NSF

## Statutory Mission:

To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

## Vision:

Enabling the Nation's future through discovery, learning, and innovation. Realizing the promise of the 21st century depends in large measure on today's investments in science, engineering, and mathematics research and education. NSF's investment—in people, in their ideas, and in the tools they use—will catalyze the strong progress in science and engineering needed to secure the Nation's future.

# A MESSAGE FROM THE DIRECTOR

> "Science and engineering are at the heart of the 21st century. New knowledge is a powerful driver of economic prosperity and a force for human progress. That makes new knowledge the most sought after prize in the world."
>
> **Rita R. Colwell**

February 2002

It is my pleasure to introduce the National Science Foundation's *FY 2001 Management and Performance Highlights*, the first of what we expect to be an annual report. This overview is intended to capture our core business priorities and accomplishments of the past year. I am particularly proud that this year we have been singled out by the Director of the Office of Management and Budget as "a true center of excellence…for reaching for real results and measuring and attaining those results…." It is a challenge to sustain that praise, one we take seriously and proudly.

Every year, for more than half a century, the Foundation's far-sighted investments continue to enrich Americans' health, security, environment, economy, and general quality of life. And every year, the Foundation's optimal use of limited public funds relies on two conditions: ensuring that NSF's investments are aimed—and continuously re-aimed—at the frontiers of understanding; and that they go to competitive, merit-reviewed, and time-limited awards with clear criteria for success. When these two conditions are met, our Nation gets the most intellectual and economic leverage from its investments in research and education.

In the aftermath of the terrorist attacks on September 11, the stakes for our investments could not be higher. The future of America—indeed the future of the world—is more dependent upon advances in science and technology than ever before. An inspired scientific community is focused on ensuring not just our security, but also our very quality of life. We well remember that our national

security includes the condition of our spirit as much as the size of our arsenal, and we are heartened by the echo of President Franklin D. Roosevelt's words in his secret letter to Robert Oppenheimer in 1943: "Whatever the enemy may be planning, American science will be equal to the challenge."

We have always reached our distant horizons, and set out for new ones in our restless quest for knowledge. The Foundation's investments are essential to our national strategy for attaining our overarching national goals. It is impossible to predict which areas of science and engineering will yield groundbreaking discoveries, what those discoveries will be, or how they will impact other disciplines and, eventually, our daily lives.

Who can be sure what will be needed to maintain our national security and our strong economy, to clean up the environment, and to develop a healthier and better-educated citizenry? What the National Science Foundation can ensure is that the United States remains at the forefront of scientific capability by sustaining our investments in basic research and education, thereby enhancing our ability to shape a more prosperous and secure future for ourselves, our children, and future generations.

Rita R. Colwell
Director

For a more detailed discussion of NSF's FY 2001 management and performance accomplishments, see our *FY 2001 Accountability Report* at www.nsf.gov/bfa and our *FY 2001 GPRA Performance Report* at www.nsf.gov/od/gpra.

When completed, the Large Hadron Collider (LHC), currently under construction at the CERN Laboratory in Geneva, Switzerland, will be the world's most powerful high energy physics accelerator. Research at the LHC is expected to lead to a new understanding of science at the smallest scales ever investigated. For example, it will enable a search for particles, predicted by a powerful theoretical framework known as supersymmetry, which will provide clues to how the four known fundamental forces of nature evolved from different aspects of the same "unified" force in the early universe. The LHC project is a large, complex, and expensive instrumentation project that involves the collaboration of an international consortium of more than twenty-five nations. The total estimated cost of the project is $6 billion, of which NSF is contributing $81 million. The NSF contribution supports the construction of components for the ATLAS and CMS detectors, two of the four detection devices that are being built for the LHC and the largest particle physics detectors ever constructed. LHC construction began in 1999 and is expected to be completed in 2006. In this photo, the outer shell of the vacuum tank has been welded and inserted into the central yoke of the CMS detector.


# EXPANDING FRONTIERS

For more than fifty years, the National Science Foundation (NSF) has been the steward of America's science and engineering enterprise. Although NSF represents only 4 percent of the total federal budget for research and development, it accounts for one-fifth of all federal support for basic research and 40 percent of support for basic research at academic institutions, excluding the life sciences. Despite its small size, NSF has an extraordinary impact on scientific and engineering knowledge and capacity.

During NSF's five decades of leadership, groundbreaking advances in knowledge have reshaped society and enabled the United States to become the most productive nation in history. The returns on NSF's strategic investments in science, engineering, and mathematics research and education have been enormous. Much of the sustained economic prosperity America has enjoyed over the past decade is the result of technological innovation—innovation made possible, in large part, by NSF support.

Realizing the promise of the 21st century will depend in great measure on the investments that NSF makes in the years to come. The events of September 11 demonstrated that we live in a society defined by and dependent on science and technology. Solutions to the problems arising in the aftermath of those tragic events—airline security, bioterrorism, failure of communication links, threats to our food and water supplies, and damage to the nation's infrastructure—depend on scientific and technical knowledge. There has been no other time in the postwar period when NSF's investments to catalyze progress in science and engineering have been more critical to securing our future.

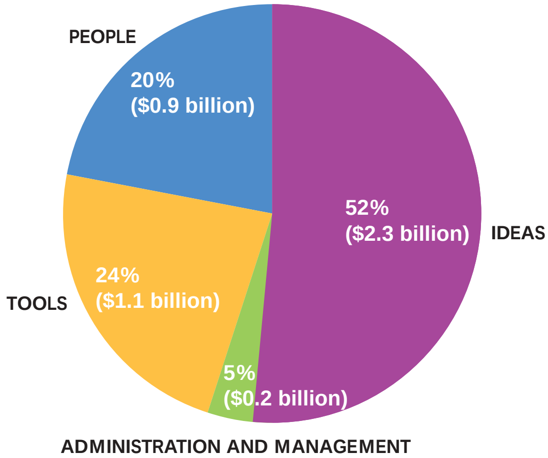
## People. Ideas. Tools.

To promote the progress of science, NSF invests in three strategic areas.

People: Facilitating the creation of a diverse, internationally competitive, and globally engaged workforce of scientists and engineers and well-prepared citizens is NSF's first priority. To achieve this goal, NSF supports improvement efforts in formal and informal science, mathematics, engineering, and technology education. Across its science, mathematics, engineering, and technology research and education programs, NSF works to enhance the diversity of our science and engineering workforce. The Foundation provides support for almost 200,000 people, including students, teachers, researchers, post-doctorates, and trainees.

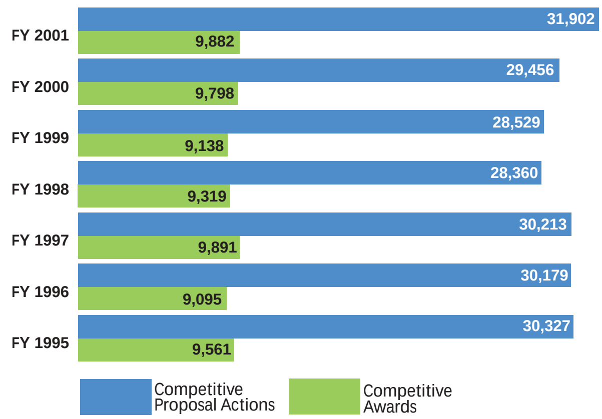
Ideas: Investments in ideas support cutting edge research and education that yield new and important discoveries and promote the development of new knowledge and techniques within and across traditional boundaries. These investments help maintain America's academic institutions at the forefront of science and engineering. The results of NSF-funded projects provide a rich foundation for broad and useful applications of knowledge and development of new technologies. Support for ideas also promotes the education and training of the next generation of scientists and engineers.

### FY 2001 BUDGET
$4.46 BILLION




In FY 2001, NSF invested half of its $4.46 billion budget in ideas, and almost that much in people and tools. Only 5 percent of the Foundation's total budget is allocated to administration and management.

### NUMBER OF COMPETITIVE PROPOSALS AND AWARDS




NSF funds about one in three proposals each year.

Tools: NSF investments provide state-of-the-art tools for research and education, including instrumentation and equipment, multiuser facilities, digital libraries, research resources, accelerators, telescopes, research vessels and aircraft, and earthquake simulators. These tools also include large surveys and databases as well as computation and computing infrastructure for all fields of science, engineering, and education. Support for these unique national facilities is essential to advancing U.S. research and education.

# A Catalyst for Innovation

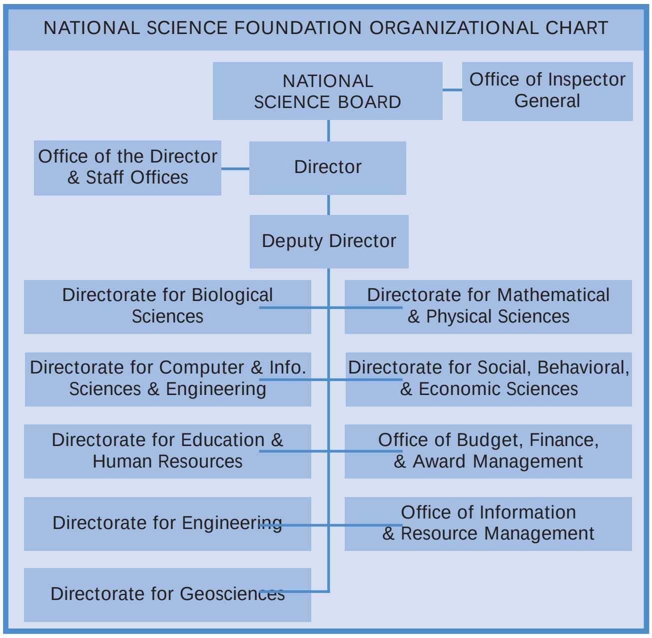
NSF does not conduct research or operate laboratories. Instead, the Foundation is a catalyst—seeking out and funding the best ideas and most capable people, making it possible for these researchers to pursue new knowledge, discoveries, and innovation. Each year NSF receives about 30,000 proposals, of which about one in three is funded. During FY 2001, NSF invested $4.2 billion in promising research and education projects at nearly 2,000 colleges, universities, and other institutions—public and private; state, local, and federal—throughout the United States.

Nearly 90 percent of NSF funding is allocated through a rigorous competitive process that is critical to fostering the highest standards of excellence and accountability—standards for which NSF is known the world over. Each year nearly 40,000 external reviewers from all segments of the science, engineering, mathematics, and education communities help NSF program officers conduct more than 200,000 merit reviews. Reviewers focus on two primary criteria: the intellectual merit of the proposed activity and its broader impacts. Reviewers also consider how well the proposed activity fosters the integration of research and education and broadens opportunities to include diverse participants, particularly from underrepresented groups.

Abolhassan Astaneh-Asl, an NSF-supported researcher from the University of California, Berkeley, recovers critical evidence from the site of the collapsed World Trade Center (WTC) towers. The knowledge obtained from Ground Zero can help prevent future tragedies by enabling construction of buildings more resistant to earthquakes, bombs, and other catastrophic forces. In the wake of the attacks on September 11, NSF quickly funded several studies on the engineering, communications, and psychological implications of those events. In December 2001, a team of scientists from Rensselaer Polytechnic Institute headed to the site of the WTC attacks to study how New York's utility companies worked together to quickly restore water, power, transit, and phone services. A team from Northern Arizona University is studying how individuals respond to collective loss. Results from the study may aid intervention efforts directed at coping with catastrophic loss.

### NUMBER OF PEOPLE DIRECTLY ENGAGED IN NSF ACTIVITIES

| | |
|---|---|
| Senior Researchers | 27,601 |
| Other Professionals | 9,904 |
| Postdoctoral Associates | 5,608 |
| Graduate/Undergraduate Students | 56,505 |
| K-12 Students | 11,335 |
| K-12 Teachers | 83,401 |
| **Total** | **194,354** |




NSF is headed by a director, who is appointed by the President and confirmed by the Senate. The current director, distinguished biologist Dr. Rita R. Colwell, was appointed in 1998 and holds the distinction of being the first woman to head the Foundation. See the Appendix for a detailed description of each directorate and management office and for a list of NSF Executive Staff and NSF Officers.

A twenty-four member National Science Board (NSB) oversees the policies and programs of the Foundation. NSB members—prominent contributors to the science, mathematics, engineering, and education communities—are appointed by the President with the consent of the Senate. The Board also serves the President and the Congress as an independent advisory body on policies related to the U.S. science and engineering enterprise. See the Appendix for a list of National Science Board members.

## A Center of Excellence

The White House Office of Management and Budget (OMB) recently lauded NSF as a true center of excellence in government. The Foundation has long been recognized as a model of administrative efficiency for low overhead costs—just 5 percent of its total budget—and the proposal review system, which disseminates tax dollars through a merit-based competitive process to researchers pursuing the frontiers of science. As an example of performance results, OMB noted that eight of the twelve most recent Nobel Laureates were supported by NSF.

As part of the Administration's focus on strengthening performance, OMB developed a management scorecard in the fall of 2001. The scorecard used red, yellow, and green indicators to reflect an agency's performance in each of the President's five government-wide Management Agenda initiatives. OMB noted that NSF received a better baseline evaluation than most other agencies, and, in fact, NSF was the only agency to receive a green indicator—for financial management. NSF was cited as having received clean audit opinions for three consecutive years, with no material weaknesses or reportable conditions. OMB also commended NSF as a federal government leader for E-Government and information technology.

The growing demands on NSF will require the Foundation to further improve its management and administrative processes in the years to come. Over the past decade, the Foundation's budget increased more than 80 percent and its program responsibilities have become more challenging, now including international or multidisciplinary research projects involving partnerships with other government agencies and organizations. However, NSF staffing levels have remained essentially flat. In order to accommodate the increased and more complex workload as well as better serve its diverse and growing customer base, NSF is engaged in an ongoing effort to streamline work processes, invest in systems and infrastructure improvements, and better deploy its human and capital resources.

NSF's pursuit of advanced information technologies to facilitate business transactions with the academic research community has produced impressive results. Virtually all of the more than 30,000 grant proposals received each year are now submitted electronically. NSF is currently the only federal research agency that receives and processes proposals and payments to grantees electronically on a production basis.

NSF is committed to making and implementing effective management, stewardship, and policy and program decisions. The Foundation adheres to the highest standards of management efficiency and integrity and, in its pursuit of excellence and efficiency, assumes a proactive role in meeting its management challenges. Looking ahead, significant challenges to be addressed include accommodating new functions and processes, and an increased workload; better human capital management to sustain a high-performing workforce; increased emphasis on leadership and succession planning; and better oversight, management, and accountability of larger, more complex interdisciplinary program activities and large infrastructure projects. The President's Management Agenda initiatives dealing with Human Capital, Competitive Sourcing, Improved Financial Management, e-Government, and Budget/Performance Integration are high priorities for the Foundation.

## President's Management Agenda **Scorecard**

FY 2001 Baseline Evaluation

**Initiative** — **Current Status**

**Human Capital:** NSF received a red because its agency human capital strategy is not integrated into its budget and strategic plans and the agency does not implement succession plans. NSF does use staffing flexibilities well, such as that provided for in the Intergovernmental Personnel Act. NSF is moving expeditiously to develop a Training Academy and to conduct an Organizational Assessment Survey. The agency also will initiate a significant workforce analysis in 2002. The Foundation is developing a five-year administration and management strategic plan to lay out how it plans to address its workforce issues in the coming years.

**Competitive Sourcing:** NSF has not launched a viable competitive sourcing initiative. In its 2000 analysis of workforce activities, NSF identified 533 positions as performing commercial functions. NSF has not decided if it will compete any positions at this time. The agency wants to wait until it gets results from its upcoming workforce analysis before it makes a decision on competing positions. At that rate it will be difficult for the agency to meet 2003 competition goals. NSF must develop and submit a competitive sourcing plan to meet near-term goals.

**Financial Management:** NSF is a leader in financial management and has met all core criteria for a green rating for financial management. NSF's financial management systems meet federal financial management system requirements and it has received unqualified and timely audit opinions on its annual financial statements. NSF expects to maintain this position.

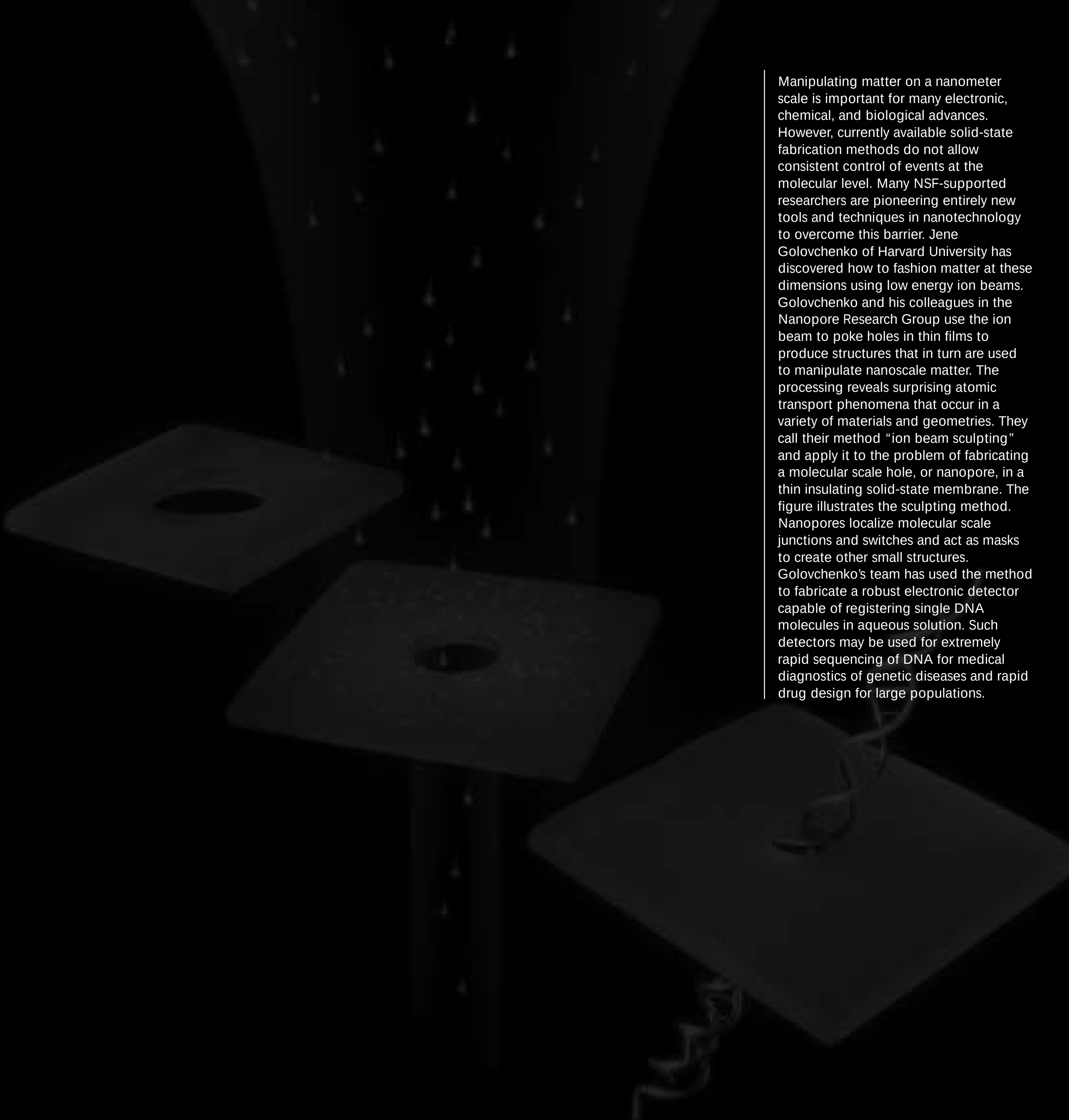
**E-Government:** NSF meets most, but not all, of the standard core criteria for expanding E-Government. All major information technology projects provided sufficient business cases. However, NSF's Government Information Security Reform Act report reflects deficiencies in a number of important areas of security. These concerns include failure to implement appropriate security controls to protect critical information and risk of disruption of essential services. NSF has submitted its corrective action plans and will be reallocating 2002 funds to quickly correct identified problems.

**Budget/Performance Integration:** NSF's budget does not tie resources to results, provides limited focus on outcomes, and does not charge the full budgetary cost to individual activities. There are inherent difficulties in integrating the budget with performance, given the long-term nature of research in which results may not occur for ten years or more. Nonetheless, NSF could do more. In spring 2002, OMB and the White House Office of Science and Technology Policy will work with major research agencies to develop criteria for evaluating basic research during the formulation of the 2004 Budget.

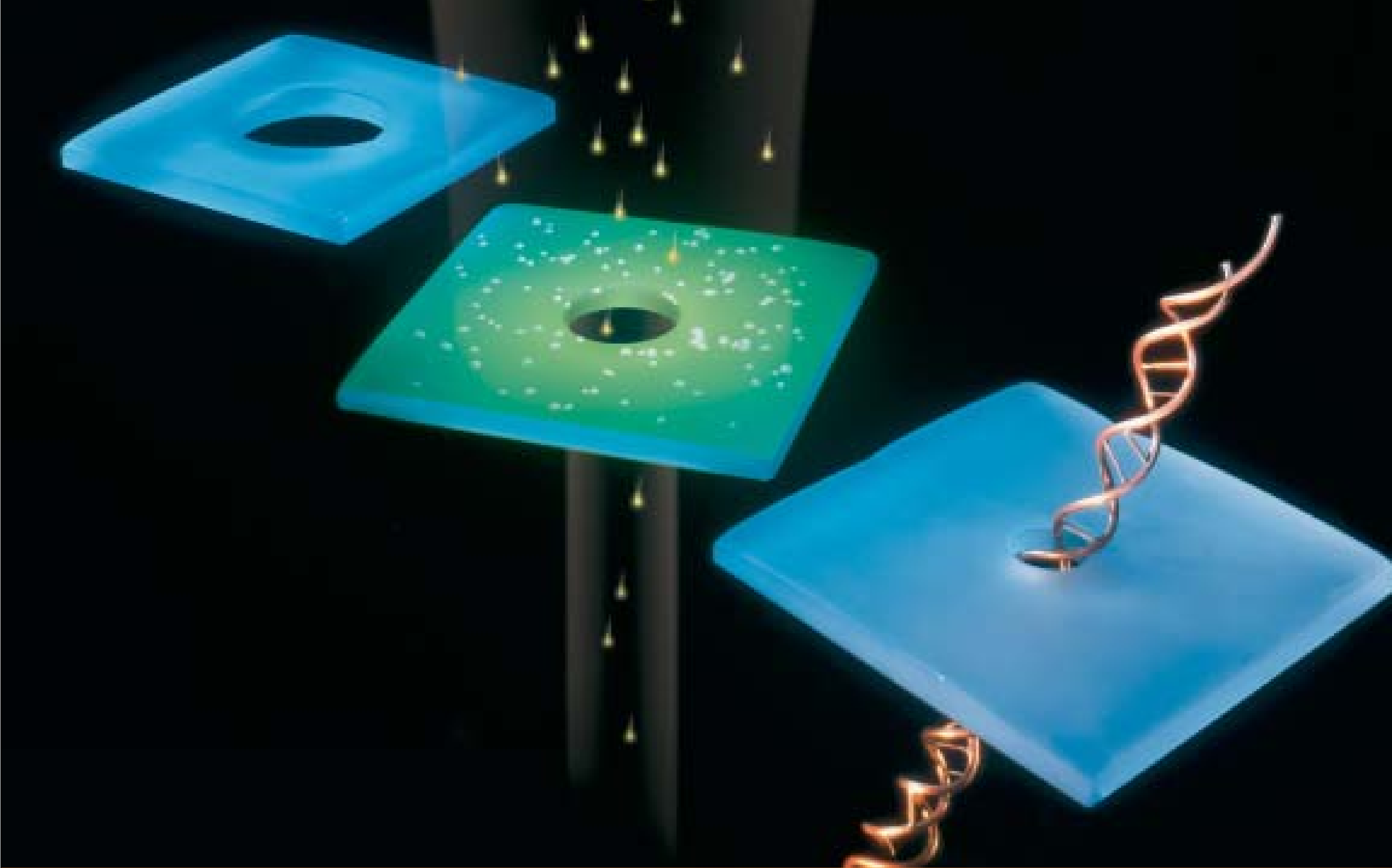
**KEY:**

- Indicates that the agency has met all of OMB's core criteria for the initiative.
- Indicates achievement of some but not all of OMB's core criteria for the initiative and agency has no "red" conditions.
- Indicates that at least one of the conditions identified by OMB for that initiative is in need of correction.

*For a more detailed discussion of the President's Management Agenda, see the* Budget of the U.S. Government, FY 2003.



Manipulating matter on a nanometer scale is important for many electronic, chemical, and biological advances. However, currently available solid-state fabrication methods do not allow consistent control of events at the molecular level. Many NSF-supported researchers are pioneering entirely new tools and techniques in nanotechnology to overcome this barrier. Jene Golovchenko of Harvard University has discovered how to fashion matter at these dimensions using low energy ion beams. Golovchenko and his colleagues in the Nanopore Research Group use the ion beam to poke holes in thin films to produce structures that in turn are used to manipulate nanoscale matter. The processing reveals surprising atomic transport phenomena that occur in a variety of materials and geometries. They call their method “ion beam sculpting” and apply it to the problem of fabricating a molecular scale hole, or nanopore, in a thin insulating solid-state membrane. The figure illustrates the sculpting method. Nanopores localize molecular scale junctions and switches and act as masks to create other small structures. Golovchenko’s team has used the method to fabricate a robust electronic detector capable of registering single DNA molecules in aqueous solution. Such detectors may be used for extremely rapid sequencing of DNA for medical diagnostics of genetic diseases and rapid drug design for large populations.



# AN IMPRESSIVE RETURN ON INVESTMENT

In assessing the return on NSF's investment in the future, the Foundation is guided by the NSF *GPRA (Government Performance and Results Act of 1993) Strategic Plan FY 2001–2006.* In this plan, NSF seeks to clearly communicate its vision and ideals and to provide a framework for the future. This framework is informed by NSF's mission, as set out by Congress in the National Science Foundation Act of 1950, and by the Foundation's unique role as the only federal agency charged with strengthening the overall health of U.S. science and engineering across a broad and expanding frontier.

NSF's Strategic Plan emphasizes three areas of focus—people, ideas, and tools, and describes the three core strategies—developing intellectual capital, integrating research and education, and promoting partnerships—which, together with its core values, guide NSF in achieving its mission. The plan also sets forth NSF's implementation strategy and introduces four emerging areas that will benefit from increased attention over the next several years—Biocomplexity in the Environment, Information Technology, Nanoscale Science and Engineering, and 21st Century Workforce.

NSF-funded scientist Hans-Werner Braun of the University of California, San Diego checks on the construction of a relay station that is helping to bring wireless Internet access to Native Americans in the remote mountain reservations of the La Jolla and Pala tribes in San Diego County. This project collaborates with the Pala tribe to provide their Learning Center with high-speed Internet connectivity. The project is an interdisciplinary effort to design a network that is reliable even under very adverse conditions, including catastrophic earthquakes. The High Performance Wireless Research and Education Network (HPWREN) is developing such a system for geophysicists, astronomers, and ecologists, while demonstrating that the same tools can connect underserved users such as schools at remote locations. The Foundation has always taken a lead role in bridging the digital divide—funding the growth of the Internet from a small network linking university computer science departments to its current state as a medium for business, news, information, and entertainment used by millions around the world.

This is the third year NSF has reported GPRA performance results. The strategic outcome goals described in the *NSF GPRA Strategic Plan* provide the basis for both NSF's FY 2001 Annual Performance Plan and NSF's FY 2001 Budget, which were developed concurrently to ensure a direct link between programmatic activities and the achievement of NSF's strategic goals.

GPRA implementation has been a particular challenge for agencies like NSF whose mission involves research activities. This is primarily due to (1) the difficulty of linking research outcomes to annual investments and the agency's annual budget, because research outcomes often appear years or decades after the initial investment, and (2) the fact that assessing the results of research is inherently retrospective and requires the qualitative judgment of experts. NSF has developed an alternative format, approved by OMB, using external expert review panels to assess research results and reporting research outcome goals using a qualitative scale. The use of expert panels to review research results and outcomes is a common, long-standing practice used in the academic research community.

NSF's Performance Scorecard includes three mutually supportive sets of performance goals and measures—for Strategic Outcomes, for Management, and for Investment Process. The longer-term desired results of NSF awards are reflected in the Strategic Outcome Goals. Attaining the Investment Process Goals and Management Goals is necessary to ensure that the longer-term Strategic Outcome Goals will be achieved.

In FY 2001, NSF achieved fifteen of twenty-three performance goals, or 65 percent.  Overall, these results are comparable to prior year results, when NSF achieved 64 percent of its performance goals.

# NSF FY 2001 PERFORMANCE SCORECARD

## STRATEGIC OUTCOME GOALS

| Strategic Outcome | Performance Goal | Result |
|---|---|---|
| **PEOPLE** Develop a diverse, internationally competitive, and globally engaged workforce of scientists, engineers, and well-prepared citizens. | | |
| **Workforce Development and an Informed Citizenry** | Demonstrate significant achievement in one or more of the following indicators:<br>• Improved mathematics, science, and technology skills for U.S. students at the K-12 level and for citizens of all ages, so that they can be competitive in a technological society.<br>• A science and technology and instructional workforce that reflects America's diversity.<br>• Globally engaged science and engineering professionals who are among the best in the world.<br>• A public that is provided access to the benefits of science and engineering research and education.<br>**Result:** Reports prepared by external experts provide assessments and retrospective examples of NSF-supported projects that document significant achievement. A number of these assessments were emphatic that NSF must continue and increase its efforts toward increasing diversity. | |
| **K-12 Education Reform** | After three years of NSF support, more than 80 percent of schools participating in systemic initiative programs will (1) implement a standards-based curriculum in science and mathematics; (2) further professional development of the instructional workforce; and (3) improve student achievement on a selected battery of tests.<br>**Result:** The curriculum, instructional workforce, and improved achievement in science components of the goal were successful. However, fewer than 80 percent of schools met the goal of improved student achievement in mathematics. In FY 2002, appropriate technical assistance will be provided to schools not meeting the goal. | |
| **Teacher Development and Enhancement** | Through systemic initiatives and related teacher enhancement programs, NSF will provide intensive professional development experiences for at least 65,000 pre-college teachers.<br>**Result:** In the 1999–2000 school year, NSF awards provided intensive professional development (60+ hours) to 79,000 teachers, substantially exceeding the goal of 65,000. | |
| **IDEAS**<br>**Enable discovery across the frontier of science and engineering, connected to learning, innovation, and service to society.** | Demonstrate significant achievement in one or more of the following indicators:<br>• A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas, including the science of learning.<br>• Discoveries that advance the frontiers of science, engineering, and technology.<br>• Partnerships connecting discovery to innovation, learning, and societal advancement.<br>• Synergistic research and education processes.<br>**Result:** Reports prepared by external experts provide assessments and retrospective examples of NSF-supported projects that document significant achievement. | |
| **TOOLS**<br>**Provide broadly accessible, state-of-the art, and shared research and education tools.** | Demonstrate significant achievement in one or more of the following indicators:<br>• Shared use platforms, facilities, instruments, and databases that enable discovery and enhance the productivity and effectiveness of the science and engineering workforce.<br>• Networking and connectivity that take full advantage of the Internet and make science, mathematics, engineering, and technology (SMET) information available to all citizens.<br>• Information and policy analyses that contribute to the effective use of science and engineering resources.<br>**Result:** Reports prepared by external experts provide assessments and retrospective examples of NSF-supported projects that document significant achievement. *[Other than the Division of Science Resources Statistics, very limited contributions and limited involvement of NSF programs are used in developing information and other materials fundamental to national policy debates.]* | |

KEY
- Indicates goal was achieved in FY 2001.
- Indicates goal was not achieved but significant progress was made in FY 2001.
- Indicates goal was not achieved in FY 2001.

See NSF's *FY 2001 GPRA Performance Report* (www.nsf.gov/od/gpra) for a complete discussion of NSF's FY 2001 performance goals and results.

## MANAGEMENT GOALS

| Performance Area | Performance Goal | Result |
|---|---|---|
| **BUSINESS PRACTICES** | | |
| **Electronic Proposal Submission** | Receive 95 percent of full proposals electronically through FastLane. | |
| **Electronic Proposal Processing** | Conduct ten pilot paperless projects that manage the competitive review process in an electronic environment. | |
| **Videoconferencing/ Long Distance Communications** | Increase use of a broad range of videoconferencing and long distance communications technology by 100 percent over the FY 1999 level. | |
| **STAFF** | | |
| **Diversity** | Increase over 1997 the total number of hires for science and engineering positions from underrepresented groups. | |
| **Work Environment** | Establish various baselines that will enable management to better assess the quality of work life and work environment within NSF. **Result:** Development of an employee survey is underway. This survey, which will be distributed to employees in FY 2002, will provide baseline information on the quality of work life and work environment at NSF. | |

## INVESTMENT PROCESS GOALS

| Performance Area | Performance Goal | Result |
|---|---|---|
| **PROPOSAL AND AWARD PROCESSES** | | |
| **Merit Review** | Allocate at least 85 percent of basic and applied research funds to projects that undergo merit review. | |
| **Implementation of Merit Review Criteria:** *Reviewers* | Reviewers address the elements of both generic review criteria: intellectual impact and broader impact. **Result:** Reports prepared by external experts provide an assessment of the implementation of merit review criteria for reviewers. In FY 1998–FY 2000, reviewers did not consistently address the broader impacts criterion. In FY 2001, NSF added separate review screens to FastLane to enable reviewers to address each merit review criterion separately. NSF also established an internal task force to examine strategies to improve both proposer and reviewer attention to the broader impacts criterion. A number of FY 2001 reports note that reviewers are making significant progress in utilizing both merit review criteria. In FY 2002, NSF will continue to develop and apply recommendations that focus on strategies that stress the importance of using both criteria. It will also collect and make available examples of broader impacts and develop a plan to disseminate them. | |
| **Implementation of Merit Review Criteria:** *Program Officers* | Address the elements of both generic review criteria — intellectual impact and broader impact. | |
| **Customer Service:** *Time to Prepare Proposals* | Make 95 percent of program announcements available to relevant individuals and organizations at least three months prior to the proposal deadline or target date. | |

## INVESTMENT PROCESS GOALS *(continued)*

| Performance Area | Performance Goal | Result |
|---|---|---|
| **Customer Service:** *Time to Decision* | Tell 70 percent of applicants whether their proposal has been declined or recommended for funding within six months. **Result:** In FY 2001, 62 percent of proposals were processed within six months of receipt. This performance improves upon the FY 1998 baseline of 59 percent, but is still short of the 70 percent goal. Data show that about 77percent of proposals were processed in fewer than seven months and more than 90 percent were processed in fewer than nine months. In FY 2002, NSF will continue to focus on improving the efficiency of proposal processing, including the dissemination of best practices to program staff. | |
| **Award Size** | Increase the average annualized award size for research projects to $110,000. | |
| **Award Duration** | Increase the average award duration for research projects to at least three years. **Result:** Resource limitations affected NSF's ability to achieve both the award size and award duration goals. NSF focused its efforts on increasing average annualized award size. In FY 2002, NSF will continue to focus on increasing award size and duration to improve the efficiency of the research process. | |
| **Maintaining Openness in the System** | Award 30 percent of research grants to new investigators. **Result:** This goal remains a challenge for the Foundation. FY 2001 was the fifth consecutive year that NSF was unsuccessful in achieving this goal. In FY 2002, NSF will continue its outreach to new investigators to promote awareness of research funding and to encourage new investigators to submit proposals. | |
| **BROADENING PARTICIPATION** **Reviewers** | Begin to electronically request voluntary demographic data from all reviewers to determine participation levels of underrepresented groups. | |
| **FACILITIES OVERSIGHT** **Construction and Upgrade** | Keep construction and upgrades for 90 percent of facilities within the annual expenditure plan, not to exceed 110 percent of estimates. | |
| **Construction and Upgrade** | Meet all annual milestones by the end of the reporting period for 90 percent of facilities. **Result:** Of the twenty-five construction and upgrade projects, twenty-one (84 percent) met all annual schedule milestones by the end of the reporting period. Project delays were caused in part by circumstances beyond the control of the facility, technical problems and personnel issues. In FY 2002, NSF will work with awardees to identify obstacles to successful performance and implement plans to avoid or mitigate their consequences in the future. | |
| **Construction and Upgrade** | Keep total cost within 110 percent of estimates made at the initiation of construction for all construction and upgrade projects initiated after 1996. | |
| **Operations 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 facilities. **Result:** Of the twenty-nine reporting facilities, twenty-five (86 percent) met the goal of keeping unscheduled downtime to below 10 percent of the total scheduled operating time. Some causes of failure were outside the control of the facility or were related to technical problems. In FY 2002, NSF will continue to work with awardees to identify obstacles to successful performance and develop plans to avoid or mitigate their consequences in the future. | |

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See NSF's *FY 2001 GPRA Performance Report* (www.nsf.gov/od/gpra) for a complete discussion of NSF's FY 2001 performance goals and results.

NSF-funded ecologists in Alaska are developing sampling methods that can be applied to waterways across the United States. These scientists have learned that small streams remove more nutrients such as nitrogen from water than do their larger counterparts. The finding could have important implications for land-use policies in watersheds from the Chesapeake Bay on the East Coast to Puget Sound in the West. Although excess nitrogen has many sources, including runoff from residential lawns and byproducts of automobile combustion, protecting small streams will reduce the overall nitrogen load that makes its way into larger bodies of water.

# WHERE DISCOVERIES BEGIN

NSF supports cutting edge research that yields new discoveries over time. These discoveries are essential for maintaining the nation's capacity to excel in science and engineering and lead to new and innovative technologies that benefit society. The following examples illustrate the impact and success of NSF's programs in achieving important discoveries and supporting education efforts. Because many research results appear long after an investment is made, these discoveries are the outcome and results of long-term support of research and education projects that emerged and were reported in FY 2001. Other examples of NSF-supported discoveries are available from NSF's Public Affairs Website (www.nsf.gov/od/lpa/).

## Oceans Reveal Their Secrets

Scientists exploring a remote area of the central Indian Ocean seafloor 2½ miles deep have found animals that look like fuzzy snowballs and chimney-like structures two stories tall spewing super-heated water full of toxic metals. Another team in the northern Pacific has found astounding numbers of *archaea*, a microscopic life form distinct from plants and animals once thought to exist only in extremely hot or acidic environments. Yet another team in the Atlantic has found hydrothermal vents towering 180 feet above the ocean floor.

An NSF-supported team of thirty-four scientists and engineers from a dozen institutions explored the Indian Ocean aboard the Woods Hole Oceanographic Institution's 279-foot research vessel *Knorr*. They deployed instruments, like the remotely operated vehicle *Jason*, to explore temperature variations, which led them to the discovery of the hydrothermal vents resembling smokestacks and the sea anemones resembling snowballs.

David Karl, Markus Karner, and Edward DeLong of the NSF-sponsored Hawaii Ocean Time-series project sampled the northern Pacific Ocean from the surface to a depth of 4,750 meters deep and found that *archaea* may make up as much as 50 percent of the biomass in the open sea.

Another expedition of scientists from the Scripps Institution of Oceanography, Duke University, the University of Washington, and other institutions explored a mid-Atlantic mountain ridge. The towering hydrothermal vents they discovered are the largest ever observed. They are also unique in their composition of carbonate material and silica and the fact that dense macrofaunal communities such as clams, shrimps, mussels, and tube worms, which typify most other mid-ocean ridge hydrothermal environments, are absent in the area.

Researchers at the University of Washington and Woods Hole Oceanographic Institution discovered a new hydrothermal vent system—dubbed "The Lost City"—on an undersea mountain in the Atlantic Ocean. Using the submersible *Alvin* and deep-towed vehicle *Argo*, researchers observed a field of active and inactive hydrothermal vents. The steep-sided deposits, shown here, are composed of multiple spires that reach 30 feet in width at their tops.

These findings may provide critical answers to long-standing questions about the diversity of life in the deep sea, how the oceans function ecologically, how animals move from place to place, and how the ocean crust is changing.

## Synthetic Clay May Clean Waste

Researchers at Pennsylvania State University completed an important step in the drive to remove harmful materials from waste streams and drinking water. A team led by Sridhar Komarneni, professor of clay mineralogy, demonstrated that a synthetic clay known as swelling mica can separate ions of radium, a radioactive metal, from water. The finding could have implications for radioactive and hazardous waste disposal, particularly in the cleanup of mill tailings left after uranium processing for the nation's nuclear industry. The tailings contain radium and heavy metals that can leach into groundwater and contaminate drinking water supplies.

The swelling mica, known as Na-4, is one of a group of clays not found in the natural environment. Created specifically for water treatment purposes, swelling micas expand as they absorb metal ions and then, reaching their capacity, collapse and seal the contaminants inside. The swelling micas are being explored for potential use in separating ions of heavy metals such as lead, zinc, and copper as well as other radioactive materials, including strontium, from waste streams. Because they trap the ions, the micas can permanently immobilize these pollutants. They could also prove useful for the recovery and recycling of valuable metals.

## "Silent" DNA Speaks Up

By moderately raising the temperature of cells, biologists have broken through what was considered an impermeable barrier that kept half the genes in some cells "silent." The surprising results, that these heated genes reached 500 times their normal rate of expression, could lead to a better understanding of the cellular processes involved in aging, fever, and toxicity.

Biochemistry and molecular biology professor David Gross and graduate student Edward Sekinger conducted the research at Louisiana State University Health Science Center with NSF support. Their findings appeared in the May 2001 issue of the journal *Cell*.

These findings could turn the gene-expression field upside down. The process that makes some genes silent could help scientists understand aging. Apart from these possible implications, the research could eventually help explain why certain cells are more vulnerable to fever and toxic chemicals and how to control these negative effects.

## Math and Science Gains

In 1993, NSF undertook a bold initiative to encourage and invest in system-wide reform of K-12 mathematics and science education in some of the most disadvantaged urban school systems. Students in these systems were performing poorly in mathematics and science, with wide gaps evident between minority and majority students. NSF introduced Urban Systemic Initiatives (USI) to enable cities to implement wide-ranging reforms through standards-based curricula, professional development for teachers, and accountability for achievement through data collection and assessment. Now, an external evaluation team reports some dramatic payoffs from these investments.

*Academic Excellence for All Urban Students*, a summary report on urban programs making up NSF's USI, shows that students in most of the twenty-two cities where school systems undertook reform efforts are making progress in several areas.

The report is part of a larger, ongoing NSF-funded evaluation study. The study has found that in most of the USI cities, students are taking more math and science courses and increasing their achievement levels, as demonstrated through various assessment tools. Minority students, meanwhile, are making even greater gains in enrollment and performance, reducing the "achievement gap" between themselves and majority students.

These preliminary indicators provide insight into what can happen when school systems use investments wisely to support system-wide learning policies to develop teacher capabilities and to create community partnerships. Great returns on investment are possible when all the pieces fit together.

Although evaluating system-wide change is a long-term process, many urban systemic programs are producing noticeable gains in math and science achievement.

## Superconductivity: Making It Work

A new high-temperature superconductor found in January 2001 by a Japanese team in a simple, commonly available compound has profound potential for future uses. U.S. scientists at an NSF materials research center at the University of Wisconsin, in collaboration with an NSF-funded solid-state chemistry group at Princeton University, have shown that the compound, magnesium diboride or $MgB_2$, will be useful for real-world applications in electronics, communications, and industrial tasks that would benefit from the passage of large amounts of current with no resistance.

Superconductors are materials that lose all their resistance to electrical current flow below a certain critical temperature. The higher the critical temperature, the more useful the material for practical applications. $MgB_2$'s critical temperature at 39 Kelvin is lower than other candidate materials—generally copper oxides—but the compound has other properties that this team says make it a "go."

In the copper oxide superconductors discovered so far, the interfaces between the crystals of the material—the so-called "grain boundaries"—interfere with the efficient flow of current, severely limiting their usefulness. In the case of $MgB_2$, the research team has shown that the current passes smoothly between the crystal grains. Potential applications include magnetic resonance imaging (MRI) devices, more efficient power transmission lines, and a variety of electronic devices.

## Genome Sequencing Yields Insights

Genetics reached a major milestone in December 2000 when an international research team announced it had completed the first plant genome sequence. The species *Arabidopsis thaliana* has emerged as the plant counterpart of the laboratory mouse, offering clues to how all sorts of living organisms behave genetically, with potentially widespread applications for agriculture, medicine, and energy.

The Arabidopsis Genome Initiative (AGI) is a collaboration of research groups in the United States, Europe, and Japan funded by government agencies, including NSF. Because it is a model for over 250,000 other plant species, Arabidopsis is yielding insights that scientists are already applying to make other plants easier to grow under adverse conditions and healthier to eat.

The complete sequence of Arabidopsis is directly relevant to human biological functions because many fundamental life processes at the molecular and cellular levels are common to all higher organisms. Arabidopsis contains numerous genes equivalent to those that prompt disease in humans—ranging from cancer to premature aging. To help researchers capitalize on the genome sequence, NSF has begun a “2010 Project” to determine the function of 25,000 Arabidopsis genes.

The applications of this project are not confined to biology and medicine. Plants hold great potential as sources of renewable energy, although they currently represent just 3 percent of U.S. energy resources. Study of the *Arabidopsis* genome sequence is revealing how photosynthesis converts solar energy and carbon dioxide into biomass, helping scientists develop better plants for fuel and chemical uses.

Another NSF-funded team of scientists has completed the genome sequence of *Halobacterium* species NRC-1, a microorganism that is among the most ancient forms of life. This achievement is especially significant given this bacterium’s widespread use as a model for genetic manipulation.

The research was led by microbial geneticist Shiladitya DasSarma at the University of Massachusetts at Amherst in collaboration with molecular biotechnologist Leroy Hood at the Institute of Systems Biology in Seattle. DasSarma and Hood led a consortium of researchers from twelve universities and research centers in the United States, Canada, and the United Kingdom on the three-year project. *Halobacteria* convert sunlight to energy, giving off a red byproduct whose light sensitivity may make it commercially useful in applications such as information storage for computers.

These tiny creatures will provide many insights into how more complex creatures manage life functions, including cell division, and how cells transport proteins across biological membranes. Several biomedical applications using *Halobacterium* are now being investigated, including the development of orally administered vaccines and the design of new antibiotics.

## Full of Holes

Scientists developing photonic devices for optical and electronic applications may get a boost from a new process for “cutting” three-dimensional arrays of holes in a polymer material. Mohan Srinivasarao found a way to create an orderly pattern of air bubbles throughout a polymer film using a simple solvent. By controlling the polymer, solvent, humidity, and flow of air across the polymer, scientists can trigger condensation of tiny uniform water droplets that sink into the polymer film. The process repeats itself on its own until the film is filled with a three-dimensional array of water bubbles. When the solvent and water evaporate, they leave behind a polymer scaffold with a lattice of equal-sized air bubbles.

The process could contribute to the development of optical switches and the ability to direct or "steer" light beams, just as electrical switches and conducting materials control and direct electrical current. Potential applications include lasers, antennas, millimeter wave devices, and solar cells. This discovery represents an easy way of making materials with the regular structure needed for optical and photonic applications in a completely self-assembled process.

Researcher Srinivasarao, a physical polymer chemist in the Georgia Institute of Technology's textiles and fiber engineering department, is an NSF CAREER awardee. The Foundation-wide CAREER program recognizes and supports the early career development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. CAREER awardees are selected on the basis of creative career development plans that effectively integrate research and education within the mission of their institution.

## The Birth of the Universe

Two teams of cosmologists have released new findings about the nature of the universe in its infancy. Their spectacular images of the cosmic microwave background (CMB), taken with instruments operating from Antarctica, reveal the strongest evidence to date for the theory of inflation, the leading model for the formation of the universe.

Equipment from the BOOMERANG (Balloon Observations of Millimetric Extragalactic Radiation and Geophysics) project in Antarctica has given scientists valuable new information about the birth of the universe.

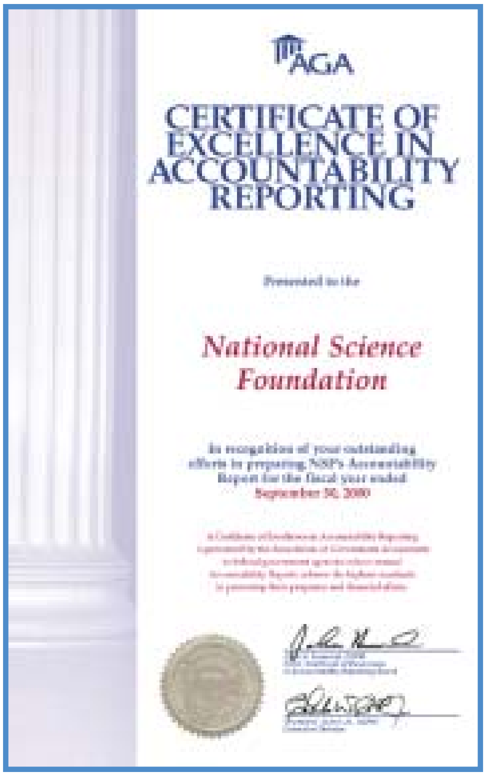
The announcement represents the first release of data from the Degree Angular Scale Interferometer, a thirteen-element ground-based instrument operating since last year at the NSF Amundsen Scott South Pole Station. Scientists also released similar results from further analysis of data from the Balloon Observations of Millimetric Extragalactic Radiation and Geophysics project, obtained in 1998 and first reported in 2000.

These spectacular results represent a payback from the significant national investment in research conducted in the polar regions. The Antarctic environment provides exceptional clarity for astrophysical observations, and the U.S. Antarctic Program provides unmatched support for such world-class research. Both analyses, unveiled at the American Physical Society meetings, support the model that the universe experienced a tremendous spurt of growth shortly after the Big Bang. Cosmologists believe the structures that formed in the first moments of the cosmos left their imprint as a very faint pattern of variations in the temperature of the CMB, the radiation left over from the intense heat that filled the embryonic universe during the initial growth spurt. Some 12 to 15 billion years later, these temperatures have become detectable from Earth with highly sensitive instruments. Multiple teams supported by NSF have probed the CMB for these minute temperature variations, including the two teams operating from the polar region. Two other teams using instruments in the continental United States also released data.

This is an outstanding example of how NSF supports multiple scientific projects, leading to rapid, new results. It took more than a decade to get the initial observations of the cosmic microwave background with the COBE satellite, but over a few short years, the progress in sharpening those observations has been truly astounding.

The teams used independent methods and two different technologies to obtain detailed observations of the CMB. The observations provided so much data that new methods had to be invented to analyze them. As the data analyses continue, they are providing precise measurements of parameters that cosmologists have long used to describe the early evolution of the universe, but in the past could illustrate only with models.

# MESSAGE FROM THE CFO




FY 2001 was a very successful year for the Foundation's business operations. During the year, NSF

- Received an unqualified opinion on its financial condition, providing a solid foundation for a discussion of agency performance and strategic investments in people, ideas, and tools.
- Was the only federal agency to receive a green indicator on OMB's Management Scorecard—for outstanding financial management.
- Implemented a new finance and payroll system into NSF's enterprise architecture successfully and seamlessly.
- Became only the second agency to be awarded the Association of Government Accountants' Certificate of Excellence in Accountability Reporting for two consecutive years.

NSF continues to be an efficient operation. A small, dedicated staff of about 1,200—with an operating budget that is just 5 percent of the agency's total budget—manages a nearly $5 billion operation. Technology fuels these efficiencies, and NSF has long been recognized as the leader in the federal use of information technology. In the past year alone, NSF electronically processed nearly 14,000 grantee payments (91 percent); received 32,000 proposals (99 percent) electronically; and accepted nearly 20,000 electronic signatures on incoming proposals.

In November 2001, the Director of OMB publicly commended NSF for both excellence in financial management and efficient operations. Clearly, the Foundation's leadership in advancing the frontiers of science and engineering is fueled by a commitment to leading edge excellence in administration and management processes. Looking ahead, while NSF's strategy is on target and implementation improves daily, NSF intends to continue to raise the bar for more effective and efficient management operations. In the coming year, our focus will be on the government-wide initiatives outlined in the President's Management Agenda, including human capital, competitive sourcing, and e-government. We will also be addressing issues identified during our annual financial statement audit, such as improved cost accounting and grantee oversight, as well as the agency's management challenges.

For five decades, NSF grants have led to historical breakthroughs. In FY 2002, NSF intends to continue to invest in innovations to our management operations to ensure that the agency is prepared for a new era of progress.

Thomas N. Cooley

Thomas N. Cooley
Chief Financial Officer

From high atop remote mountains in Chile and Hawaii, the Gemini Observatory gives astronomers access to the universe with twin state-of-the-art telescopes. The 8-meter Gemini telescopes are located on both sides of the equator to provide complete sky coverage for astronomers in the seven-country Gemini partnership. Early observations from Gemini have revealed the center of the Milky Way galaxy in unprecedented detail, unexpected conditions at the core of a distant active galaxy, the closest brown dwarf (or failed star) ever imagined around a sun-like star, and a spectacular image dubbed "the perfect spiral galaxy."

# FINANCIALS

The National Science Foundation is committed to providing quality financial management to all our stakeholders. We honor that commitment by preparing annual financial statements in conformity with generally accepted accounting principles in the United States and then subjecting the statements to an independent audit to ensure their reliability in assessing the performance of NSF. Our unqualified audit opinion is a measure of the fair presentation of our financial statements. A complete set of NSF's financial statements, accompanying notes, and audit opinion can be found in the *FY 2001 Accountability Report* (www.nsf.gov/bfa). Included here are three of those statements: the Balance Sheet, the Statement of Net Cost, and the statement of Stewardship Investments.

The **Balance Sheet** presents the funding that is available for use by NSF (assets) against the amounts owed (liabilities) and amounts that comprise the difference (net position).

The **Statement of Net Cost** presents the annual cost of operating NSF programs. The gross cost less any offsetting revenue for each NSF program is used to arrive at the net cost of specific program operations.

**Stewardship Investments** are NSF-funded investments that yield long-term benefits to the general public. NSF investments in research and education yield quantifiable outputs shown in this statement as the number of awards made and the number of researchers and students supported in the pursuit of discoveries in science and engineering and in science and math education.

**National Science Foundation**
## Balance Sheet
**As of September 30, 2001**
**(Amounts in Thousands)**

| | | |
|---|---|---|
| **ASSETS** | | |
| Intragovernmental Assets: | | |
| Fund Balance With Treasury | $ | 5,720,311 |
| Accounts Receivable | | 5,588 |
| Total Intragovernmental Assets | | 5,725,899 |
| Cash | | 5,744 |
| Accounts Receivable, Net | | 875 |
| Advances | | 66,138 |
| General Property, Plant and Equipment, Net | | 203,242 |
| **Total Assets** | $ | 6,001,898 |
| **LIABILITIES** | | |
| Intragovernmental Liabilities: | | |
| Advances From Others | $ | 115,125 |
| Other Intragovernmental Liabilities | | 108 |
| Employee Benefits | | 296 |
| Total Intragovernmental Liabilities | | 115,529 |
| Accounts Payable | | 284,386 |
| Other Liabilities | | 3,207 |
| Employee Benefits | | 1,806 |
| Lease Liabilities | | 451 |
| Accrued Annual Leave | | 9,660 |
| **Total Liabilities** | | 415,039 |
| **NET POSITION** | | |
| Unexpended Appropriations | | 5,343,547 |
| Cumulative Results of Operations | | 243,312 |
| **Total Net Position** | | 5,586,859 |
| **Total Liabilities and Net Position** | $ | 6,001,898 |

Notes to the Balance Sheet are available in NSF's *FY 2001 Accountability Report* at www.nsf.gov/bfa/dfm.

**National Science Foundation**
## Statement of Net Cost
**For the Year Ended September 30, 2001**
**(Amounts in Thousands)**

| | |
|---|---|
| **Program Costs** | |
| **People** | |
| Intragovernmental | |
| Program Cost | $ 1,454 |
| Salary & Expense and Inspector General Cost | 493 |
| **Total Intragovernmental Cost** | 1,947 |
| With the Public | |
| Program Cost | 703,495 |
| Salary & Expense and Inspector General Cost | 27,808 |
| **Total Public Cost** | 731,303 |
| Total People Program Cost | 733,250 |
| Less: Earned Revenues | 9,832 |
| **Net People Program Cost** | 723,418 |
| **Ideas** | |
| Intragovernmental | |
| Program Cost | 10,419 |
| Salary & Expense and Inspector General Cost | 3,528 |
| **Total Intragovernmental Cost** | 13,947 |
| With the Public | |
| Program Cost | 1,964,948 |
| Salary & Expense and Inspector General Cost | 77,670 |
| **Total Public Cost** | 2,042,618 |
| Total Ideas Program Cost | 2,056,565 |
| Less: Earned Revenues | 54,125 |
| **Net Ideas Program Cost** | 2,002,440 |
| **Tools** | |
| Intragovernmental | |
| Program Cost | 82,119 |
| Salary & Expense and Inspector General Cost | 27,810 |
| **Total Intragovernmental Cost** | 109,929 |
| With the Public | |
| Program Cost | 846,178 |
| Salary & Expense and Inspector General Cost | 33,448 |
| **Total Public Cost** | 879,626 |
| Total Tools Program Cost | 989,555 |
| Less: Earned Revenues | 17,272 |
| **Net Tools Program Cost** | 972,283 |
| **Net Cost of Operations** | $ 3,698,141 |

Notes to the Statement of Net Cost are available in NSF's *FY 2001 Accountability Report* at www.nsf.gov/bfa/dfm.

## National Science Foundation
# Stewardship Investments in Research and Human Capital
(Amounts in Thousands)
(Unaudited)

| | | 2001 |
|---|---|---|
| **Research and Human Capital Activities** | | |
| Basic Research | $ | 2,692,243 |
| Applied Research | | 211,421 |
| Education and Training | | 704,949 |
| Non-Investment Activities | | 170,757 |
| **Total Research and Human Capital Activities** | $ | 3,779,370 |
| **Inputs, Outputs, and/or Outcomes** | | |
| **Research and Human Capital Activities** | | |
| Investments in: | | |
| Universities | $ | 2,631,405 |
| Industry | | 162,176 |
| Federal Agencies | | 125,823 |
| Small Business | | 130,977 |
| Others | | 728,989 |
| | $ | 3,779,370 |
| Support to: | | |
| Scientists | $ | 355,261 |
| Postdoctoral Programs | | 128,499 |
| Graduate Students | | 362,820 |
| | $ | 846,580 |
| Outputs & Outcomes: | | |
| Number of: | | |
| Awards | | 20,357 |
| Years of Scientist Support | | 5,759 |
| Scientists Supported | | 27,215 |
| Postdoctorals Supported | | 5,576 |
| Graduate Students Supported | | 25,479 |

NSF's role in achieving performance goals in science and engineering leads to investments in integrative research and human capital activities to enhance the potential for important discoveries or new knowledge with expected future benefits to our society. Because of the close connections between the investments in performing research and building a research base of skilled scientists and engineers through academic and training opportunities, expenses incurred by NSF are presented as overall stewardship investments for NSF performance measurement. The outputs and outcomes of NSF investments in the research and academic community resulted in a number of grants awarded and scientists and students supported.

# APPENDIX

## NSF Directorates and Management Offices

The Directorate for Biological Sciences (BIO) supports research programs to advance understanding of the underlying principles and mechanisms governing life. Research ranges from the study of the structure and dynamics of biological molecules such as proteins and nucleic acids, through studies of cells, organs, and organisms, to studies of populations and ecosystems. It encompasses processes that are internal to the organism, as well as those that are external, and includes temporal frameworks ranging from measurements in real time, through individual life spans, to the full scope of evolutionary times. Among the research programs BIO supports are fundamental academic research, biodiversity, environmental biology, and plant biology.

The Directorate for Computer and Information Sciences and Engineering (CISE) supports research on the theory and foundations of computing, system software and computer system design, human-computer interaction, as well as prototyping, testing, and developing cutting-edge computing and communications systems to address complex research problems. CISE also provides the advanced computing and networking capabilities needed by academic researchers for cutting-edge research in all science and engineering fields.

The Directorate for Education and Human Resources (EHR) supports a cohesive and comprehensive set of activities that encompass every level of education and every region of the country. EHR promotes public science literacy and plays a major role in the Foundation's long-standing commitment to developing our nation's human resources for the science and engineering workforce of the future. Focus is given to programs that encourage the participation and achievement of groups underrepresented in science and engineering. NSF-supported education and training programs cover a broad spectrum—from supporting students and teachers, through creating new ways of teaching and learning, to assisting school districts and other systems forge greater gains in learning.

The Directorate for Engineering (ENG) supports research and education activities that spur new technological innovations and create new products and services and more productive enterprises. ENG also makes critical investments in facilities, networks, and people to ensure diversity and quality in the nation's infrastructure for engineering education and research. Funding is included within ENG to meet the mandated level for the Foundation-wide Small Business Innovation Research (SBIR) program. ENG supports research in areas including information technology, nanotechnology, biotechnology, and microelectronics.

The Directorate for Geosciences (GEO) supports research in the atmospheric, earth, and ocean sciences. Basic research in the geosciences advances our scientific knowledge of the Earth and advances our ability to predict natural phenomena of economic and human significance, such as climate change, weather, earthquakes, fish-stock fluctuations, and disruptive events in the solar-terrestrial environment. GEO also supports the operation of national user facilities.

This three-dimensional animation was developed with assistance from the NSF's Small Business Innovation Research program. The virtual signer from the SigningAvatar™ software depicted here can translate English into sign language for display on computer screens.

The Directorate for Mathematical and Physical Sciences (MPS) supports research and education in astronomical sciences, chemistry, materials research, mathematical sciences, and physics. Major equipment and instrumentation such as telescopes and particle accelerators are provided to support the needs of individual investigators. MPS also supports state-of-the-art facilities that enable research at the cutting edge of science and research opportunities in totally new directions.

The Directorate for Social, Behavioral, and Economic Sciences (SBE) supports research to build fundamental scientific knowledge about human behavior and interaction and social and economic systems, organizations, and institutions. SBE also facilitates NSF's international activities by promoting partnerships between U.S. and foreign researchers and enhancing access to critical research conducted outside the United States. To improve understanding of the science and engineering enterprise, SBE supports Science Resource Statistics, the nation's primary source of data on the science and engineering enterprise.

The Office of Polar Programs (OPP), which includes the U.S. Polar Research Programs and the U.S. Antarctic Logistical Support Activities, supports multidisciplinary research in the Arctic and Antarctic regions. The polar regions are geographic frontiers that provide premier natural laboratories and unique research opportunities, ranging from studies of the earth, ice, and oceans to research in atmospheric sciences and astronomy.

The Office of Budget, Finance, and Award Management (BFA) is headed by the Chief Financial Officer, who has responsibility for budget, financial management, grants administration and procurement operations, and related policy. Budget responsibilities include the development of the Foundation's annual budget, long-range planning, and budget operations and control. BFA's financial, grants, and other administrative management systems ensure that the Foundation's resources are well managed and that efficient, streamlined business and management practices are in place. NSF has been an acknowledged leader in the federal research administration community, especially in its pursuit of a paperless environment that provides more timely, efficient awards administration.

The Office of Information and Resource Management (OIRM) provides information systems, human resource management, and general administrative and logistic support functions to the NSF community of scientists, engineers, and educators as well as to the general public. OIRM is responsible for supporting staffing and personnel service requirements for staff members including visiting scientists; NSF's physical infrastructure; dissemination of information about NSF programs to the external community; and administration of NSF's sophisticated technological infrastructure, providing the hardware, software, and support systems necessary to manage the Foundation's grant-making process and to maintain advanced financial and accounting systems.

# APPENDIX

## NSF Executive Staff

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Rita R. Colwell, Director

Joseph Bordogna, Deputy Director

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Eamon M. Kelly, Chair
Marta Cehelsky, Executive Officer

Office of Equal Opportunity Programs
Ana A. Ortiz, Program Manager

Office of the General Counsel
Lawrence Rudolph, General Counsel

Office of the Inspector General
Christine C. Boesz, Inspector General

Office of Integrative Activities
Nathaniel G. Pitts, Director

Office of Legislative and Public Affairs
Curtis Suplee, Director

Office of Polar Programs
Karl A. Erb, Director

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Mary E. Clutter, Assistant Director

Directorate for Computer and Information Sciences and Engineering
George Strawn, Acting Assistant Director

Directorate for Education and Human Resources
Judith A. Ramaley, Assistant Director

Directorate for Engineering
Esin Gulari, Acting Assistant Director

Directorate for Geosciences
Margaret S. Leinen, Assistant Director

Directorate for Mathematical and Physical Sciences
Robert A. Eisenstein, Assistant Director

Directorate for Social, Behavioral, and Economic Sciences
Norman M. Bradburn, Assistant Director

Office of Budget, Finance, and Award Management
Thomas N. Cooley, Director

Office of Information and Resource Management
Linda P. Massaro, Director

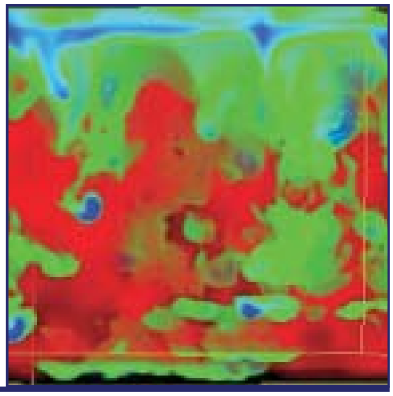
## NSF Officers

Chief Financial Officer
Thomas N. Cooley (Office of Budget, Finance, and Award Management)

Chief Information Officer
Linda P. Massaro (Office of Information and Resource Management)

NSF Affirmative Action Officer
Ana A. Ortiz (Office of Equal Opportunity Programs)

Robert Stein, a Michigan State University physics professor, used the NSF-funded National Computational Alliance's supercomputer to create massive models of portions of the sun to simulate the processes—such as the entropy fluctuations shown here—behind the sun's smaller-scale features. Using these models, Stein and his colleagues focused on understanding convection and magnetic flux near the solar surface.



## National Science Board

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President Emeritus and Professor
Payson Center for International Development and Technology Transfer
Tulane University

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Department of Computer Science
University of Virginia

**Members**
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Vice President for Science and Technology
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Department of Ecology and Evolutionary Biology
University of Tennessee

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California State Polytechnic University

Richard Tapia
Professor, Department of Computational and Applied Mathematics
Rice University

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University of California at Berkeley

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National Center for Atmospheric Research

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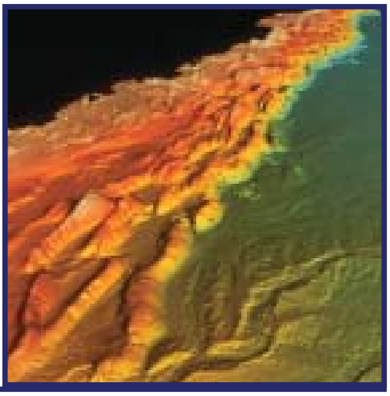
Mark S. Wrighton
Chancellor
Washington University at Saint Louis

Rita R. Colwell, *Member Ex Officio* and Chair, Executive Committee
Director, National Science Foundation

Marta Cehelsky
Executive Officer
National Science Board

NSF-funded researchers Lincoln Pratson and William Haxby are studying the geological forces at work on the continental margins. This computer-generated image of the Oregon coast depicts the coming together of two of the Earth's crustal plates. Pratson and Haxby's analysis of geological forces is providing new tools that will assist companies considering oil or gas exploration and those laying transcontinental cables.



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Page 31 | Robert Stein, Michigan State University and Aake Nordland Observatory, Copenhagen University, Denmark. Calculations performed at the National Center for Supercomputing Applications, Michigan State University, and the University of Denmark.
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