority principal or co-principal investigator from the FY 2004 level of 12 percent to 13 percent. (Minority is defined as Hispanic/Latino, African American, Native Hawaiian and other Pacific Islander, and American Indian and Alaska Native.) **Explanation of result:** NSF was not successful for this goal. We will continue our efforts to encourage minorities to submit proposals to this area. The performance goal was set at an approximate target level, and the deviation from that level is slight. The result had no effect on overall program or activity performance.	
STRATEGIC OUTCOME GOAL 4: ORGANIZATIONAL EXCELLENCE—An agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices.		
ORGANIZATIONAL EXCELLENCE **Strategic Outcome Goal**	NSF will demonstrate significant achievement in the majority of the following performance indicators: • Operate a credible, efficient merit review system. • Utilize and sustain broad access to new and emerging technologies for business application. • Develop a diverse, capable, motivated staff that operates with efficiency and integrity. • 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.	
Time-to-decision	For 70 percent of proposals, inform applicants about funding decisions within 6 months of deadline or target date, or receipt of data, whichever is later.	
Time-to-decision: Nanoscale Science and Engineering	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 date, while maintaining a credible and efficient competitive merit review system.	
Time-to-decision: Individuals	For 70 percent of proposals submitted to the Individuals Program, inform applicants about funding decisions within 6 months of proposal receipt or deadline date, while maintaining a credible and efficient competitive merit review system.	