

**Right:** Peering backward in time to an instant after the big bang, physicists at the University of Wisconsin-Madison have devised an approach that may help unlock the hidden shapes of alternate dimensions of the universe. A new study demonstrates that the shapes of extra dimensions can be “seen” by deciphering their influence on cosmic energy released by the violent birth of the universe 13 billion years ago. The method provides evidence that physicists can use experimental data to discern the nature of these elusive dimensions—the existence of which is a critical but as yet unproven element of string theory, the leading contender for a unified “theory of everything.” Scientists developed string theory, which proposes that everything in the universe is made of tiny, vibrating strings of energy, to encompass the physical principles of all objects from immense galaxies to subatomic particles. Though currently the front-runner to explain the framework of the cosmos, the theory remains, to date, untested. The image at right shows the surface of a cross-section of a six-dimensional object which is a likely candidate of the shape of the six hidden dimensions of space that must exist in addition to four-dimensional space-time.



## MEASURING PERFORMANCE

**For more information:**

[www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=110195&org=NSF&from=newsField](http://www.nsf.gov/news/news_summ.jsp?cntn_id=110195&org=NSF&from=newsField)

**For more information:**

*NSF Investing in America's Future: Strategic Plan FY 2006–2011*  
[www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=nsf0648](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0648)

*NSF Research Highlights and Discoveries*  
[www.nsf.gov/discoveries/](http://www.nsf.gov/discoveries/)

*NSF's FY 2009 Budget Request to Congress*  
[www.nsf.gov/about/budget/](http://www.nsf.gov/about/budget/)

*Program Assessment Rating Tool (PART)*  
[www.ExpectMore.gov](http://www.ExpectMore.gov)

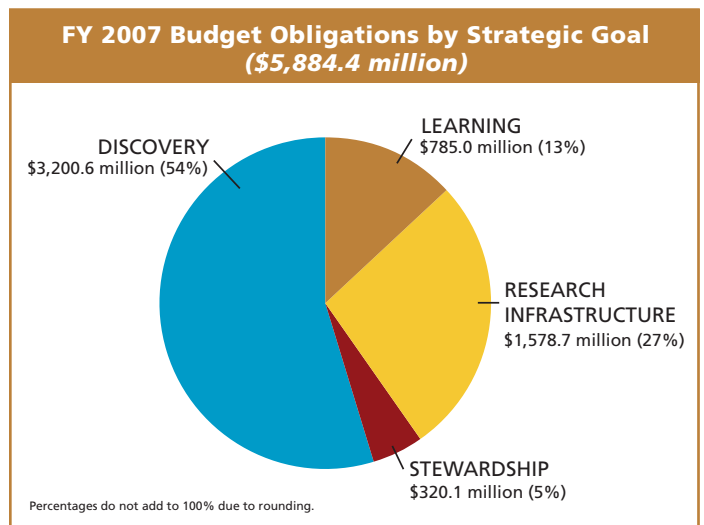
*e-Gov and the Grants Management Line of Business initiative*  
[www.whitehouse.gov/omb/egov/](http://www.whitehouse.gov/omb/egov/)

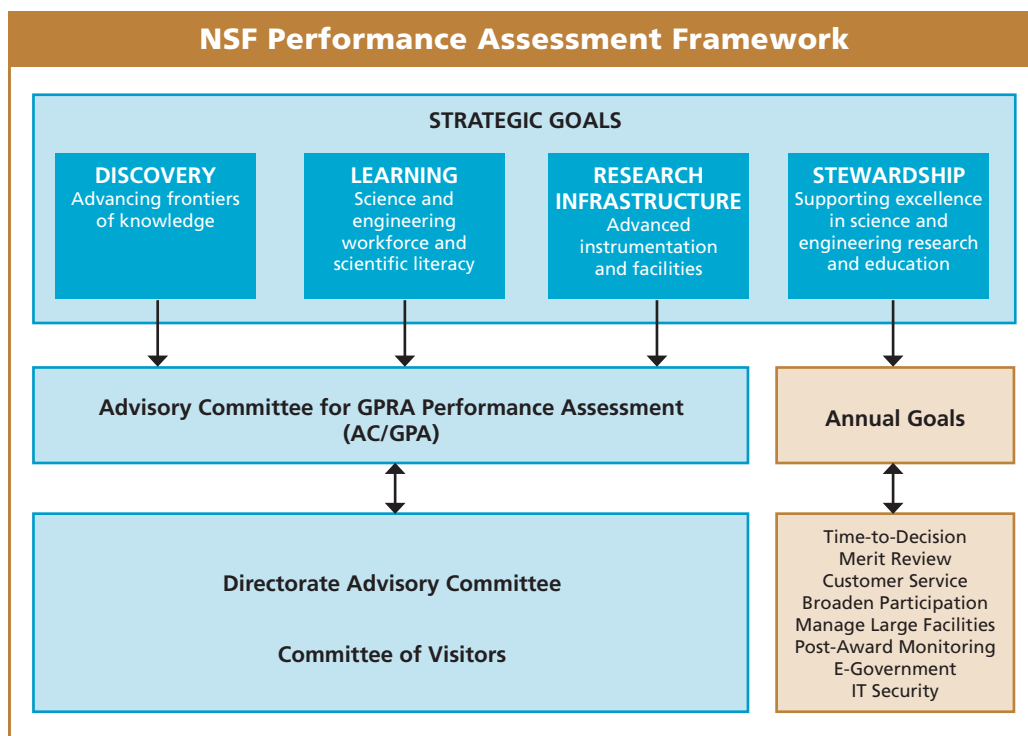
*FY 2007 Report from the Advisory Committee on GPRA Performance Assessment*  
[www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=nsf07207](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf07207)

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 investments. In FY 2007, performance assessment was guided by the Government Performance and Results Act of 1993 (GPRA) and by NSF's *FY 2006–2011 Strategic Plan*. GPRA requires agencies to develop a strategic plan, establish annual performance goals, and report annually on the progress made toward achieving those goals.

NSF's *FY 2006–2011 Strategic Plan* outlines the strategic outcome goals by which NSF measures its annual performance: *Discovery*, *Learning*, *Research Infrastructure*, and *Stewardship*. These four interrelated goals—shown in NSF's Performance Assessment Framework on the opposite page—establish an integrated strategy to deliver new knowledge at the frontiers, meet vital national needs, and work to achieve the NSF vision. The first three goals focus on NSF's long-term investments in science and engineering research and education. The fourth goal—*Stewardship*—is an internally focused goal that emphasizes management of the investment process.

This chart shows NSF's budget by strategic goal. In FY 2007, NSF invested \$3,200.6 million to foster research that will advance the frontiers of knowledge (*Discovery*), \$785.0 million to support activities to cultivate a world-class science and engineering workforce (*Learning*), and \$1,578.7 million to build the nation's research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure, and experimental tools (*Research Infrastructure*). Just over 5 percent of NSF's budget supports administration and management activities (*Stewardship*).





## Assessment Framework

The assessment framework shown above allows NSF to gather meaningful information on performance while also recognizing the inherent limits to assessing long-term investments in basic research. This framework accounts for the fact that outcomes from basic research are unpredictable and difficult to measure, with impacts often emerging many years after the research was conducted. NSF has developed an assessment approach that relies on retrospective reviews by external experts, in keeping with the recommendations from the 2001 National Academies report, *Implementing the Government Performance and Results Act for Research: A Status Report*.

The Advisory Committee for GPRA Performance Assessment (AC/GPA) leads the assessment of NSF's three externally-facing goals of *Discovery*, *Learning*, and *Research Infrastructure*. Assessment of the *Stewardship* goal is based on a set of annual goals and milestones that address administration, management, and customer service activities.

The work of the AC/GPA is integrated with other external review processes at NSF, notably the agency's Advisory Committees and Committees of Visitors (COVs). The Foundation relies on these reviews to maintain its high standards of program management, to provide continuous improvement of performance, and to ensure openness to the research and education community served by the Foundation. COVs are responsible for evaluating and reporting on one-third of NSF's programs every year.

## FY 2007 Results

For the seventh consecutive year, NSF achieved all of its annual strategic goals. In assessing outcomes, the AC/GPA reviewed over 1,100 outstanding accomplishments compiled by NSF program officers, as well as award abstracts, investigator project reports, and COV reports. The committee determined that during FY 2007, NSF made significant achievements in the *Discovery*, *Learning*, and *Research Infrastructure* goals. Moreover, the committee's assessment process was itself reviewed and validated by an independent, external management consulting firm. Some of the results reported by NSF-funded researchers in FY 2007 appear throughout this report.

## PERFORMANCE REPORT

NSF's FY 2007 Government Performance and Results Act (GPRA) performance report includes a more detailed discussion of NSF's performance evaluation framework, performance assessment process, use of the Administration's research and development criteria, extensive data verification and validation process, trend data, results of Program Assessment Rating Tool (PART)-related goals, as well as other performance-related information. NSF's FY 2007 GPRA performance report is integrated with the agency's *FY 2009 Budget Request to Congress* and is available at [www.nsf.gov/about/budget/](http://www.nsf.gov/about/budget/).

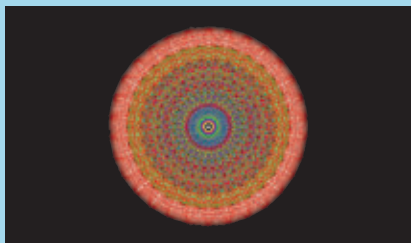
## EARLY CANCER DETECTION

New optical technology developed by an NSF-funded biomedical engineer at Northwestern University has proven effective in the early detection of colon cancer and may also hold promise for detecting pancreatic cancer, the fourth most common cause of cancer deaths in the United States. Known as a silent killer with no method of early detection, pancreatic cancer spreads rapidly and seldom is detected in its early stages.

In a pilot study of 51 patients, the research team found they could detect both early- and advanced-stage pancreatic cancer without touching or imaging the pancreas. The extraordinarily sensitive technique, which is minimally invasive and takes advantage of certain light-scattering effects, can detect abnormal changes in cells lining the duodenum even though the cells appear normal when examined with a conventional microscope.

For more information:  
[www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=109926](http://www.nsf.gov/news/news_summ.jsp?cntn_id=109926)

## MATHEMATICAL SOLUTION FOR ANOTHER DIMENSION



Ever since 1887, when Norwegian mathematician Sophus Lie discovered the mathematical group called E8, researchers have been trying to understand the extraordinarily complex object described by a numerical matrix of more than 400,000 rows and columns. Now, an international team of experts funded by NSF and the American Institute of Mathematics has mapped E8 using powerful computers and programming techniques. This feat is the numerical equivalent of mapping the human genome and will pave the way for breakthroughs in a wide range of problems in geometry, number theory, and the physics of string theory. Because of its size and complexity, the E8 calculation ultimately took about 77 hours on the supercomputer Sage and created a file 60 gigabytes in size. For comparison, the human genome is less than a gigabyte in size. In fact, if written out on paper in a small font, the E8 answer would cover an area the size of Manhattan.

For more information:  
[www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=108482&org=NSF&from=news](http://www.nsf.gov/news/news_summ.jsp?cntn_id=108482&org=NSF&from=news)

Under the *Stewardship* goal, NSF fully achieved seven of the eight annual goals for FY 2007, with partial achievement for the remaining goal (management of large facilities). These results were presented and discussed at the November 2007 meeting of the NSF Advisory Committee for Business and Operations.

### FY 2007 Strategic Outcome Goals and Results

		Result
<b>DISCOVERY</b>	<p>Foster research that will advance the frontiers of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the nation as a global leader in fundamental and transformational science and engineering.</p>	<p>Investments in <i>Discovery</i> support cutting-edge research that yields new and important discoveries and promotes the development of new knowledge and techniques within and across traditional boundaries. These investments enable NSF to meet its mission of promoting the progress of science while at the same time helping to maintain the nation's capacity to excel in science and engineering, particularly in academic institutions. The results of NSF-funded research projects provide a rich foundation for broad and useful applications of knowledge and the development of new technologies. Support in this area also promotes the education and training of the next generation of scientists and engineers by providing them with an opportunity to participate in discovery-oriented projects.</p> <p><b>Explanation of result:</b> Assessments by external experts determined that NSF has demonstrated significant achievement of this goal. The assessment process was verified and validated by an external, independent consultant. Results reported in FY 2007 by NSF-funded researchers are featured throughout this report; additional results can be found at <a href="http://www.nsf.gov/discoveries">www.nsf.gov/discoveries</a>.</p>
		<p>Leadership in today's knowledge economy requires world-class scientists and engineers and a national workforce that is scientifically, technically, and mathematically strong. Investments in <i>Learning</i> aim to improve the quality and reach of science, engineering, and mathematics education and enhance student achievement. Each year, NSF supports an estimated 190,000 people—teachers, students, and researchers at every educational level and across all disciplines in science and engineering. Embedded in all NSF programs are efforts to build a more inclusive, knowledgeable, and globally-engaged workforce that fully reflects the strength of the nation's diverse population. Because science and engineering increasingly address global questions of significant societal importance, today's research requires globally-engaged investigators working collaboratively across agencies and international organizations to apply the results of research to long-standing global challenges.</p> <p><b>Explanation of result:</b> Assessments by external experts determined that NSF has demonstrated significant achievement of this goal. The assessment process was verified and validated by an external, independent consultant. Results reported in FY 2007 by NSF-funded researchers are featured throughout this report; additional results can be found at <a href="http://www.nsf.gov/discoveries">www.nsf.gov/discoveries</a>.</p>
<b>DISCOVERY</b>		<p>FY 2004 ●</p> <p>FY 2005 ●</p> <p>FY 2006 ●</p> <p>FY 2007 ●</p>
<b>LEARNING</b>		<p>FY 2004 ●</p> <p>FY 2005 ●</p> <p>FY 2006 ●</p> <p>FY 2007 ●</p>

- Indicates successful achievement.
- Indicates partial achievement.
- ▲ Indicates not achieved.



FY 2007 Strategic Outcome Goals and Results		Result
<p><b>RESEARCH INFRASTRUCTURE</b></p> <p>Build the nation’s research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure, and experimental tools.</p>	<p>NSF investments in <i>Research Infrastructure</i> provide state-of-the-art tools for research and education, such as multi-user research facilities, distributed instrumentation networks and arrays, accelerators, telescopes, research vessels, aircraft, and earthquake simulators. In addition, investments in Internet-based and distributed user facilities are increasing as a result of rapid advances in computer, information, and communication technologies. NSF support for large multi-user facilities helps create state-of-the-art, world-class research platforms vital to new discoveries and the progress of research. NSF support may include construction, upgrades, operations, maintenance, and personnel needed to assist scientists and engineers in the conduct of research at such facilities. NSF consults with other agencies and international partners to avoid duplication and optimize capabilities for U.S. researchers.</p> <p><b>Explanation of result:</b> Assessments by external experts determined that NSF has demonstrated significant achievement of this goal. The assessment process was verified and validated by an external, independent consultant. Results reported in FY 2007 by NSF-funded researchers are featured throughout this report. Additional results can be found at <a href="http://www.nsf.gov/discoveries">www.nsf.gov/discoveries</a>.</p>	<p>FY 2004 ●</p> <p>FY 2005 ●</p> <p>FY 2006 ●</p> <p>FY 2007 ●</p>
<p><b>STEWARDSHIP</b></p> <p>Support excellence in science and engineering research and education through a capable and responsive organization.</p>		<p>●</p>
<p>1. Time-to-Decision</p>	<p>For 70 percent of proposals, inform applicants whether their proposals have been declined or recommended for funding within six months of deadline or target date or of receipt date, whichever is later.</p>	<p>FY 2004 ●</p> <p>FY 2005 ●</p> <p>FY 2006 ●</p> <p>FY 2007 ●</p>
<p>● Indicates successful achievement.            ■ Indicates partial achievement.            ▲ Indicates not achieved.</p>		

### PART ASSESSMENTS

In 2002, OMB developed the Program Assessment Rating Tool (PART) as a systematic methodology for assessing the performance of program activities across the federal government. A PART evaluation focuses on program purpose and design, strategic planning, program management, and program results and accountability. PART is an important component of NSF’s performance activities. PART performance measures and action plans have provided valuable tools for program assessment and for improving program performance and management. To date, OMB has completed more than 1,000 PART assessments, representing 98 percent of all federal programs; of those, only 18 percent received the highest rating of “Effective.” All NSF programs assessed to date received an effective rating, with one additional assessment slated for completion in FY 2008.

OCEAN HEALTH



With support from NSF, an international group of ecologists and economists has shown that the loss of biodiversity is profoundly reducing the ocean's ability to produce seafood, resist diseases, filter pollutants, and rebound from stresses such as overfishing and climate change. The study reveals that every species lost causes a faster unraveling of the overall ecosystem. Conversely, every species recovered adds significantly to overall productivity and stability of the ecosystem and its ability to withstand stresses. The 4-year analysis is the first to examine all existing data on ocean species and ecosystems, synthesizing historical, experimental, fisheries, and observational data sets to understand the importance of biodiversity at the global scale. Examination of protected areas worldwide shows that restoration of biodiversity increased productivity four-fold in terms of catch per unit effort and made ecosystems 21 percent less susceptible to environmental and human-caused fluctuations on average. The buffering impact of species diversity also generates long-term insurance values that must be incorporated into future economic valuation and management decisions.

For more information:  
[www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=108149](http://www.nsf.gov/news/news_summ.jsp?cntn_id=108149)









A NEW WINDOW INTO THE EYE

In work that could improve diagnoses of many eye diseases, NSF-funded researchers at the Massachusetts Institute of Technology have developed a new type of laser for taking high-resolution, three-dimensional images of the retina, the part of the eye that converts light to electrical signals that travel to the brain. The new imaging system is based on Optical Coherence Tomography (OCT), which uses light to obtain high-resolution, cross-sectional images of the eye to visualize subtle changes that occur in retinal disease. Future clinical studies, as well as further development, may someday enable ophthalmologists to routinely obtain "OCT snapshots" of the eye, containing comprehensive volumetric information about the microstructure of the retina. Such snapshots could potentially improve diagnoses of retinal diseases such as diabetic retinopathy, glaucoma, and age-related macular degeneration.

For more information:  
<http://web.mit.edu/newsoffice/2007/eye-imaging.html>

FY 2007 Strategic Outcome Goals and Results		Result
<b>STEWARDSHIP</b> <i>(continued)</i>		
2. Merit Review (New in FY 2007)	<p>Improve the transparency of decisions and the quality of the merit review process.</p> <p>NSF's performance is successful when a majority of the following milestones are achieved:</p> <ul style="list-style-type: none"> <li>• Develop methods or metrics to assess the transparency and quality of the merit review process.</li> <li>• Provide a written context statement to the Principal Investigator (PI) that describes the process by which the proposal was reviewed and the context of the decision (such as the number of proposals and awards, information about budget availability, and considerations in portfolio balancing).                      FY 2007 Target: 95 percent                      FY 2007 Result: 95 percent</li> <li>• Develop a website to identify and disseminate effective merit review practices.</li> <li>• Ensure that the Program Management Seminar includes case studies on how to implement an effective merit review process.</li> <li>• Include a section on training and mentoring of program officers in the annual Merit Review Report to the National Science Board.</li> </ul>	●
3. Customer Service (New in FY 2007)	<p>Improve customer service to the science, engineering, and education communities.</p> <p>NSF's performance is successful when the following milestones are achieved:</p> <ul style="list-style-type: none"> <li>• Conduct a survey of investigators on the proposal submission and review processes, targeting those who have submitted proposals to NSF. Gather data on such factors as (1) drivers that increase proposal submissions, (2) PI perceptions regarding success rates, (3) impacts on the PI and reviewer community of increasing proposal submission rates, and (4) trends in customer satisfaction.</li> <li>• Analyze the survey results for directions in improving customer service in order to implement selected recommendations in FY 2008.</li> </ul>	●
4. Broaden Participation (New in FY 2007)	<p>Expand efforts to increase participation by underrepresented groups and diverse institutions throughout the United States in all NSF activities and programs.</p> <p>NSF's performance is successful when the following milestones are achieved:</p> <ul style="list-style-type: none"> <li>• Develop a plan to increase participation in NSF programs by underrepresented groups, which includes defining existing baseline data.</li> <li>• Develop a plan to broaden the pool of reviewers for NSF proposals.</li> </ul>	●
<p>● Indicates successful achievement.                  ● Indicates partial achievement.                  ▲ Indicates not achieved.</p>		



FY 2007 Strategic Outcome Goals and Results		Result
<b>STEWARDSHIP</b> <i>(continued)</i>		
5. Management of Large Facilities (New in FY 2007)	<p>Ensure the efficient and effective management of the construction and operation of large facilities.</p> <p>NSF's performance is successful when the following milestones are achieved:</p> <ul style="list-style-type: none"> <li>• For construction projects funded by the Major Research Equipment and Facilities Construction appropriation, keep negative cost and schedule variance to less than 10 percent. [Note: The Scientific Ocean Drilling Vessel (SODV) did not achieve its construction schedule; NSF program staff will continue to work with the project managers to monitor the SODV construction schedule.]</li> <li>• For facilities in the operational phase, keep operating time lost to less than 10 percent for 90 percent of those facilities.</li> </ul>	          
6. Post-Award Monitoring (New in FY 2007)	<p>Fully implement NSF's program of post-award financial and administrative monitoring, in order to test the risk-based identification model against the mitigation strategy of increasing methods of oversight.</p> <p>NSF's performance is successful when a majority of the following milestones are achieved:</p> <ul style="list-style-type: none"> <li>• Apply the risk assessment results to develop the FY 2007 monitoring plan (on-site visits, desk reviews, and Financial Cash Transaction Report (FCTR) sampling efforts).</li> <li>• Complete 95 percent of projected FY 2007 on-site monitoring visits by the end of FY 2007.</li> <li>• Complete 95 percent of projected FY 2007 desk reviews by the end of FY 2007.</li> <li>• Complete 95 percent of projected FY 2007 FCTR transaction testing by the end of FY 2007.</li> </ul>	
7. E-Government (New in FY 2007)	<p>Establish an E-Government Implementation Plan.</p> <p>NSF's performance is successful when the following milestones are achieved:</p> <ul style="list-style-type: none"> <li>• Achieve 90 percent of major E-Government Plan implementation milestones.</li> <li>• Post 100 percent of discretionary grants applications on Grants.gov as specified in NSF Ramp-Up Plan.</li> </ul>	
8. Information Technology (IT) Security (New in FY 2007)	<p>Conduct a successful Federal Information Security Management Act IT Program Review.</p> <p>NSF's performance is successful when a majority of the following milestones are achieved:</p> <ul style="list-style-type: none"> <li>• Ensure major applications and general support systems certification and accreditations are current and up to date.</li> <li>• Ensure that 96 percent or more of IT systems are installed in accordance with security configurations.</li> <li>• Ensure that 90 percent or more of applicable systems have Privacy Impact Assessments.</li> </ul>	
 Indicates successful achievement.  Indicates partial achievement.  Indicates not achieved.		