II. FY 2002 GPRA PERFORMANCE RESULTS

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EXECUTIVE SUMMARY

This report, prepared pursuant to the Government Performance and Results Act (1993), covers activities of the National Science Foundation during Fiscal Year 2002.

NSF goals are divided into two broad areas: Strategic Outcome Goals and Management Goals.

Strategic Outcome Goals: Our strategic outcome goals focus on PEOPLE, IDEAS, and TOOLS and concern the practical, concrete, long-term results of NSF grants and programs. They represent what we seek to accomplish with the investments we make in science and engineering research and education.

Management Goals: Our management goals relate to the effectiveness and efficiency of our activities. They relate to the procedures we use to make awards, fund and manage capital projects, and otherwise serve our customers.

FY 2002 Results: We met 18 (78%) of our 23 goals. Foundation staff verified and validated all NSF performance data. In addition, International Business Machines (IBM) Business Consulting Services, an independent examiner engaged by NSF, verified and validated selected performance information and data.

Outcome Goals: We were successful for all four (100%) of our outcome goals related to:

- Developing "a diverse, internationally competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens";
- Systemic reform in K-12 schools;
- Enabling "discovery across the frontier of science and engineering, connected to learning, innovation and service to society"; and,
- Providing "broadly accessible, state-of-the-art and shared research and education tools."

Examples of accomplishments for each of the outcome goals are provided within the body of the report. They represent only a small fraction of the results identified by external experts.

Management Goals: We were successful for 14 of our 19 goals (74%) in this area: We were able to:

- Allocate at least 85% of funds to projects reviewed by external peer groups and selected through merit-based competition (Goal IV-1).
- Ensure that reviewers address the elements of *both* generic review criteria when evaluating proposals at a level above that of FY 2001. In FY 2002 approximately 84% of the reviewers addressed both criteria (Goal IV-2).
- Ensure that NSF Program Officers address both generic review criteria when making award decisions. Approximately 78% of review analyses commented on aspects of both merit review criteria (Goal IV-3).
- Process 70% of our proposals within six months of receipt. Seventy-four percent of our proposals were processed within six months of receipt (Goal IV-5).
- Increase our average annualized award size for research projects to $113,000. We exceeded our goal, achieving an average annualized award size of $115,666 (Goal IV-7a).
- Develop and initiate a risk assessment / risk management plan for awards (Goal IV-8).
- Keep annual construction and upgrade expenditures at 90% of our facilities within 110% of estimates. Ninety-three percent of the projects were within 110% of annual expenditure plans (Goal IV-9a).
- Keep total cost of construction and upgrade projects initiated after 1996 within 110% of estimates made at the initiation of construction. Two projects were completed (Goal IV-9c).
- Continuing to advance the role of "e-business" in review, award, and management processes by having the technological capability to move competitive proposals submitted electronically through the entire review process without generating paperwork (Goal IV-11).

- Initiate actions to meet the requirements of the Security Act, Office of Management and Budget (OMB) Circular A-130, and the National Institute of Standards and Technology Security Self-Assessment Guide for Information Technology Systems in response to the Government Information Security Reform Act (Goal IV-12).
- Increase the total number of science and engineering hires at NSF from under-represented groups, as judged against an FY 2000 baseline. NSF achieved a 17% increase in female hires and a 42% increase in minority hires (Goal IV-13).
- Establish an internal NSF Academy to promote continuous learning for NSF staff. (Goal IV-14).
- Initiate a strategic business analysis to provide a comprehensive perspective on our future workforce requirement (Goal IV-15).
- Develop an employee survey to establish various baselines that will enable management to better assess the quality of worklife and work environment within the Foundation (Goal IV-16).

We were not successful for five of our management goals. These were:

- Ensuring that 95% of program announcements are available at least three months prior to proposal submission deadlines. We achieved 94%. In FY 2003 NSF will work toward this goal by planning for competitions requiring individual announcements and solicitations as far in advance as possible and initiating clearance processes in a timely manner (Goal IV-4).
- Establishing a baseline for participation of members of underrepresented groups in NSF proposal review activities. Provision of data is voluntary. NSF requested and collected demographic data from reviewers but given the low response rate there was not enough information to establish a baseline. We will continue to request demographic information from reviewers (Goal IV-6).
- Increasing the average duration of awards for research projects to at least three years. Sufficient resources were not available to achieve both the average annualized award size and the average duration goals. We focused on increasing our average annualized award size. We will continue to focus on increasing both award size and duration (Goal IV-7b).
- Having 90% of our facilities meet all annual schedule milestones. Of 27 construction and upgrade projects supported by NSF, 13 (or 48%) met this goal (compared with 84% in FY 2001). In FY 2001, milestones reached at any time within the fiscal year were considered successful. In FY 2002, milestones had to be reached by the specified date determined during project development. We will work with awardees to identify obstacles to successful performance and implement plans to avoid or mitigate their consequences (Goal IV-9b).
- Holding operating time lost due to unscheduled downtime at 90% of NSF facilities to less than 10% of total scheduled operating time. Of 31 reporting facilities, 26 (84%) met the goal (Goal IV-10).

Management Challenges: The NSF Office of the Inspector General listed 10 major management challenges for FY 2002[1]:

- Work Force Planning and Training
- Management of Large Infrastructure Projects
- Award Administration
- Cost Sharing
- Data Security
- GPRA Data Quality
- Cost Accounting Systems
- Management of U.S. Antarctic Program
- Merit Review and its Role in Fostering Diversity
- The Math and Science Partnership Program

Our responses and focused NSF activities in these areas are provided within the report.

[1] This Chapter will only address FY 2002 Management Challenges. FY 2003 challenges are discussed in Chapter IV.

I. SOME NSF ACHIEVEMENTS

NOBEL PRIZES FOR 2002

Physics

Raymond Davis, Jr., of Brookhaven National Laboratory and the University of Pennsylvania was honored for his detection of solar neutrinos. Before Davis' early work in the 1960s, scientists had theorized that the fusion reactions in the sun should produce massless particles called neutrinos. At present it is believed there are three types of neutrinos. The number of neutrinos his experiment detected was significantly less than predicted. This result played a major role in development of the theory that neutrinos change from one type to another and that at least one type actually does have mass. Since 1985 Davis' work at the University of Pennsylvania and the operation of the Homestake neutrino detector have been supported by the National Science Foundation.

In 2001, Davis was also awarded the National Medal of Science administered by the National Science Foundation.

Davis shares this year's Nobel Prize in Physics with Riccardo Giacconi, of Associated Universities, Inc., and Masatoshi Koshiba of the University of Tokyo.

Chemistry

John B. Fenn of the Virginia Commonwealth University was awarded the Nobel Prize in Chemistry for his work developing mass-spectrometric analysis tools that allow scientists to "weigh" and identify large biological molecules. Conventional mass spectrometry techniques vaporize substances to identify individual molecules, but proteins are too fragile to survive such harsh methods. Fenn solved this problem by developing a technique to spray water droplets containing proteins into the mass spectrometer. As the water evaporates, the "stark-naked" protein molecules that are left behind can be analyzed. The technique now allows researchers to identify proteins rapidly and analyze hundreds of potential drugs and biological samples per day.

Fenn has received 13 research awards from the National Science Foundation since 1975, including funding for his prize-winning work on "electrospray ionization."

Fenn shares the chemistry prize with Koichi Tanaka of Shimadzu Corp. in Kyoto Japan and with Kurt Wüthrich of the Swiss Federal Institute of Technology (ETH), Zürich, Switzerland and The Scripps Research Institute, La Jolla, USA.

Economics

Daniel Kahneman of Princeton University was recognized for his groundbreaking work in behavioral economics. While traditional economic models treated consumers as purely rational decision-makers, Kahneman's experiments have shown that people's decisions are often biased and based on rules of thumb. Kahneman has helped explain consumer motivations and has influenced fields as diverse as advertising, the stock market and medical decision-making.

Vernon L. Smith of George Mason University was honored for founding the field experimental economics. Smith pioneered the use of controlled laboratory experiments to test predictions from economic theory. He was also the first to use controlled experiments. Smith's work has been used in designing markets for trading pollution rights, auctioning the broadband communication spectrum, deregulating electricity utilities, and allocating landing slots at airports.

NSF is currently supporting Kahneman's work and has supported Vernon Smith's work since it's very beginnings.

PEOPLE

Indicator P1. ***Development of well-prepared scientists, engineers or educators whose participation in NSF activities provides them with the capability to explore frontiers and challenges of the future***

National Medal of Science. Karen Uhlenbeck works on partial differential equations originally derived to describe things like electromagnetism, but now used to look at the shapes of space. She is well known for her work on gauge field theory and its applications to four manifolds.

In 2000, Uhlenbeck received the National Medal of Science as one of the founders of geometry based on analytical methods, as a leader in her field, and as a mentor for women and minorities in mathematics. Uhlenbeck founded the Mentoring Program for Women in Mathematics held at the Institute for Advanced Study in Princeton, New Jersey

Television show enhances science learning. *DragonflyTV* is a multimedia science experience for kids, educators, and families. In January 2002, a new weekly science magazine television show, *DragonflyTV,* was launched and is now seen by over 1,000,000 households nationwide. The show involves real kids doing real science and gives children and scientists a national forum where they share the excitement of scientific discovery. Does it translate to real science learning? A Multimedia Research evaluation says "yes." More than 90% of 5th graders and 87% of 6th graders said they understood the *DragonflyTV* investigations. In small-group discussions, these children were able to describe investigations in detail, and offer ideas for new investigations of their own. The series is accompanied by a hands-on, interactive Website[2], Teacher's Guides that reach over 40,000 classrooms, as well as community outreach to schools, Boys and Girls Clubs of America, and other youth organizations.

Indicator P2. Improved science and mathematics performance for U.S. K-12 students involved in NSF activities;

Mobile Chemistry Laboratory. The Mobile Chemistry Laboratory (MCL) is an outreach project of Virginia Tech to rural and disadvantaged high schools. It is a self-contained unit that carries chemical instrumentation, computers, chemical equipment, and modern lab space to high schools in Southwestern, Central Virginia, and inner city Richmond, all of which lack adequate laboratory facilities. The unit brings state-of-the-art chemical instrumentation to underserved schools. This outreach project provides a conduit for the exchange of ideas with a student population that would normally have little external scientific stimuli. Teachers are trained on the MCL curriculum in NSF and state-supported workshops. The effectiveness of the MCL program is gauged by the significant increase in the Chemistry Standards of Learning (SOL) Pass rates from 2000 (no MCL program) to 2001 (using the MCL). The average gain was 20 points for the 18 schools. The state average gain was only 8 points. The largest gains (school 1 and 2) were from inner-city schools in Richmond.

Early exposure to physics boosts student performance. What would happen if you introduced physics into the curriculum in 9th grade before chemistry and biology? *Active Physic*s, an innovative curriculum supported by the Instructional Materials Development program, is expanding the number of students taking physics and strengthening conceptual learning and inquiry skills using themes surrounding communication, home, medicine, predictions, sports, and transportation. Since published in 1998, more than 500,000 students have completed units and market potential expected to reach millions. A growing number of the 322 implementing districts already show gains in student performance using the *Stanford Achievement Test* (SAT-9). In addition, University of California (UC) faculty recently

[2] http://pbskids.org/dragonflytv/index.html

approved the curriculum as meeting the "d-laboratory science" requirement, finding that it provides a solid foundation for college-level work and a deeper conceptual understanding than is achieved through traditional approaches emphasizing number problems. The U.S. Department of Energy (DOE) has adopted the *Active Physics* model in content, design, and pedagogical format.

NSF-supported high school instructional materials improve student learning. *Contemporary Mathematics in Context (Core-Plus*)—a secondary mathematics curriculum emphasizing investigations of real-life contexts and applications of mathematical modeling—represents a four-year research, development, and evaluation effort. *Core-Plus* students are showing gains in achievement, as well as effective transition to university-level study. For example:

A University of Michigan study of over 200 *Core-Plus* students from a district of high socioeconomic status near Detroit scored higher in their first university mathematics course, on average, than students from a control school in a similar Detroit suburb. This pattern also held when comparing *Core-Plus* students to those who graduated from the same school before the curriculum was implemented. *Core-Plus* students were also as likely as peers to take advanced courses (e.g., Calculus II, Differential Equations) when entering the university.

In 1999-2000, released assessment items from the Third International Mathematics and Science Study (TIMSS) were administered at three sites to assess the curriculum's effectiveness. Core-Plus students had mean scores similar to students in the Netherlands, the top-scoring country in mathematics literacy; in advanced mathematics, Core-Plus students scored above the international average on probability, statistics, and transformation geometry. By the end of junior year, Core-Plus students performed considerably better in those areas than typical U.S. seniors enrolled in alternative pre-calculus, calculus and Advanced Placement (AP) calculus courses.

Indicator P3. Professional development of the STEM instructional workforce involved in NSF activities

Project links pre-service teacher preparation to inservice teacher enhancement. To address the need for more science and mathematics teachers, the Montana Systemic Teacher Excellence Preparation (STEP) project has connected state universities and colleges with Tribal Colleges and has combined distance education courses with onsite courses. In Years 3–5 of the project, investigators developed an "early career support program" that served 127 beginning teachers and continues to serve about 60 new teachers per year. To date, there is a 95% retention rate in the profession for teachers who participated in the program. In addition to providing professional development for new teachers, the Montana STEP project has established an M.S. in Science Education degree program, which is an interdisciplinary program involving both on campus and distance learning. It is the only inter-college program for science education in the United States with a 65% distance education component. To date, over 100 teachers have been admitted to the program, 42 have received graduate degrees, and 77 are currently enrolled.

An internship program in marine science for African American teachers. The Dauphin Island Sea Laboratory (DISL) is operated by the Alabama Marine Environmental Sciences Consortium. The faculty studies a variety of problems in oceanography and marine biology, and they provide advice to industry, government, and the public. DISL serves Alabama's research and instructional needs in the marine sciences. Students at all educational levels, including K-12 pupils, undergraduate and graduate students, teachers-in-training, elder hostel participants, and the general public, benefit from the programs offered at DISL. A recently constructed public building, The Estuarium, exhibits live organisms and recreates the estuarine and marine environments of Alabama. DISL is an NSF-Research Experiences for Undergraduate (REU) site, and the laboratory is developing a minority

internship program in marine science, the first of its kind in Alabama. In addition, this year the lab has developed a program to bring in African American teachers as interns for the summer to learn the material presented in the Discovery Hall displays, assist in teaching at each grade level, assist in the field-based programs and be mentors for the young students. These opportunities go beyond traditional methods of teaching and curriculum enhancement and will blaze a trail for minority teachers in marine science.

Highest discovery rate for novae found in this galaxy. The use of astronomy in Research Based Science Education at the National Optical Astronomy Observatories/National Solar Observatory (NOAO/NSO) brings teachers to NOAO for intensive workshops and also produces Web-based educational materials. A particularly successful and widely distributed program contains the imaging data from an NOAO telescope that is used by students to discover new novae in the Andromeda Galaxy. Astronomers, high school teachers and their students have discovered 73 novae in Andromeda. Novae are stellar outbursts that lead to a rapid brightening when mass is transferred between two stars in a binary system, causing the surface layers of one star to ignite explosively from the fusion of hydrogen nuclei. The novae in Andromeda were discovered by students using images from Kitt Peak National Observatory and collectively represent the highest discovery rate for novae found in this galaxy.

Indicator P4. Contributions to development of a diverse workforce through participation of underrepresented groups (women, underrepresented minorities, persons with disabilities) in NSF activities

Minority graduate education at Mountain States Alliance. The Minority Graduate Education at Mountain States Alliance (MGE@MSA) has enrolled 329 African American, American Indian, and Hispanic students in science, engineering, and mathematics (SEM) doctoral programs within the alliance. This represents an increase of 196.3% over the 111 enrolled during the baseline year. Designed by individual awardees of the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring, MGE@MSA sponsored the first of a series of doctoral mentoring institutes. This institute provided 58 select doctoral faculty from ten regional universities with both an overview of successful mentoring practices and meaningful tools to empower them to address problems associated with recruiting, retaining, and graduating underrepresented minority science education and math (SEM) students at the Ph.D. level. After the first year of MGE@MSA, 43 SEM doctoral degrees were awarded to African Americans, American Indians, and Hispanics within its alliance. This represents a sharp increase (86.9%) over the 23 produced in the baseline year. The overall five year goal of MGE@MSA is to triple the number of underrepresented minority science, mathematics, and engineering doctorates to achieve an annual rate of 69 in the year 2004.

Indicator P5. Participation of NSF scientists and engineers in international studies, collaborations, or partnerships

Partnerships involving multiple organizations. Co-supported by NSF, the Centre National de Recherche Scientifique (CNRS), the French Ministry of Research, the Scientific Mission of the French Embassy, and several industrial sources, this program gives students training in an international environment via 12-week research immersion experiences at several universities across France. In a reciprocal exchange, French undergraduates live with domestic peers at Florida. Participants are encouraged to co-author publications and more than 40 peer-reviewed papers have been published. Since 1997, some 105 students have been recruited from 30 US states and Puerto Rico. Students participate in a mid-program science meeting and a post-program poster session at Florida. This multidisciplinary program recruits students of Chemistry, Chemical Engineering, Physics, Materials Science, and Biochemistry and gives them academic credit in the University of Florida

honors program and co-registration in French Universities.

Tissue Engineering. NSF-supported researchers have participated in WTEC (World Technology Division of the International Technology Research Institute[3]) studies on Tissue Engineering that was sponsored by NSF. Their study involved a comparative review of tissue engineering research and development activities in the United States, Japan, and Western Europe. It covers biomaterials, cells, biomolecules, non-medical applications, engineering design, informatics, and legal and regulatory issues associated with tissue engineering research and applications. The panel's conclusions are based on a literature review, a U.S. review workshop held at the National Institutes of Health (NIH) in June of 2000, and a series of site visits to leading tissue engineering research centers in Japan and Western Europe.

Indicator P6. Enhancement of undergraduate curricular, laboratory, or instructional infrastructure

Game theory and social interactions. A Virtual Collaboratory for Teaching and Research Game theory is one of the prime contenders for becoming the central theory in economics and related social sciences. Broadly speaking, a game is an interactive situation in which everyone's incentives depend on their own and others' actions. Games have been used to model a wide variety of environments, such as collective action problems, market pricing, auctions, committee voting, family decisions, organizational behavior, and contract law negotiations. The Nash equilibrium, which has been the central solution concept in game theory, is one of the most commonly used constructs in economics. Game theory is increasingly being applied in political science and management science. Its relevance in many non-market interactions, however, is limited by the extreme rationality assumptions that underlie standard solution concepts. Although game theory has been successfully applied in some settings (for example, the design of the Federal Communications Commission (FCC) spectrum auctions), the inclusion of behavioral elements and limited rationality is essential to ensure a major impact on the study of a wide array of social interactions. This project has brought together a group of social scientists that incorporate behavioral and cultural factors into the analysis of strategic interactions. Cross-cultural studies of non-economic motivations have been naturally supplemented with controlled experiments. To make experiments easily available, a portable wireless laboratory and web-based software to connect participants at different locations have been developed.

Strengthening undergraduate education. The project "Strengthening Undergraduate Education through Research in Radio Astronomy" is designed to combine the development of a small radio telescope with the development of educational materials and a Web-based environment to support the use of radio astronomy in undergraduate research. Twenty-three institutions have utilized the 37-meter telescope for educational activities; 165 students participated in the activities, 8 student theses were written based on undergraduate research experiences associated with the use of the telescope or Web-based materials, and 14 student projects were completed. In addition, faculty from 23 community colleges and small four-year colleges attended in an NSF Chautauqua course on "*Radio Astronomy in the Undergraduate Classroom.*" Two articles and a book chapter were either published or accepted for publication based on the work of the project.

Indicator P7. Awardee communication with the public in order to provide information about the process and benefits of NSF supported science and engineering activities

PBS series explores *"The Secret Life of the Brain."* In the past decade of the 1990's, science has deciphered more secrets of the human brain than in the previous 90 years combined. In 2002, the Public Broadcasting System (PBS) aired the five-part series, *The Secret Life of the Brain*, exploring the startling new map of our most complicated organ, contradicting much of what was previously believed, and holding out hope

[3] http://www.wtec.org

for dramatic advances in the areas of addiction, depression, learning disorders, Alzheimer's Disease, and schizophrenia. With support from the NSF, *The Brain* called on neuroscience's leading researchers to assist the public in understanding how research is practiced; the connection between pure and applied research; and how these methods impact their lives. The series explores stages of human development—infancy, childhood, adolescence, adulthood, and old age—from fundamental neural development and innovative medical treatments to behavioral therapies, new brain-based educational techniques, and the characteristics of the older brain that may form the basis of wisdom. Through the series, the public learns of significant departures from previous theories, e.g., that the brain develops throughout life, increasing and renewing its capacities from birth to death instead of remaining static after reaching early maturity.

The *Brain* received a 1.9 national rating that translates to approximately 2.0 million households and 2.4 million viewers per average broadcast. Approximately 15.4 million people viewed all or part of the total series. Educational outreach products include: (1) an award-winning book, *The Secret Life of the Brain* (2001), Richard Restak, M.D., Joseph Henry Press; (2) a Website[4], including multi-media, interactive areas that has been accessed by more than 609,500 users with 2,276,600 page views with an average hit time of 22-40 minutes; (3) teen and adult guides; and, (4) grants to PBS stations nationally for educational outreach and audience development.

Socio-linguistic variations in American Sign Language. Phase I of this NSF-supported research collected videotaped data from 207 American sign language users from sites throughout the United States. In Phase II, graduate research assistants employed data reduction to analyze systematic and patterned socio-linguistic variations (phonological, lexical, and syntactical) in American Sign Language, comparing it with spoken language. The results were disseminated through workshops, conference presentations and journal articles. The supplement supported videotape development and workshops to educate the public. Both workshop and conference presentations have brought increased understanding within the deaf community of the nature of human language, the nature of the structure of sign language, and how it compares to spoken language.

Arecibo Observatory Visitor and Education Facility (AOVEF). The National Astronomy and Ionosphere Center AOVEF overlooks the 305-meter radio telescope, and was funded entirely with non-Federal monies. This Center (opened in March 1997) contains a series of exhibits describing the science done at the Observatory. These heavily "hands-on" bilingual displays were funded by NSF and provide a unique resource for Puerto Rico's 650,000 K-12 students – with the exception of the Visitor Center there are no other science museums of any sort on the Island of Puerto Rico. The Arecibo AOVEF receives 120,000 visitors and 40,000 K-12 students each year, approximately triple the number that visited before the AOVEF was built.

IDEAS

Indicator I1. Discoveries that expand the frontiers of science, engineering or technology

Survival of plants during periods of drought. Plants must continually supply their leaves with water that is absorbed by the roots and transported to the leaves through the stem. The driving force for this comes from the evaporation of water from leaf surfaces, which exerts a "pull" on the water column. This allows the plant to draw water from the soil through hollow xylem cells, which form conduits for water transport through the stem -- essentially using the stem as a straw. Because the water is under tension, air is sucked into the xylem occasionally, causing an embolism that blocks water flow. It is well known that air embolism occurs in plants, sometimes to the extent that water delivery to leaves is significantly impaired. The goal of this study is to understand the mechanisms by which plants may be able to

[4] www.pbs.org/wnet/brain

repair air-filled conduits such that they are able to reuse them in water transport. It is only in the past decade that researchers have realized that plants can reverse embolism, and there is some evidence that this repair may occur even during the day when the water in the xylem is under substantial tension. This study is increasing our understanding of how plants survive periods of low water availability and has improved our ability to predict plant responses to environmental factors such as drought and temperature extremes.

Self-tightening bolts. At a laboratory at the Virginia Polytechnic Institute and State University, when bolts and screws are used, NSF-supported researchers also use sensors and washers made of the "smart" materials known as piezoelectric (PZT) or PZT patches and shape memory alloys (SMAs) respectively. The former provide an electrical signal used for continuous monitoring of the mechanical load or torque on the bolt or screw, and when something changes, for example in response to vibrations, extreme loads, or perhaps something as simple as temperature induced changes that allow the nut to loosen, the SMA washer changes it shape to "take up the slack" and restore the tightness of the bolt to its design load.

Superconductivity. Conventional superconductivity in materials like lead and tin results from interaction of electrons with lattice vibrations (phonons). NSF-supported researchers have now used the facilities of the National High Magnetic Field Laboratory to show that superconductivity can also result from the existence of charge density waves, in an organic material at low temperatures. This kind of superconductivity was first predicted to be possible in 1954. Such superconductivity had never been seen before. The sample had to be cooled to within one degree of absolute zero in a magnetic field five hundred thousand times as strong as the Earth's field.

Composite bone materials. An NSF project has developed a nanoscale self-assembly technique to create composite materials very similar to bone tissue. This technique has developed new polymeric molecules that self-assemble on their own to form cylindrical nano-sized fibers. These fibers direct the growth of reinforcing minerals such as hydroxyapatite into an alignment that is very similar to that in natural bone. This new technique holds promise not only for development of artificial bone, but also for repairing nerve fibers, creating nano-electronic wires, and preparing high-strength polymeric composites. This result was published in *Science* and elicited major coverage in *Chemical & Engineering News* and other publications.

Cosmology. The spectacular burst of new information about the early universe (Cosmic Microwave Background or CMB) is transforming the field of cosmology. A new approach to the study of cosmology, which involves both direct observations and intensive computer modeling of the early universe, has come to dominate the field, much of it accomplished with NSF support. The Degree Angular Scale Interferometer (DASI), Balloon Observations of Millimeter Extragalactic Radiation and Geophysics (BOOMERanG), and the Cosmic Background Imager (CBI) experiments all have contributed new or more precise measurements of the CMB emission that are analyzed to create images of the early universe. These images are combined with complex theoretical calculations to test different cosmological models and measure fundamental cosmological parameters such as the overall density of the universe.

Indicator I2. Discoveries that contribute to the fundamental knowledge base

Discovery of largest object in solar system. The largest object in the solar system orbiting far from the sun (a Kuiper Belt Object), even larger then the largest asteroid, was discovered with the Cerro Tololo Inter-American Observatory (CTIO) 4-meter telescope. This discovery, by astronomers from Lowell Observatory, arose from collaboration with the National Aeronautics and Space Administration (NASA) to characterize these outermost objects with the objective of gaining fundamental information on the formation of the solar system.

Early history of whales. Three articles published in Science and Nature this year by two groups of scientists point out great advances being made in understanding the early history of cetaceans (whales). Both groups arrive independently at the same startling conclusions about the early evolution of whales based on new fossil finds in Pakistan. Whales evolved approximately 50 million years ago from land-based even-toed ungulates (hoofed animals) rather than mesonychians (an extinct group of carnivorous ungulates) as has been traditionally believed. These fox- and wolf-sized four-footed animals were surface paddlers in the shallow seas of Eocene time that evolved into modern whales.

Opening of the Bering Strait. A U.S.-Russia collaborative research project determined the date of the Bering Strait's opening by studying *Astarte* clams found in southern Alaska. The results indicate that the Strait opened about 2 million years earlier than previously thought. The revised opening date will allow researchers to more accurately document ancient climates.

Indicator I3. Leadership in fostering newly developing or emerging areas

Molecular electronics. Molecular electronics is based on the notion that the molecular organization of matter can result in very different electronic properties than are seen in more traditional semiconductor structures. The critical issue has to do with how charge is shared between molecules (discrete nano-scale structures) and electrodes (continuous metals). The most general picture for how these things work focuses on the interface, and on transport at that interface. In this area, an NSF-supported group at Northwestern University has developed robust general theoretical methodologies for *designing* interfaces that would be most effective in producing charge flow in molecular nanostructures. *Science* magazine cited this as the breakthrough of the year in 2001.

3-D models of solid-state lasers. A US-Bulgaria project encompassed coordinated experimental and theoretical work on novel techniques in ultra-short light pulse generation and measurement. The scientists developed the first completely 3-D models of solid-state lasers.

Adaptive optics. NSF started support of adaptive optics over 15 years ago. Today, adaptive optics is maturing into a very powerful tool for high spatial resolution imaging. A few years ago, astronomical adaptive optics were limited to correcting for atmospheric turbulence over a small area of about 6 arc-seconds and required that a bright star be in the field. Today astronomers have learned how to create an artificial star in the sky using lasers, and have learned enough about the dynamics of the turbulent atmosphere to measure and forecast correction over arc-minutes field of view for telescopes in the 10 to 20 meter size category.

Extreme pressure research. An NSF-supported research project has developed a new and inexpensive diamond anvil cell making extreme pressure research available to a larger body of researchers.

Indicator I4. Connections between discoveries and their use in service to society

Effects of increased atmospheric carbon dioxide. An NSF-supported project has discovered that rising levels of atmospheric carbon dioxide that are associated with global warming can interfere with plants' ability to incorporate certain forms of nitrogen, dramatically altering the flora worldwide and forcing significant changes in agricultural fertilizer use. Previous studies have shown that increased concentrations of carbon dioxide in the atmosphere initially lead to increases in carbon intake and growth in plants, but eventually the accelerated carbon assimilation declines. This NSF-funded project has shown that the decline in growth rate is attributable to inhibition of nitrogen incorporation in the plant tissues. Nitrogen is an element that is key to producing proteins and nucleic acids such as deoxyribonucleic acid (DNA) in plants. Because it is so important to plant growth, farmers and gardeners commonly apply nitrogen-rich fertilizers to their crops. The researchers found that nitrate fertilizer is not nearly as efficient as

ammonium fertilizer when atmospheric carbon dioxide levels are unusually high. In laboratory experiments they discovered that elevated levels of carbon dioxide inhibited the processing of nitrate compared to ammonium. This study suggests that a shift to increase ammonium availability might be needed in the coming years as atmospheric CO2 levels increase.

Fisheries management models. An NSF-project has looked at problems with current fisheries management models and management plans that simply ignore the theory of fish harvesting. The fishing industry is highly selective in the fishes that are targeted – both because fishers want larger fish, but also because regulations mandate size selectivity. In their research, the researchers hypothesized that harvesting of the larger members of a population would cause evolutionary changes resulting in slower growth rates and smaller size at a given age. These are not features that are desired in fished species. Furthermore, slower growth and smaller sizes can conceivably lead to higher natural levels of predation where predator avoidance is assisted by being larger. According to the researchers, "Management plans that ignore the evolutionary consequences of fishing may repeat the lessons learned in attempts to control pests and pathogens, albeit over a somewhat longer time scale. Moreover, the genetic changes caused by selective harvest may be irreversible; cessation of harvest does not guarantee reverse selection back to the original state. Ignoring evolutionary consequences of selective harvest contradicts the precautionary approach to resource conservation. No take reserves would help to preserve genetic diversity and the elimination of the genes for faster growth and size-at-age; so might the elimination of minimum size restrictions without having complementary maximum size refuges from fishing."

Hidden damage to buildings from earthquakes. Earthquakes cause buildings and bridges to collapse and highways to crack, but much of their most severe damage does not meet the eye. University of Southern California researchers at the Multidisciplinary Center for Earthquake Engineering Research (MCEER) (headquartered at The University at Buffalo) have been seeking ways to make public utility systems more resilient in the face of earthquakes. The researchers, including geotechnical, structural, risk and electrical engineers and economists from multiple institutions and municipalities, identify elements that are at risk, evaluating the geotechnical causes of damage, and estimating potential losses due to continuing service outages. The system allows municipalities to anticipate areas of greatest damage, strengthen those vulnerable areas and make preemptive repairs, develop better emergency plans, and respond faster to needs in the event of an earthquake.

Thin-film material may have important applications in drug synthesis. An NSF-supported team has developed a thin-film material with nanometer-sized cavities that serves as a molecular gatekeeper. The material can be manipulated to allow the passage of certain molecules but not others depending on size, shape and other properties. The scientists have also found a means of chemically transforming molecules within these cavities. The tiny cavities of the array serve as a filter, but in solution the cavities can also be used to encapsulate catalysts that chemically transform molecules. The next step is to combine the filtration and catalytic steps. This would allow conversion of plentiful low-cost hydrocarbon molecules into valuable complex molecules with potential applications such as selective drug delivery, synthesis of specialty chemicals or new types of semiconductors.

Indicator I5. Connections between discovery and learning or innovation

A new route for polymer synthesis. Kris Matyjaszewski received this year's American Chemical Society (ACS) Polymer Chemistry Award for his innovations through development of the new technique of Atom Transfer Radical Polymerization (ATRP). This new synthetic tool has found very widespread application all over the world and is considered the most robust method for creating many polymeric materials. This work has created a market in polymer synthesis that is expected to exceed $20

billion/year. His technique is now used by dozens of laboratories around the world.

Gliders for 4-D measurement of bio-optical and chemical parameters. Scientists from the University of Maine and the University of Washington, in partnership with industry, have been developing new and advanced autonomous underwater vehicles (gliders) and biological sensors. Recent advances in sensor development will provide unprecedented views of the biology of the ocean, specifically phytoplankton, both in time and in space. NSF and the National Oceanographic Partnership Program (NOPP) currently support these efforts. The work with gliders is revolutionizing the way that measurements are being made in the coastal and open ocean waters and provide oceanographers with a 4-dimensional view of the ocean,

Indicator I6. Partnerships that enable the flow of ideas among the academic, public or private sectors

Advanced numerical hurricane model. An NSF-supported scientist, in collaboration with the National Oceanic and Atmospheric Administration has developed an advanced numerical hurricane model. In addition to providing better understanding of ocean/atmosphere interactions, the numerical model developed has demonstrated significant improvement in storm intensity prediction compared to the previous operational (uncoupled) numerical model. The new system has been run in parallel with the prior model and the ocean coupling has improved hurricane intensity forecasts by about 25%. The National Weather Service has adopted the model developed under this award as their new operational model.

Suppercritical carbon dioxide process – partnership with DuPont Teflon. DuPont Fluoroproducts has introduced the first commercial DuPont Teflon® fluoropolymer resins made using proprietary and fundamentally new manufacturing technology that replaces traditional water-based polymerization with a process based on supercritical carbon dioxide. According to DuPont, the new technology produces Teflon® with enhanced performance and processing capabilities, while generating less waste. The new products are being manufactured at the company's Fayetteville, N.C., plant in a new $40 million facility that started up in late 2000. The new technology was developed jointly by DuPont and scientists at the University of North Carolina, Chapel Hill. The fundamental chemical processes in supercritical carbon dioxide that form the basis of this new technology were developed with NSF support.

International long-term ecological research. To promote the establishment of International Long-Term Ecological Research (ILTER) sites in the southern Africa region, NSF supported the travel of 16 researchers (from Botswana, Namibia, Mozambique, South Africa, Tanzania, and Zimbabwe) to various U.S. LTER sites in May 2001. Currently one ILTER site exists in Namibia. Other proposed sites include areas of transboundary importance, such as the Okavango Delta in Botswana, and a shared river basin in Mozambique, as well as sites in the Kruger National Park (South Africa) and the Serengeti National Park (Tanzania). The sites draw on each area's unique resources, but the environmental and ecological problems to be explored concern many other parts of the region, as well as the rest of the world. Many of the sites will also afford researchers the opportunity to study the impact of transboundary issues (such as shared water resources or the development of transnational parks), and the results can be a valuable benefit in the development of scientifically based ecosystem management plans

Undergraduate research experience in Native American archaeology and heritage preservation. The University of Arizona (UA) and the White Mountain Apache Tribe (WMAT) have established a REU Site that focuses on archaeology and heritage preservation in east-central Arizona. The primary goal of the project is to teach students how to combine scientific research and tribal heritage preservation goals through collaborative activities.

TOOLS

Indicator T1. Provision of facilities, databases, or other infrastructure that enable discoveries or enhance productivity by NSF research or education communities

Global seismographic network. The Earth's interior remains a major scientific frontier holding the key to understanding the origin of the planet. Recent developments in seismic sensor design, and the acquisition, transmission and storage of data have resulted in dramatic improvements in the resolving power of seismic imaging of the interior. Earthquake research, including rapid and accurate location and characterization of the earthquake source, its magnitude and a better understanding of the physical process involved, has also benefited greatly from recent technical advances. The *Incorporated Research Institutions for Seismology* (IRIS) facility serves the research needs of the national and international seismology community by making available state of- the-art designs in seismic sensors and data acquisition systems. In addition to its role in providing the observational data essential for basic research in geophysics and earthquake dynamics, IRIS plays a significant role in seismic monitoring of the Comprehensive Test Ban Treaty and in bringing seismology to students and the public through the activities of its Education and Outreach program.

Center for Spatially Integrated Social Science. Over recent decades, major advances in three sets of technologies (geographic information systems, the Global Positioning System, and remote sensing) have provided dramatic new insights into patterns, processes, and changes on the Earth's surface. Although many disciplines have adopted these technologies and use them successfully for a variety of inquiries, fewer social and behavioral scientists have begun to use them on a significant scale. To accelerate the adoption and use of these technologies, a national center based at the University of California-Santa Barbara is focusing on the methods, tools, techniques, software, data access, and other services needed to promote and facilitate a novel and integrating spatially enabled approach to the social and behavioral sciences. The center builds on the efforts of the National Center for Geographic Information and Analysis, engaging in six core programs that are targeted across the full spectrum from inductive, exploratory science to theory-based, confirmatory science. Among major research areas that are benefiting as a result of these efforts are human environmental interactions, urban studies, social and economic inequality, social and business networks, health and disease, criminal justice, and community-based grassroots organizations.

Indicator T2. Provision of broadly accessible facilities, databases, or other infrastructure that are widely shared by NSF research or education communities

Continual queries of databases. NSF-supported researchers at the Georgia Institute of Technology have introduced the concept of Continual Queries and have developed techniques to support efficient processing of continual queries that monitor events using distributed triggers, and notify the user of changes whenever updates of interest happen. The continual query project has produced two operational systems: Open continual queries (CQ) for monitoring semistructured information updates, and Web CQ for monitoring changes in arbitrary Web pages. The National Cancer Institute has used the Web CQ system to track cancer clinical trial information over a dozen information sources. Web CQ helps cancer researchers, patients, friends, and relatives track new treatments and new cancer trials of interest. CQ technologies are being applied to application areas including logistics and unified access to about 500 biological databases.

Assessment of children's attention. Accurate assessment of children's attention is essential for continued examination of the role of attention in the development of skills such as literacy and numeracy as well as examination of the neurological substrates of attention. NSF-supported scientists at the Sackler Institute for Developmental Psychobiology at the Weill Medical College of Cornell have developed the

Attention Network Task to reliably assess orienting and alerting aspects of attention in children. In their own work, the Attention Network Task is being used to track an attention-oriented literacy-training program that is showing initial promise in the laboratory and in public school settings. As well, they are using this task to link genetic, electroencephalograms (EEG), and magnetic resonance imaging (MRI) findings to attentional behavior. Other researchers have begun to use the Attention Network Task to study Attention Deficit Hyperactivity Disorder (ADHD), autism, child abuse, and other conditions that might affect attentional functioning[5].

Indicator T3. Partnerships, e.g., with other federal agencies, national laboratories, or other nations, to support and enable development of large facilities and infrastructure projects

Macromolecular Structure Database (MSD). The Macromolecular Structure Database (MSD), formerly the Protein Data Bank, collects, archives and distributes high quality structural data to the scientific community on a timely basis. It is a distributed collaboratory, involving Rutgers University, the University of California San Diego, and the National Institute of Standards and Technology. The MSD systems are reliable and stable. The challenges of large data rates and complex structures, such as the ribosome, have been met. Legacy data from Brookhaven National Laboratory have been evaluated and restored. A new more robust query and distribution system has been developed. A target registration databases for structural genomics has been created to prevent duplication of efforts. All of the software for data deposition and validation has been distributed. Two sites, one in Japan and one in Europe, also handle data deposition and validation, an important aspect given the anticipated increase in structures.

Toxic heavy metal contamination. Contamination of soils with toxic heavy metals is a serious worldwide problem both for human health and agriculture. Cleanup of hazardous wastes by the currently used engineering-based technologies has been estimated to cost at least $400 billion in the U.S. alone. Recently, there has been considerable interest in the use of terrestrial plants as an alternative "green technology" for the remediation of surface soils contaminated with toxic heavy metals. A major factor behind the recent interest in phytoremediation of metal-polluted soils has been the growing awareness by the scientific community of the existence of a number of plant species that not only can tolerate high levels of toxic heavy metals in the soil, but actually can accumulate these metals to very high levels in the easily harvested above-ground shoot biomass. The ultimate goal of this research is to develop transgenic plants that both are metal hyperaccumulators and produce high-shoot biomass, and thus will be well suited for the phytoremediation of metal-contaminated soils.

Indicator T4. Use of the internet to make SMET information available to the NSF research or education communities

Internet teacher network. Teachers' tacit knowledge about teaching is an important influence on how they teach, but is rarely made explicit and shared. The project seeks to design and evaluate salient features of an on-line network of pre-service and in-service mathematics and science teachers. Teachers can virtually visit each other's classrooms to observe and discuss approaches to teaching mathematics and science topics and to share lesson plans, student work and assessment. The site includes 30 classrooms, each of which includes a video of an entire lesson, artifacts from that lesson (lesson plan, teacher reflections, examples of student work, links to national and state standards, etc.), and web forums to discuss issues that arise from that particular lesson or more general topics such as the nature of inquiry learning and teaching. The site also includes collaborative workspaces called "Inquiry circles" and modules for professional development that can be completed for self-growth or for university graduate credits. There is an "Auditorium" event for many participants (*e.g.*, a webcast), personalized spaces for

[5] http://www.sacklerinstitute.org/_homepages/posner/index.html

participants for storing their preferences and individual resources, and a shared library of resources relevant to secondary mathematics and science teaching.

The HERO collaboratory. Understanding global environmental change in local places cannot happen in isolation. To build a picture of the local causes and consequences of global change, scientists who study and monitor this problem must share data, methods, and ideas. The World Wide Web makes it possible for scientists to work collaboratively without leaving their home institutions. Researchers working on the Human- Environment Regional Observatory (HERO) project are developing a collaboratory to foster remote collaboration among scientists studying global change in far-flung local places. Collaboratories use the interconnectivity of the Web to link scientists in near-real to real time. Collaboratories go beyond e-mail and instant messengers to include such novel ideas as Web-based videoconferences, electronic Delphi tools for collective discussion and decision making, shared notebooks and databases, and interactive maps and graphs. This tool makes it possible for scientists from around the world to meet routinely at nominal expense. The techniques being explored by HERO have greatly facilitated their collaboration.

The Panel Study of Income Dynamics (PSID). The PSID[6] is a longitudinal survey initiated in 1968 of a nationally representative sample for U.S. individuals and the family units in which they reside. The major objective of the panel is to provide shared-use databases, research platforms and educational tools on cyclical, intergenerational and life-course measures of economic and social behavior. The PSID's innovative design and long-term panel have been central to the fundamental understanding of key social science issues with substantial broad impacts on society: income, poverty and wealth; cyclical behavior of wages, labor supply and consumption; savings, wealth accumulation and transfers; demographic events (teen childbearing, marriage, divorce, living arrangements, mortality); labor market behavior; and the effects of neighborhoods. PSID data transformed research on poverty from a static view of poor and rich to a dynamic one in which families experience episodes of poverty or affluence. PSID data are being used to assess current government policies such as the impact of welfare reform on low income, African-American and Hispanic families. The project currently delivers more than 10,000 customized data sets a year to researchers via its Internet Data Center. Since 1968, over 2,000 journal articles, books and chapters, dissertations and other works have been based on PSID data. A consortium of government agencies supports the PSID, including NSF, the National Institute on Aging (NIA), the Department of Health and Human Services (HHS), the U.S. Department of Housing and Urban Development (HUD) and the U.S. Department of Agriculture (USDA).

Indicator T5. Development, management, or utilization of very large data sets and information-bases

Dissemination of statistical data and protecting confidentiality. Algorithms were developed that use geographical aggregation to disseminate as nearly as possible at the county level data that previously were disseminated only at the state level; and also allow characterization of inferences drawn from the release information. Systems were built to implement geographical aggregation in real time, producing maps and other forms of output that disseminate information safely and in unprecedented detail. The Web-based system for geographical aggregation, with its powerful graphical user interface, is usable by researchers and by citizens. The project is developing an entirely new paradigm for disseminating information derived from confidential data, balancing the utility of the released information against disclosure risk.

Community Data Portal. For decades, the National Center for Atmospheric Research (NCAR) has maintained one of the world's premier archives of weather data, including the output from uncounted runs of global climate models. To access this archive, researchers have relied on sophisticated code while NCAR

[6] http://www.isr.umich.edu/src/psid/

technicians swap out tapes and disks. Now the NCAR computing center is building a more direct path to some of its collections, whose size is now approaching one quadrillion bytes of data. The Community Data Portal (CDP) is a pilot effort that will allow users to access NCAR holdings through the World Wide Web and a variety of client-based applications. It also serves as a key node for real-time geoscience data made available by the University Corporation for Atmospheric Research (UCAR) Unidata program. Several large data sets became available on the CDP in experimental fashion starting in 2001. A side benefit of the portal is to dramatically reduce the entry cost of becoming a data provider, making it possible for programs and projects of all sizes to participate and thereby making more data available to users.

Distributed realtime ocean data from multiple sites. The Joint Global Ocean Flux Study (JGOFS) is an international collaboration spanning several years and designed to elucidate fundamental knowledge of the ocean carbon cycle. JGOFS efforts include time-series measurements at two locations (Hawaiian Oceanic Time-series and Bermuda Time Series), process studies, global surveys, synthesis and modeling efforts, and data management. Sponsored internationally by the Scientific Committee on Oceanic Research and the International Geosphere-Biosphere Programme and nationally by the U.S. Global Change Research program, the program spawned a new field of ocean biogeochemistry with an emphasis on quality measurements of carbon system parameters and interdisciplinary field studies of the biological, chemical and physical processes that control the ocean carbon cycle.

National Virtual Observatory (NVO). The first concept of the virtual observatory was developed with the help of a Small Grant for Exploratory Research (SGER) award that enabled fuller discussions in the community and the creation of a white paper on the idea. This year saw the culmination of this effort with the support of a large collaborative project to build the framework for the NVO. This project will federate astronomical data sets and establish them as a common resource for both researchers and the public. The project also establishes the protocols, standards and tools that will permit the large astronomical datasets of the future to be fully utilized. Coordinated efforts are also underway at collaborating institutions to develop archives, visualization tools, and related resources.

Indicator T6. Development of information and policy analyses that contribute to the effective use of science and engineering resources

Electronic publishing in science and authorship rights in the digital age. The emergence of electronic journals in scientific publication has the potential to transform the management and communication of scientific information. Electronic publication is not likely to reach its full potential without a stable legal framework that balances the protection of researchers' intellectual property with the open dissemination and exchange of scientific information. This project describes the challenges that advances in information technology pose for intellectual property law, and identifies a set of "core values" that should be embedded in a system of scientific publishing. Those core values can serve as a basis for defining a common ground on which all stakeholders can build new publishing systems and legal frameworks. The report recommends new patterns of licensing that will enable scientists and scientific publishers to build a publishing system that will promote broad access to and use of scientific information, all within existing copyright law.

II. SUMMARY OF PERFORMANCE RESULTS

Overall, we were successful in achieving 78% (18 of 23) of our performance goals.

RESULTS FOR STRATEGIC OUTCOME GOALS: We achieved all four of our outcome goals (100%) in FY 2002.

FY 2002 Performance Results	
Number of Goals Achieved	
Outcome Goals	**4 of 4 (100%)**
Management Goals	**14 of 19 (74%)**
TOTAL	**18 of 23 (78%)**

RESULTS FOR MANAGEMENT GOALS: We achieved 14 of our 19 management goals (74%) in FY 2002.

The following Table provides a summary of NSF's FY 2002 results.

ANNUAL PERFORMANCE GOALS FOR NSF'S STRATEGIC OUTCOMES

Strategic Outcome	FY 2002 Annual Performance Goal[7]	Results for National Science Foundation
People Strategic Outcome **Outcome Goal III-1:** Development of "a diverse, internationally competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens."	***Performance Goal III-1a:*** **NSF's performance for the People Strategic Outcome is successful when, in the aggregate, results reported in the period demonstrate significant achievement in the majority (4 of 7) of the following indicators:** • Development of well-prepared scientists, engineers or educators whose participation in NSF activities provides them with the capability to explore frontiers and challenges of the future. • Improved science and mathematics performance for U.S. K-12 students involved in NSF activities. • Professional development of the SMET instructional workforce involved in NSF activities. • Contributions to development of a diverse workforce through participation of underrepresented groups (women, underrepresented minorities, persons with disabilities) in NSF activities. • Participation of NSF-supported scientists and engineers in international studies, collaborations, or partnerships. • Enhancement of undergraduate curricular, laboratory, or instructional infrastructure. • Awardee communication with the public in order to provide information about the process and benefits of NSF supported science and engineering activities. FY 2002 Result: Reports prepared by external experts during FY 2002 GPRA reporting provide assessments and retrospective examples of NSF-supported projects that document significant achievement.	**FY 2001:** NSF successful **FY 2002: NSF is successful for goal III-1a.** • Demonstrated significant achievement • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement • Demonstrated significant achievement • Demonstrated significant achievement. • Demonstrated significant achievement.

[7] These performance goals are stated in the alternate form provided for in GPRA legislation.

ANNUAL PERFORMANCE GOALS FOR NSF'S STRATEGIC OUTCOMES (continued)

Strategic Outcome	FY 2002 Annual Performance Goal	Results for National Science Foundation
People Strategic Outcome	***Performance Goal III-1b:*** **After three years of NSF support, over 80 percent of schools participating in systemic initiative programs will: (1) implement a standards-based curriculum in science and mathematics with at least one-third of their teachers; (2) provide professional development for at least one-third of their teachers; and (3) improve student achievement on a selected battery of math and science tests at one or more of three educational levels (elementary, middle and high school).** FY 2002 Result: Systemic Initiative (SI) projects reported that 93% of their schools met the GPRA goal for mathematics curriculum implementation and 91% met the goal for the implementation of science curriculum. For professional development 96% of the SI schools reported meeting the goal for mathematics professional development and 95% met the goal for science professional development. Finally SI projects reported that at the middle school level 87% of participating schools met the goal of improved student achievement in math and 86% met the goal of improved student achievement in science.	**FY 1999:** NSF successful **FY 2000:** NSF successful **FY 2001:** NSF not successful **FY 2002: NSF is successful for goal III-1b.**

ANNUAL PERFORMANCE GOALS FOR NSF'S STRATEGIC OUTCOMES (continued)

Strategic Outcome	FY 2002 Annual Performance Goal[8]	Results for National Science Foundation
Ideas Strategic Outcome **Outcome Goal III-2:** Enabling "discovery across the frontier of science and engineering, connected to learning, innovation and service to society."	***Performance Goal III-2:*** **NSF's performance for the Ideas Strategic Outcome is successful when, in the aggregate, results reported in the period demonstrate significant achievement in the majority (4 of 6) of the following indicators:** • Discoveries that expand the frontiers of science, engineering, or technology. • Discoveries that contribute to the fundamental knowledge base. • Leadership in fostering newly developing or emerging areas. • Connections between discoveries and their use in service to society. • Connections between discovery and learning or innovation. • Partnerships that enable the flow of ideas among the academic, public or private sectors. FY 2002 Result: Reports prepared by external experts during FY 2002 GPRA reporting provide assessments and retrospective examples of NSF-supported projects that document significant achievement.	**FY 2001:** NSF successful **FY 2002: NSF is successful for goal III-2.** • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement.

[8] These performance goals are stated in the alternate form provided for in GPRA legislation.

ANNUAL PERFORMANCE GOALS FOR NSF'S STRATEGIC OUTCOMES (continued)

Strategic Outcome	FY 2002 Annual Performance Goal[9]	Results for National Science Foundation
Tools Strategic Outcome **Outcome Goal III-3:** Providing "broadly accessible, state-of-the art and shared research and education tools."	***Performance Goal III-3:*** **NSF is successful when, in the aggregate, results reported in the period demonstrate significant achievement in one or more of the following indicators:** • Provision of facilities, databases or other infrastructure that enable discoveries or enhance productivity by NSF research or education communities; • Provision of broadly accessible facilities, databases or other infrastructure that are widely shared by NSF research or education communities; • Partnerships, e.g., with other federal agencies, national laboratories, or other nations, to support and enable development of large facilities and infrastructure projects; • Use of the Internet to make SMET information available to the NSF research or education communities; • Development, management, or utilization of very large data sets and information-bases; and • Development of information and policy analyses that contribute to the effective use of science and engineering resources. FY 2002 Result: Reports prepared by external experts during FY 2002 GPRA reporting provide assessments and retrospective examples of NSF-supported projects that document significant achievement.	**FY 2001:** NSF successful **FY 2002: NSF is successful for goal III-3.** • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement. • Demonstrated significant achievement.

[9] These performance goals are stated in the alternate form provided for in GPRA legislation.

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Proposal and Award Process		
Use of Merit Review	***Performance Goal IV-1:*** At least 85 percent of basic and applied research funds will be allocated to projects that undergo merit review. FY 2000 Goal 80% FY 2000 Result 87% FY 2001 Goal 85% FY 2001 Result 88% FY 2002 Goal 85% FY 2002 Result 88%	**FY 1999:** NSF successful for related goal **FY 2000:** NSF successful **FY 2001:** NSF successful **FY 2002: NSF is successful for goal IV-1.**
Implementation of Merit Review Criteria – Reviewers	***Performance Goal IV-2:*** Reviewers will address the elements of both generic review criteria at a level above that of FY 2001. Performance Indicator: Percent of reviews using both merit review criteria. FY 2001 Result 69% FY 2002 Result 84%	**FY 2001:** NSF not successful **FY 2002: NSF is successful for goal IV-2.**
Implementation of Merit Review Criteria – Program Officers	***Performance Goal IV-3:*** Program Officers will consider elements of both generic review criteria in making decisions to fund or decline proposals. Performance Indicator: Percent of review analyses (Form 7s) that comment on aspects of both merit review criteria as determined by directorate or advisory committee sampling. FY 2001 Result: Program reports prepared by external experts during FY 2001 GPRA reporting led NSF to conclude it was successful in implementation of both merit review criteria by program managers. FY 2002 Result: A statistically determined sample of FY 2002 review analyses was evaluated by NSF staff to determine the extent of Program Officer usage of both review criteria. It was determined that approximately 78% of review analyses commented on aspects of both merit review criteria.	**FY 2001:** NSF successful **FY 2002: NSF is successful for goal IV-3.**

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Customer Service: Time to Prepare Proposals	***Performance Goal IV-4:*** Ninety-five percent of NSF program announcements will be available to relevant individuals and organizations at least three months prior to the proposal deadline or target date. FY 1998 Baseline 66% FY 1999 Result 75% FY 2000 Goal 95% FY 2000 Result 89% FY 2001 Goal 95% FY 2001 Result 100% FY 2002 Goal 95% FY 2002 Result 94% FY 2002 Result: In FY 2002, 94% (111 of 118) of program announcements and solicitations were made available at least 90 days before the proposal deadline or target date. In FY 2003 NSF will work toward this goal by planning for competitions requiring individual announcements and solicitations as far in advance as possible and initiating clearance processes in a timely manner. In addition, NSF has recently implemented the electronic Program Information Management System (PIMS), which is expected to improve the efficiency of announcement preparation.	**FY 1999:** NSF not successful **FY 2000:** NSF not successful **FY 2001**: NSF successful **FY 2002: NSF is not successful for goal IV-4.**
Customer Service: Time to Decision	***Performance Goal IV-5:*** For 70 percent of proposals, be able to tell applicants whether their proposals have been declined or recommended for funding within six months of receipt. FY 1998 Baseline 59% FY 1999 Result 58% FY 2000 Goal 70% FY 2000 Result 54% FY 2001 Goal 70% FY 2001 Result 62% FY 2002 Goal 70% FY 2002 Result 74%	**FY 1999:** NSF not successful **FY 2000:** NSF not successful **FY 2001:** NSF not successful. **FY 2002: NSF is successful for goal IV-5.**

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Diversity - Reviewer Pool	***Performance Goal IV-6:*** Establish a baseline for participation of members of underrepresented groups in NSF proposal review activities. FY 2002 Result: NSF cannot legally require reviewers to provide demographic information. Provision of such data is voluntary. NSF requested and collected demographic data from reviewers but given the low response rate there is not enough information to establish a baseline. A total of 37,943 distinct reviewers returned their reviews on proposals decided upon in FY 2002. Demographic information is available for 3,507 of these reviewers and 1,168 (33%) of these 3,507 reviewers are members of an underrepresented group. In FY 2003, NSF will continue to request demographic information from reviewers.	**FY 2001:** NSF successful for related goal **FY 2002: NSF is not successful for goal IV- 6.**
Award Portfolio		
Award Size	***Performance Goal IV-7a:*** NSF will increase the average annualized award size for research projects to a level of $113,000, compared to a goal of $110,000 in FY 2001. FY 1998 Baseline $90,000 FY 1999 Result $94,000 FY 2000 Result $105,800 FY 2001 Goal $110,000 FY 2001 Result $113,601 FY 2002 Goal $113,000 FY 2002 Result $115,666	**FY 2001:** NSF successful **FY 2002: NSF is successful for goal IV-7a**.

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Award Duration	***Performance Goal IV-7b:*** NSF will maintain the FY 2001 goal of 3.0 years for the average duration of awards for research projects. FY 1998 Baseline 2.7 years FY 1999 Goal 2.8 years FY 1999 Result 2.8 years FY 2000 Result 2.8 years FY 2001 Goal 3.0 years FY 2001 Result 2.9 years FY 2002 Goal 3.0 years FY 2002 Result 2.9 years FY 2002 Result: Resource limitations negatively impacted 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 2003, NSF will continue to focus on increasing award size and duration in order to improve the efficiency of the research process.	**FY 1999:** NSF successful **FY 2000:** Goal not applicable **FY 2001:** NSF not successful **FY 2002: NSF is not successful for goal IV-7b**.
Award Oversight and Management		
Award Oversight	***Performance Goal IV-8:*** NSF will develop and initiate a risk assessment / risk management plan for awards. Performance Indicators: • Development of an appropriate risk assessment model. • Development of an effort analysis to determine necessary resource allocation (personnel, travel and training). • Completion of a pilot program testing the risk assessment monitoring tools at several high-risk awardee institutions. FY 2002 Result: NSF produced the Risk Assessment and Award Monitoring Guide, developed an effort analysis to determine necessary resource allocation for future risk management efforts, and developed and completed a pilot test of risk assessment monitoring tools at 15 sites.	**FY 2002: NSF is successful for goal IV-8.**

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Facilities Oversight		
Construction and Upgrade of Facilities	***Performance Goal IV-9a:*** For 90 percent of facilities, keep construction and upgrades within annual expenditure plan, not to exceed 110 percent of estimates. FY 1999 Result: Majority of facilities within 110 percent of annual spending estimates. FY 2000 Result: Of the 11 construction and upgrade projects, all were within annual expenditure plans; most were under budget. FY 2001 Result: Of 25 construction and upgrade projects, 24 (96%) were within 110 percent of annual expenditure plans. FY 2002 Result: Of 28 construction and upgrade projects, 26 (93%) were within 110 percent of annual expenditure plans.	**FY 1999:** NSF successful for related goal **FY 2000:** NSF successful **FY 2001:** NSF successful for related goal **FY 2002: NSF is successful for goal IV-9a.**
Construction and Upgrade of Facilities	***Performance Goal IV-9b:*** Ninety percent of facilities will meet all annual schedule milestones. FY 1999 Result: Majority of facilities on schedule. FY 2000 Result: Majority (7 of 11) of construction/upgrade projects within the annual schedule goal. FY 2001 Result: Of the 25 construction and upgrade projects, 21 (84%) met all annual schedule milestones by the end of the reporting period. FY 2002 Result: Of the 27 construction and upgrade projects, 13 (48%) met all annual schedule milestones. In FY 2001, milestones reached at any time within the fiscal year were considered successful. In FY 2002, milestones had to be reached by the specified date determined during project development. In some instances contract negotiations caused project delays. In FY 2003, NSF will continue to work with awardees to identify obstacles to successful performance and implement plans to avoid or mitigate their consequences in the future. NSF is also modifying goal statements to more accurately address these measures. Note that while there were 28 reporting facilities for the annual cost goal (Goal IV-9a), one facility was not required to report on annual milestone achievement. This project was expected to continue into FY 2002 but was redefined by Congress and, as a result, was deemed completed in FY 2001. The completed project had no milestones in FY 2002.	**FY 1999:** NSF successful for related goal **FY 2000:** NSF not successful for related goal **FY 2001:** NSF not successful for related goal **FY 2002: NSF is not successful for goal IV-9b.**

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Construction and Upgrade of Facilities	***Performance Goal IV-9c:*** For all construction and upgrade projects initiated after 1996, keep total cost within 110 percent of estimates made at the initiation of construction. FY 2001 Result: One project was completed. The actual total cost was equal to the estimated total cost. FY 2002 Result: Two projects were completed. In one case the actual total cost was equal to the estimated total cost. For the second project, the actual total cost was less than the estimated total cost. NSF is also modifying goal statements to more accurately address these measures.	**FY 1999 and FY 2000:** There were no projects completed, therefore this goal did not apply. **FY 2001:** NSF successful **FY 2002: NSF is successful for goal IV-9c.**
Operations and Management of Facilities	***Performance Goal IV-10:*** For 90 percent of facilities, keep operating time lost due to unscheduled downtime to less than 10 percent of the total scheduled operating time. FY 1999 Result: Reporting database under development. FY 2000 Result: Of the 26 reporting facilities, 22 (85%) met the goal of keeping unscheduled downtime to below 10% of the total scheduled operating time. FY 2001 Result: Of the 29 reporting facilities, 25 (86 percent) met the goal of keeping unscheduled downtime to below 10 percent of the total scheduled operating time. FY 2002 Result: Of the 31 reporting facilities, 26 (84 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, such as unfavorable weather or electric power supply interruption. Other causes of failure were related to technical problems such as sub-par performance of new instrumentation early in its commissioning stage. In FY 2003, 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. NSF is also modifying goal statements to more accurately address these measures.	**FY 1999:** Inconclusive for related goal **FY 2000:** NSF not successful for related goal **FY 2001:** NSF not successful **FY 2002: NSF is not successful for goal IV-10.**

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Business Practices		
Electronic Business	***Performance Goal IV-11:*** NSF will continue to advance the role of "e-business" in review, award, and management processes. Performance Indicator: NSF will double the FY 2001 number of paperless projects that manage the competitive review process in an electronic environment. FY 2001 Result: Ten pilot paperless projects were completed. FY 2002 Result: Thirty-one paperless projects were completed.	**FY 2001**: NSF successful **FY 2002: NSF is successful for goal IV-11.**
Security Program	***Performance Goal IV-12:*** NSF will implement an agency-wide security program in response to the Government Information Security Reform Act. Performance Indicators: • Risk assessments and certification to operate will be documented and retained. • Policies will be developed and disseminated. • Security management structure will be implemented. • Security related changes to personnel policies (as necessary) will be documented. FY 2002 Result: During the past year, NSF initiated actions to meet the requirements of the Security Act, OMB Circular A-130, and the National Institute of Standards and Technology Security Self-Assessment Guide for Information Technology Systems. The agency met all four performance indicators.	**FY 2002: NSF is successful for goal IV-12.**
Human Resources and Workplace		
NSF Staff - Diversity	***Performance Goal IV-13:*** NSF will show an increase over FY 2000 in the total number of hires to NSF science and engineering positions from underrepresented groups. FY 2000 Result: 35 females and 19 members of underrepresented minority groups were hired. FY 2001 Result: 38 females and 22 members of underrepresented minority groups were hired. FY 2002 Result: 41 females and 27 members of underrepresented minority groups were hired.	**FY 2000:** NSF successful for related goal **FY 2001:** NSF successful for related goal **FY 2002: NSF is successful for goal IV-13.**

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Workforce Training	***Performance Goal IV-14:*** NSF will establish an internal NSF Academy to promote continuous learning for NSF staff. Performance Indicator: Availability of new or revised courses that contribute to an organized curriculum for NSF staff. FY 2002 Result: Originally conceived in September 2000, the Academy is evolving in incremental steps. Consolidation of training functions commenced in FY 2001, initial seed money was provided in FY 2002, and more substantive funding has been requested for FY 2003 to initiate a broader curriculum and expanded programs. Once fully operational, the Academy will serve as the central locus of learning, and provide continual learning opportunities for NSF staff. The Academy's courses are now organized in 5 curricula areas: 1. Business and Administrative, 2. Program and Project Management, 3. Leadership and Supervisory Skills, 4. Communication and Personal Effectiveness, and 5. Distance Learning and Technology. During FY 2002, 76 courses were offered, 30 of which were new. In addition, 3 courses were revised to be more responsive to the needs and requirements of our staff.	**FY 2002: NSF is successful for goal IV-14.**
	Performance Goal IV-15: NSF will initiate a strategic business analysis to provide a comprehensive perspective on its future workforce requirements. Performance Indicators: • Request for Proposals to perform the strategic business analysis will be released. • Skill mix / competencies of the current NSF workforce will be examined. FY 2002 Result: A Request for Proposals was released in March 2002. A contract to conduct the business analysis was awarded in June 2002. A report on initial review of workforce competencies and skill mix was completed and delivered to NSF.	**FY 2002: NSF is successful for goal IV-15.**

ANNUAL PERFORMANCE GOALS FOR NSF'S MANAGEMENT (continued)

Performance Area	FY 2002 Annual Performance Goal	Results for National Science Foundation
Work Environment	***Performance Goal IV-16:*** NSF will establish various baselines that will enable management to better assess the quality of worklife and work environment within the Foundation. Performance Indicator: Development of an employee survey. FY 2001 Result: NSF was not successful in completing an internal employee survey. FY 2002 Result: NSF participated in development of an Office of Personnel Management work environment survey of the 24 Federal agencies comprising the President's Management Council. NSF staff participated in the survey administered by OPM.	**FY 2001:** NSF not successful **FY 2002: NSF is successful for goal IV-16.**

SUPPORTING INFORMATION

FOR FY 2002 GPRA REPORTING

Performance Reporting Requirements and Where to Find Them in Our Report

The Government Performance and Results Act of 1993 requires each Federal agency to report, no later than 180 days following the close of each fiscal year, to the President and the Congress on its performance for the previous fiscal year.

According to the OMB Circular No. A-11 Part 2, Section 231, dated June 27, 2002, each report must include the following elements[10]:

- *"A comparison of your actual performance with the projected (target) levels of performance as set out in the performance goals in your annual performance plan (see section 231.2);*
- *An explanation, where a performance goal was not achieved, for why the goal was not met (see section 231.4);*
- *A description of the plans and schedules to meet an unmet goal in the future, or alternatively, your recommended action regarding an unmet goal where you have concluded it is impractical or infeasible to achieve the goal (see section 231.5);*
- *An evaluation of your performance plan for the current fiscal year, taking into account the actual performance achieved in the fiscal year covered by your report (see section 231.6);*
- *An assessment of the reliability and completeness of the performance data included in the report (see section 231.7); and*
- *Actual performance information for at least four fiscal years (see section 231.8)."*

Other features as they apply to the agency[11]:

- Program evaluations;
- Information on use of non-Federal parties;
- Classified appendices not available to the public;
- Description of the quality of the reported performance information;
- Budget information;
- Analysis of tax expenditures; and
- Waivers of administrative requirements.

[10] The first five of these elements are provided with each goal discussed in our report. The last element is discussed in Section VI.

[11] Information on program evaluations is given in Appendices I. and II. Quality of reported performance information is discussed in Section VI. The other features are discussed in Section IX.

NSF STRATEGIC OUTCOME GOALS

III. NSF STRATEGIC OUTCOME GOALS

Introduction to Section III: NSF Strategic Outcome Goals

NSF assessment activities are based on an OMB-approved alternative reporting format that utilizes external expert panels for qualitative, retrospective evaluations of Foundation outcome results. In years prior to FY 2002, NSF used external independent assessments of NSF's outcome goal indicators provided by Committee of Visitors and Directorate Advisory Committees[12].

These committees provided assessment at program, divisional, or directorate levels. In FY 2002, NSF created a new external advisory committee – the Advisory Committee for GPRA Performance Assessment (AC/GPA) – to provide advice and recommendations to the National Science Foundation (NSF) Director regarding the Foundation's performance under the Government Performance and Results Act (GPRA) of 1993.

The charge to the NSF AC/GPA asked for development and transmittal to NSF of a report that included:

(1) An assessment of NSF retrospective results for indicators associated with the PEOPLE, IDEAS, and TOOLS strategic outcome goals;
(2) Comments on the quality/relevance/balance of NSF award portfolios; and
(3) Comments on NSF investment portfolios for their potential future impact.

The format of Section III is the following:

- An NSF assessment of performance with respect to the strategic outcome goal;
- Comments by the AC/GPA concerning the strategic outcome goal; and
- For each indicator or area of emphasis associated with a strategic outcome goal:
    - Comments by the AC/GPA,
    - Retrospective and prospective examples selected by AC/GPA.

A Diverse, Balanced Portfolio

Maintaining a diverse, balanced portfolio of high quality is an essential aspect of any investment strategy, and this holds true for investments NSF makes in science and engineering research and education. We recognize that there is a significant probability of failure associated with high-risk research, that there is often a lack of experimental data or methodologies, little consensus on theory, information and/or approach. If successful, however, such high-risk research can result in a significant advance in a scientific or technological field. In addition to our regular grants, our Small Grants for Exploratory Research (SGER) are meant to encourage Program Officers to invest in new, innovative concepts and ideas and to support small-scale, high-risk exploratory work.

Our external reviewers assessed our investment portfolio for FY 1999, FY 2000 and FY 2001 with respect to quality and balance. The vast majority of their comments indicated that investments made by the Directorates contained an appropriate balance of high-risk, multidisciplinary or innovative activities. Some comments from the AC/GPA and Committee of Visitors (COV) on quality and balance follow.

[12] See Section V for further details on these committees.

AC/GPA and COV FY 2002 comments on quality

"Overall, the Committee found that COVs judged the quality of the portfolio to be high. COVs found that in some cases proposals were not funded due to lack of money, not lack of quality. However, as would be expected in a portfolio of about 30,000 active awards, there is some evidence of variability in quality in parts of the portfolio. But the COVs did not appear to detect specific or systemic patterns of variability." (AC/GPA)

"The COV finds the overall quality of funded research and education proposals to be very high; NSF support continues to be the gold standard for ecologists. Scientists who submit proposals to NSF and to Ecological Studies in particular are aware of the high degree of competition for the funds, and the stringent review process assures that only high quality research is funded."

"The quality of the research that is funded is outstanding. There is a set of declined proposals that would also fit into this category, presumably due to insufficient funds."

"In general, the quality of the research projects is excellent."

"The funded projects in this portfolio are of variable quality in relation to the goals of the IERI initiative."

"Based on a review of the lists of funded projects, the contents of selected jackets, and the COV members' knowledge of many of the IMD projects, the COV judged the quality of the funded projects to be very high."

"We noted that the scores, on average, assigned to both the declined and funded NSDL proposals are lower than expected. See our comments below on this matter."

"The quality is high and the projects are diverse."

"The quality of research and education projects across the Division were deemed to be high and meritorious. Combined high quality in both research and education are components of successful proposals."

"The quality of research is consistently of the highest caliber."

"The overall quality of research and education projects that we saw was outstanding."

"The range of the STR portfolio was most impressive."

"The Geophysics program has been extraordinarily successful in stimulating and fostering discoveries across a broad range of topics."

"The HS Program has now established a track record of supporting excellent science across a remarkably broad spectrum of hydrologic research."

"This program is funding high quality fundamental research."

"The funded projects in this portfolio are of variable quality."

"Work funded by the program has been of excellent quality, focusing on first-rate problems."

"The CD program has matured into a collection of primarily large projects, wherein first order global processes are being studied effectively and basic earth science discoveries are being made."

"As summarized in the reports for the individual programs, the COV was greatly impressed with the excellent results being achieved in every Program. EAR awards are leading to advances of major scientific or engineering importance."

"Overall, the work supported by the division is world class and absolutely at the cutting edge of research. The programs are a powerful and constructive force in shaping the educational environment of the nation."

"Funding rate appeared to differ dramatically across disciplines (Among the jackets reviewed, geosciences had a high success rate; social sciences had a low rate.) It should be determined whether this is true across all proposals and, if so, whether or not this serves INT and NSF goals."

AC/GPA and COV FY 2002 comments on innovative, risky, and multi-disciplinary research and education

"Thus, the Committee has confidence that NSF is appropriately attending to the need for both high-risk and multidisciplinary research and education as a key element in the overall portfolio. However, over time, NSF should attempt to collect more direct data on both the amount and the effectiveness of its investment in interdisciplinary research."

"71% of funded proposals were identified as especially innovative, but the COV emphasizes that essentially all funded proposals are innovative, especially given the high degree of competition for funding."

"High Risk: Very few of these were identified and even fewer were supported. The majority of funded labs have received multiple awards or are associated with well-known major institutions; in general, the program made very conservative funding decisions. This pattern could constrain the contributions made to the overall People goals of NSF."

"As would be expected for proposals submitted to this category, the majority of proposals had elements of high risk. This indicates that the program announcements solicit applications from the appropriate sectors of the scientific community. Thus, the concerns identified by the 1998 COV report appear to have been resolved. In addition, NSF is doing an adequate job in using the SGER to initiate high risk projects. However, the actual number of SGER awards made over this review period appears to be only 2%."

"The COV notes that the definition of high-risk is extremely subjective. However, based on the identification of high-risk proposal by the panels, the percentage of such proposals that is funded is increasing. We believe this is a good trend but needs to increase."

"The data are not available to determine the proportion of proposals that are multidisciplinary."

"This category of proposals is difficult to assess as the COV thought all proposals should be innovative. The COV was uncertain of what the Foundation means by the term 'innovative'."

"The COV finds that, in general, the funded projects are of high quality and that there is a balance of high risk, multidisciplinary, and innovative proposals."

"The whole NSDL program is high risk. Even taking this into account, we believe that the program is doing a good job funding high risk proposals."

"Multidisciplinarity is a hallmark of the NSDL program."

"The COV found that the jackets reviewed demonstrated high levels of innovation."

"The majority of awards in the portfolio of the Division are multidisciplinary; a balance that is deemed fully appropriate."

"Successful proposals in cluster solicitations are uniformly innovative."

"The number of proposals identified as high risk is relatively small."

"There appears to be sufficient balance of multidisciplinary proposals within the Aeronomy Program. The number of cross-disciplinary proposals is relatively small."

"The proposal pressure from the community generates more innovative proposals than can reasonably be funded. The review process and the panel process combine to insure that the most innovative proposals rise to the top."

"Despite strong division and directorate statements in support, multidisciplinary research appears to be treated in an ad hoc basis within EAR with any attempts to address specific proposals dependent on personal relations among Program Officers."

"None of the EAR programs identify innovation as a target for consideration in the review process."

"High Risk Proposals. The number of proposals in this class seems appropriate but certainly remains at a level where further expansion could be supported."

"The innovation exhibited in the proposals was remarkably high."

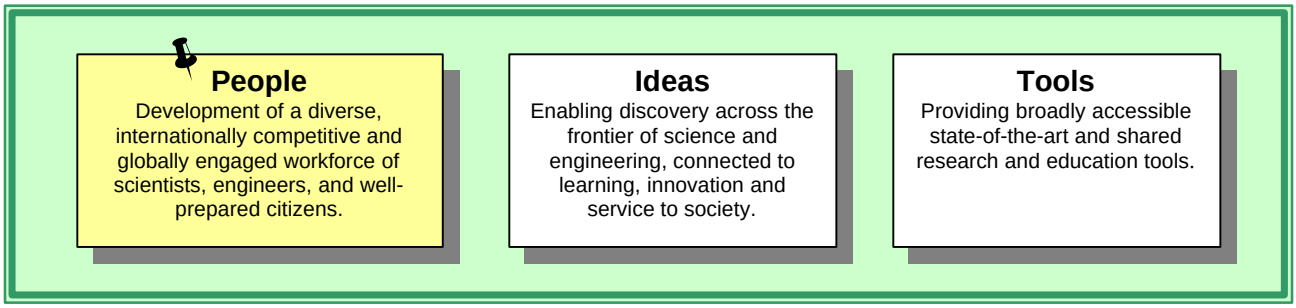
"Few multidisciplinary projects were noted in the jackets, although the COV learned of their existence."

"The technical risk of funded projects is generally low, although other elements of risk are apparent."

"The level of innovation in the funded projects is appropriate."

III. NSF OUTCOME GOALS

A. PEOPLE



STRATEGIC OUTCOME GOAL III-1a: Development of "a diverse, internationally competitive and globally engaged workforce of scientists and engineers, and well-prepared citizens."

✓ Goal Achieved

To achieve this outcome, we invest in the best and brightest students, researchers and educators to ensure a well-prepared workforce and citizenry. We provide support for formal and informal science, mathematics, engineering and technology education at all levels – pre K-12, undergraduate, graduate – in addition to professional development and public science literacy projects that engage people of all ages in life-long learning. Our efforts serve as a catalyst and a test bed for a gradual change in the process and philosophy of educating the workforce.

Our performance for this goal is successful when, in the aggregate, results reported for the period FY 2002 demonstrate significant achievement for four of the seven of the following indicators:

- Development of well-prepared scientists, engineers or educators whose participation in NSF activities provides them with the capability to explore frontiers and challenges of the future;
- Improved science and mathematics performance for U.S. K-12 students involved in NSF activities;
- Professional development of the SMET instructional workforce involved in NSF activities;
- Contributions to development of a diverse workforce through participation of underrepresented groups (women, underrepresented minorities, persons with disabilities) in NSF activities;
- Participation of NSF-supported scientists and engineers in international studies, collaborations, or partnerships;
- Enhancement of undergraduate curricular, laboratory, or instructional infrastructure; and
- Awardee communication with the public in order to provide information about the process and benefits of NSF supported science and engineering activities.

RESULT FOR PERFORMANCE GOAL III-1a: Reports prepared by external experts provided examples of significant achievement in reports they developed during FY 2002 reporting. Comments by the AC/GPA and examples they selected are presented for each of the performance indicators and areas of emphasis for this goal.

Implications for the FY 2003 Performance Plan: This goal will be continued in FY 2003.

PEOPLE: Comments by the Advisory Committee for GPRA Performance Assessment (AC/GPA)

The following statements concerning NSF achievement with respect to the Indicators and Areas of Emphasis for the PEOPLE goal are excerpted from the AC/GPA Report on NSF's PEOPLE portfolio. Additional comments as well as examples in support of significant achievement for each indicator are available at http://www.nsf.gov/od/gpra/reports/final_report_1107.doc

"The PEOPLE Indicator retrospective portfolio was impressive in its diversity, breadth, and impact. Significant achievements were accomplished in all areas of the People portfolio. A detailed discussion of the specific indicators for this portfolio can be found in Appendix 1 of this report. Program nuggets varied from small highly focused programs to international and broad impact ones. Program participants are equally varied, from pre-school teachers to graduate level students; from pre-school teachers to graduate school faculty; from two to three students in a research project to programs affecting thousands of students and/or teachers. The portfolio includes pre- and in-service teacher training programs; research experiences for students and teachers; internship opportunities and professional development workshops. Undergraduate research experiences teach research methodology and stimulate interest in science, technology, engineering and mathematics (STEM) professions.

INDICATOR 1: Development of well-prepared scientists, engineers or educators whose participation in NSF activities provides them with the capability to explore frontiers and challenges of the future.

RESULT: *Demonstrated significant achievement.*

"One critical component of NSF's portfolio includes programs and funding opportunities that explore the human infrastructure dimension. This "People" component contains important activities that expose students to non-traditional career choices, graduate school, and interdisciplinary employment opportunities in science, technology, engineering and mathematics. The nuggets clearly indicate a balance of programs ranging from K-12 through the support of senior investigators. In some programs a large number of students are impacted, while in others a smaller number of discipline specific students are participants. The emphasis and strategies used to develop and train STEM scientists, educators, and engineers are innovative and of high quality. Some are high risk and provide opportunities for non-traditional students, or utilize other strategies that increase student opportunities. Providing scholarships for students who also must hold full time jobs is an effective strategy to increase the pool of STEM students."

INDICATOR 2: Improved science and mathematics performance for U.S. K-12 students involved in NSF activities.

RESULT: ***Demonstrated significant achievement.***

"While retrospective results clearly demonstrate improved science and mathematics performance for U.S. K-12 students involved in NSF activities, the prospective analysis confirms agency's commitment to the development of 'a diverse, internationally competitive and globally engaged workforce'.

The overall quality of the retrospective portfolio of outcomes and outputs reported in FY 02 in the area of improving science and mathematics performance for U.S. K-12 students is impressive. The supported programs clearly emphasize the many aspects and variables essential to improving science and mathematics performance of K-12 students."

INDICATOR 3: Professional development of the SMET instructional workforce involved in NSF activities.

RESULT: ***Demonstrated significant achievement.***

"Based on review of information provided, the Committee concludes that NSF has made significant achievements in developing the STEM instructional workforce. NSF grants have supported a variety of activities, several of which are pervasive and nationally replicable models of teacher professional development. The portfolio includes pre- and in-service teacher training programs; research experiences; internship opportunities and professional development workshops. There were several programs that provided research experience for faculty. Some of these had associated workshops designed to present techniques for translating research experience in areas as diverse as astronomy, marine biology, arctic biology into classroom instruction."

INDICATOR 4: Contributions to development of a diverse workforce through participation of underrepresented groups (women, underrepresented minorities, persons with disabilities) in NSF activities.

RESULT: ***Demonstrated significant achievement.***

"Overall the accomplishments presented in the Retrospective Analysis are of very high quality and demonstrate methodologies that are making a difference in developing a diverse, internationally competitive work force of scientists and engineers. This does not mean however that this is a comprehensive, all-inclusive set of strategies."

"LSAMP is one of the most important programs contributing to significant achievement in this indicator. This is an example of successful demonstration project being selected for large-scale implementation by

NSF via implementation by a wide variety of educational institutions with the intention of substantially increasing participation by underrepresented populations in STEM activities and careers."

INDICATOR 5: Participation of NSF-supported scientists and engineers in international studies, collaborations, or partnerships.

RESULT: *Demonstrated significant achievement.*

"Many NSF PIs have conducted NSF-supported research that involves international activities. Some PIs have established cooperation on an individual basis with peers in other countries; others have created partnerships involving multiple organizations. In some cases, there is evidence that the level of engagement with the international participants is very high, resulting in co-authorship peer-reviewed publications."

INDICATOR 6: Enhancement of undergraduate curricular, laboratory, or instructional infrastructure

RESULT: *Demonstrated significant achievement.*

"Review of the retrospective portfolio addresing the enhancement of undergraduate curricular, laboratory, or institutional infrastructure clearly demonstrates successful accomplishment of the stated goal. Review of the prospective portfolio attests to the Agency's continued commitment to enhancing the undergraduate curricular, laboratory, and/or instructional infrastructure.

Innovation, collaboration, broad dissemination, and the potential for significant and extensive impact characterize programs in the PI 6 retrospective portfolio. Programs are broad in scope. Examples of programs in this portfolio include: involvement of liberal arts faculty from several liberal arts colleges working with STEM faculty in a summer program to develop modular case studies; development of new courses; new curricula such as neuroinformatics and bioinformatics; establishment of virtual laboratories; development of virtual laboratory experiments; a tactile printing technique enabling blind people to access scientific information; and outstanding faculty development programs. Through these programs NSF is building the educational research base and providing support for innovative instructional approaches, and faculty development. Leaders of 703 projects indicated that 1,923 faculty from doctorate-granting institutions, 549 from master's degree granting institutions, 1,657 from bachelor's degree granting institutions, and 772 from associate-degree granting institutions have been trained. A number of students, faculty, and individual programs in this portfolio have received state, regional, and national awards.

The retrospective and prospective portfolios clearly attest to NSF's commitment to innovation, and multi-disciplinary research and education. The awarded programs demonstrate NSF's response to the Nation, and science and technology fields. The overall quality of thse\programs is impressive. The competitive merit-based mechanism, such as the peer-review award process is effective and successful in addressing the agency goals and indicators, and in fostering innovation, creativity, and growth in mathematics and science fields."

INDICATOR 7: Awardee communication with the public in order to provide information about the process and benefits of NSF supported science and engineering activities.

RESULT: ***Demonstrated significant achievement.***

"These data in this section were limited in nature. Nevertheless, these selected activities are illustrative of the creative approaches that many prinicipal investigators take to disseminate their results to a broader audience and to get the pubic involved in scientific activities. The activities were both large (e.g., observatory) and small (.e.g., writing a memoir) but all had the same goal—communicate scientific results to and get the public involved in the scientific endeavor. These efforts demonstrate that even the most complex issues in science can be made accessible to the broader public."

Area of Emphasis 1: K-12 Education: The President's Math and Science Partnership.

"Progress towards improving student achievement in math and science has been impressive in urban and rural schools. In all cases, test scores have improved. In some cases, there have been significant improvement in narrowing the performance gap between majority and minority students. Performance increases are attributed to: (1) special local efforts such as targeting reform efforts at lower grades and providing additional support for at-risk students; (2) implementation of standards-based curriculum; (3) teacher participation in math/science content institutes or other subject area professional development activities; (4) adoption of state curriculum guides/frameworks and national standards."

Area of Emphasis 2: Learning for the 21st Century (Centers for Learning and Teaching; NSF Graduate Teaching Fellows in K-12 (GK-12) Education).

"The Centers for Learning and Teaching are developing pedagogy and technology to rebuild the intellectual infrastructure to ensure high-quality educational experiences for all students. Many projects involve multiple institutions and disciplines.

The GK-12 program is significantly increasing the quantity and quality of professionals to serve as content resources in the K-12 classroom. Fellows are positive role models for students. Teachers feel less risk when working with them. They bring new knowledge to the classroom."

Area of Emphasis 3: Broadening participation (Minority Serving Institutions Program)

"The accomplishments in this section are drawn heavily from EPSCoR and Minority Serving Institutions. There are no accomplishments from the Minority Institutions Infrastructure Program. Nevertheless, the accomplishments suggest that there is substantial activity on the part of NSF recepients to include underrepresented minorities in research and education projects, and to recruit and retain them in careers in science and engineering. Clearly, more needs to done in this area, but the accomplishments reviewed are illustrative of some of the successful programs that will go a long way toward increasing the number of minorities in science and engineering activities and careers. NSF should be applauded for its efforts, but must continue its commitment and increase its activities in this area. Success will come only with sustained programmatic and financial resources over the next several decades."

Area of Emphasis 4: Graduate Student Stipends, *e.g.,* Increasing stipends of GRF, IGERT, and GK-12.

"NSF's successful advocacy for increases in graduate student stipends has made these fellowship programs more attractive. In 2002, fewer applicants rejected fellowships to accept ones with higher stipend or longer duration. NSF is encouraged to keep a focus on maintaining attractive grant programs that will attract and retain students in STEM fields."

No examples provided by NSF."

STRATEGIC OUTCOME GOAL III-1b: After three years of NSF support, over 80 percent of schools participating in systemic initiative programs will: (1) implement a standards-based curriculum in science and mathematics with at least one-third of their teachers; (2) provide professional development for at least one-third of their teachers; and (3) improve student achievement on a selected battery of math and science tests at one or more of three educational levels (elementary, middle and high school).

✓ Goal Achieved

NSF manages a portfolio of programs that encourages and facilitates coordinated approaches to systemic, standards-based reform of science, mathematics, and technology (SMET) education. Systemic reform relies on partnerships to identify needs, articulate visions, and develop goals, strategies, and activities for improvement of targeted areas. Although each systemic initiative is unique in its approach, all must begin as a collaborative effort among individuals and organizations that are committed to requiring high expectations for all students through challenging educational opportunities. Systemic initiatives cultivate coordination within cities, states, rural areas, school systems, and other organizations involved with education.

In terms of the implementation of standards-based curriculum process, NSF requires that awardees certify that the curriculum materials they are adopting are consistent with their locally developed standards and demonstrate improved student learning as a result of the use of such standards-based curriculum. For the purpose of this report, curriculum implementation only refers to actual classroom use, excluding processes, such as planning, examining, or adopting a standards-based curriculum. In addition, data reflects only schools in which at least one-third of the teachers are utilizing such as curriculum.

RESULTS: NSF achieved this goal. Systemic Initiatives (SI) projects reported that 93.1% of their schools met the GPRA goal for mathematics curriculum implementation, while 91.3% met the goal for the implementation of science curriculum. In mathematics, 94.0% of elementary schools, 94.5% of middle schools, and 91.0% of high schools met the goal. Similarly, in science, 92.6% of elementary schools, 90.4% of middle schools, and 90.5% of high schools attained the goal. For professional development 96% of the SI schools reported meeting the goal for mathematics professional development and 95% met the goal for science professional development. Finally SI projects reported that at the middle school level 87% of participating schools met the goal of improved student achievement in math and 86% met the goal of improved student achievement in science.

FY 1999 Result: In 1999, 46 NSF-sponsored projects implemented mathematics and science standards-based curricula in over 81% of participating schools, and provided professional development for more than 156,000 teachers. All participating educational systems demonstrated some level of improvement in student achievement in mathematics and science.

FY 2000 Result: In 2000, 47 Systemic Initiative projects implemented mathematics and science standards in over 80% of the participating schools and provided professional development for more than 214,792 teachers. The Systemic Initiative projects reported improved student achievement in math in 81% of the 4,187 schools and improved student performance in science in 86% of the 2,474 schools using the same assessments for the last 3 years.

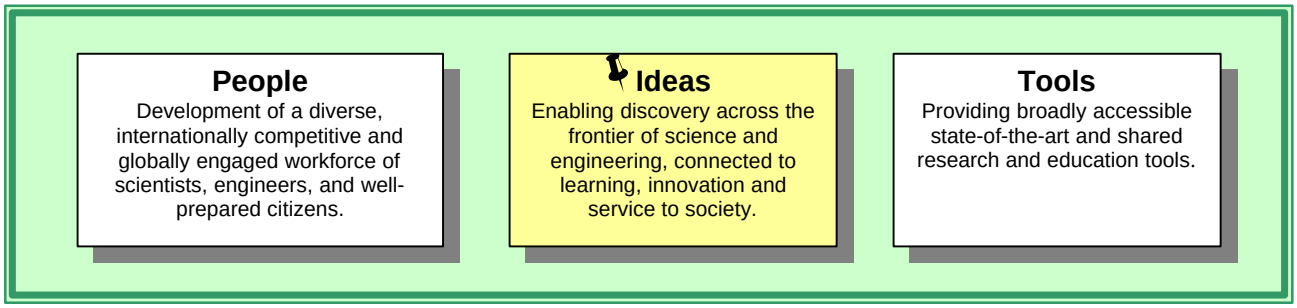
FY 2001 Result: The curriculum, instructional workforce, and improved achievement in science components of the goal were successful. However, less than 80% of schools met the goal of improved student achievement in mathematics. Forty-seven Systemic Initiative projects implemented mathematics and science standards-based curriculum in 89% of the participating schools and provided professional

development for more than 226,900 teachers. The Systemic Initiative projects reported improved student achievement in math in 74% of the 6,255 schools and improved student performance in science in 80% of the 4,082 schools using the same assessments for the last 3 years.

IMPLICATIONS FOR THE FY 2002 PERFORMANCE PLAN: This goal will be maintained in FY 2002.

NSF STRATEGIC OUTCOME GOALS

B. IDEAS



STRATEGIC OUTCOME GOAL III-2: Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."

✓ Goal Achieved

NSF invests in ideas to provide a deep and broad fundamental science and engineering knowledge base. Investments in ideas support cutting-edge research that yields new and important discoveries and promote the development of new knowledge and techniques within and across traditional boundaries. The results of NSF-funded research and education 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.

Our performance is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement in the majority (four of six) of the following indicators:

- Discoveries that expand the frontiers of science, engineering, or technology;
- Discoveries that contribute to the fundamental knowledge base;
- Leadership in fostering newly developing or emerging areas;
- Connections between discoveries and their use in service to society;
- Connections between discovery and learning or innovation; and
- Partnerships that enable the flow of ideas among the academic, public or private sectors.

RESULT: NSF achieved this goal. External experts provided examples of significant achievement in reports they developed during FY 2002 reporting. Comments by the AC/GPA and examples they selected are presented for each of the performance indicators and areas of emphasis for this goal.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: This goal will be continued in FY 2003.

IDEAS: Comments by the Advisory Committee for GPRA Performance Assessment

The following statements concerning NSF achievement with respect to the Indicators and Areas of Emphasis for the IDEAS goal are excerpted from the AC/GPA Report on NSF's IDEAS portfolio. Additional comments as well as examples in support of significant achievement for each indicator are available at http://www.nsf.gov/od/gpra/reports/final_report_1107.doc

"The Ideas Portfolio met the Committee's standards for significant achievement for all indicators based on considerations of quality, relevance and balance. A detailed discussion of the specific indicators for this portfolio can be found in Appendix II of this report. However, it should be noted that not every project provided as an example for an indicator met these standards. This is due in part to inadequate descriptions.

Review of a cross-section of NSF-supported research accomplishments drawn broadly from NSF's directorates points to a substantial number of important contributions to fundamental knowledge in existing fields of science, discoveries that have expanded the frontiers of science, engineering or technology, and leadership in fostering newly developing and emerging areas. Especially striking in the case of newly developing and emerging scientific areas is the prevalence of multi-disciplinary (and multi-institutional) approaches. This pattern appears most frequently at the interfaces between and among the life sciences, physical sciences and engineering. It is less evident in the social sciences.

Many of these research achievements under the Ideas category contribute to the attainment of performance objectives under People and Tools goals."

INDICATOR 1: Discoveries that expand the frontiers of science, engineering, or technology.

RESULT: *Demonstrated significant achievement.*

"The 67 retrospective accomplishments and 30 prospective examples reviewed ranged from fundamental studies of gravitational waves and the testing of Einstein's Theory of General Relativity to discovery of the oldest rocks on Earth and chiral catalysts with the ability to synthesize specific enantiomorphs (i.e., left or right-hand versions) of a molecule. Some of the projects described in these nuggets involve basic science, with no apparent long-term societal payoff, whereas others involve applied science and engineering with high potential for almost immediate societal impact. An example of the former is a nugget describing the discovery of extrasolar planets. An example the latter is synthesis of self-tightening bolts from smart piezoelectric and shape memory materials. Another class of nuggets involves social science research ranging from group decision making to the connections between war and technological/scientific innovations in the civilian arena, such as the development of pesticides following World War II. There were also several social science projects that dealt with public attitudes in the U.S. following the terrorist attacks of 9/11/01."

"55 of the 67 retrospective I-1 accomplishments and all 30 of the prospective I-1 examples reviewed under the Indicator "Discoveries that expand the frontiers of science, engineering, or technology" were judged to be of high quality, although it was difficult to fully understand many of the projects based on the information reported in the nuggets. The twelve I-1 retrospective accomplishments that were judged to be of less than satisfactory quality suffered from poor explanations of why the studies were significant

in a broader context of science, engineering, or technology. The projects that were judged to be outstanding (12 in the retrospective category and seven in the prospective category) covered many disciplines and represent cutting-edge research that is pushing the frontiers of science, engineering, and technology."

INDICATOR 2: Discoveries that contribute to the fundamental knowledge base.

RESULT: *Demonstrated significant achievement.*

" The Indicator 2 (I2) portfolio contains many nuggets that describe work of very high quality and with large impact on the fundamental knowledge base. The nuggets selected are representative of this high quality work."

"The I2 portfolio describes projects that cut across the entire NSF. These projects fit well into the mission of the Foundation, have impact on the PIT Goals, and are relevant to the Foundation's stakeholders."

"The work represented in the I2 portfolio will likely have large and positive impact on the fields represented. In some cases, that impact will go beyond the disciplinary area of the PI."

INDICATOR 3: Leadership in fostering newly developing or emerging areas.

RESULT: *Demonstrated significant achievement.*

"Selection based on documentation within vignettes of external recognition by scientific community, bridging of two or more scientific fields/techniques, and breadth of applicabiity of potential solutions. Several vignettes presented under prospective impacts are excellent examples of risky, interdisciplinary research; indeed, they are better examples than several of those listed under that emphasis area."

"Uneven quality of documentation dominates ability to assess overall quality of NSF portfolio. However, a sufficient number of vignettes exist to point to attainment of NSF goal of supporting research at the frontiers of science, making contributions to fundamantal knowledge in existing fields, and most impressively, being at the cutting edge of research in forging new scientific fields. Other vignettes are more indicative of good but "normal" science. For still other vignettes, accounts are either too brief to permit assessment or raise questions about why they were showcased by program managers."

"Few proposals are explicitly listed as risky, making assessment of this criterion difficult."

INDICATOR 4: Connections between discoveries and their use in service to society.

RESULT: *Demonstrated significant achievement.*

"Uneveness in the nugget descriptions does not allow a general quality and intellectual merit determination for the I4 portfolio as a whole."

"Of the approximately 100 nuggets investigated in the I4 portfolio, about 30% were considered to be of significant service to society. Considering that NSF has struggled in the past to be directly relevant in its research projects, this is a good score."

"Because of the nature of this portfolio, (service to society), it does not contain much high risk research."

"The 30% of the I4 portfolio considered to have a high service to society rating has a relatively broad impact, by definition."

INDICATOR 5: Connections between discovery and learning or innovation.

RESULT: *Demonstrated significant achievement.*

"We interpreted indicator I5 with regard to connecting discovery to innovation as reflecting transition of scientific results into useful technology and with regard to connecting discovery to learning as reflecting research related directly to the learning process."

"The sample portfolio consisted of 25 "nuggets" (accomplishments). These covered a broad spectrum of projects including research in the life, physical, and geological sciences, research on education and educational outcomes, and the development of a number of tools. A subset that was selected as representing our interpretation of indicator I5 were of high quality and easily passed the "significant achievement" test."

"It was difficult to assess why some of the projects were selected for inclusion as nuggets."

INDICATOR 6: Partnerships that enable the flow of ideas among the academic, public or private sectors.

RESULT: *Demonstrated significant achievement.*

"Of the partnership nuggets reviewed almost all were impressive in terms of the quality, importance, and innovativeness of the research. The breadth of the research was particularly impressive, including challenging problems in areas of material science, climate modeling, nanoscience, speech recognition, gene silencing, earthquake prediction, genome sequencing, and evolutionary history. The nuggets presented above illustrate the breadth and quality of the research and other partnering activities."

"As with the retrospective nuggets, NSF has an impressive array of important projects of considerable merit. The prospective nuggets described are representative of the quality and intellectual merit of the prospective portfolio."

Area of Emphasis 1: Biocomplexity in the Environment.

"The biocomplexity area funds a very wide-ranging set of projects. Many of them are very likely to lead to significant discoveries. Essentially all of the nuggets in the portfolios – both prospective and retrospective – describe interesting interdisciplinary projects.

If there is one difficulty in the assessment, it is in the rather amorphous understanding of what is meant by *complexity*. In some instances it appears to be used only to justify inclusion under the umbrella of the initiative."

Area of Emphasis 2: Information Technology Research

"The quality, creativity, importance and breadth of the projects in the Information Technology Research (ITR) Emphasis Area are impressive. Projects show important investments in high end computing (allowing researchers to tackle problems previously considered too complex), research at the frontiers and interfaces of scientific areas, and data handling (gathering, storing, analyzing, sharing and displaying information). The nuggets provide specific examples for each of these."

"The portfolio demonstrates a good balance of risky, high potential benefit projects versus less risky research. Many of the projects are multidisciplinary, particularly the research at the interface of biology and physics."

Area of Emphasis 3: Nanoscale Science and Engineering

"Most of these research projects have great potential for future impact in many fields, ranging from medicine to computing to chemical sensing of environmental pollutants."

Area of Emphasis 4: Interdisciplinary Mathematics

"This is a new emphasis area with a small portfolio. There were only eight nuggets to review, however, the breadth and quality of these projects were impressive. This activity is part of NSF's increasingly critical role in advancing interdisciplinary science and will grow in the future. The nuggets illustrate the application of cutting-edge mathematics to problems in the physical, climate, and social sciences. The eight projects reviewed have the potential for important impacts and support NSF's goal of "enabling discovery across the frontier of science" as well as advancing NSF's role in establishing multidisciplinary communities to address the challenging problems of the future."

Area of Emphasis 5: Balance of IDEAS Portfolio, including projects that are innovative, risky, or multidisciplinary

"Interdisciplinary projects exhibit high (absolute and relative) degrees of riskiness and innovativeness**.**"

Comments from FY 2002 NSF Committee of Visitors

- "The Program Directors' use of exploratory awards is a flexibility that allows deserving concepts to be more fully developed. It is a catalyst to and protection of high risk/high yield. The majority of awards in the portfolio of the [BES/ENG] Division are multidisciplinary; a balance that is deemed fully appropriate. Successful proposals in cluster solicitations are uniformly innovative. Variable degrees of innovation are observed in the unsolicited proposals. High risk investment is evident even for well defined areas such as the regulation of transcription and translation in defining phenotype …"

- "Few multidisciplinary projects were noted in the jackets…The technical risk of funded projects is generally low, although other elements of risk are apparent. Some risk is inherent in distributing a significant number of projects in less developed countries. The level of innovation in the funded projects is appropriate."

- "Program has an appropriate balance of high risk proposals, especially in ATI (Advanced Technologies and Instrumentation) and the use of Small Grants for Exploratory Research (SGER)."

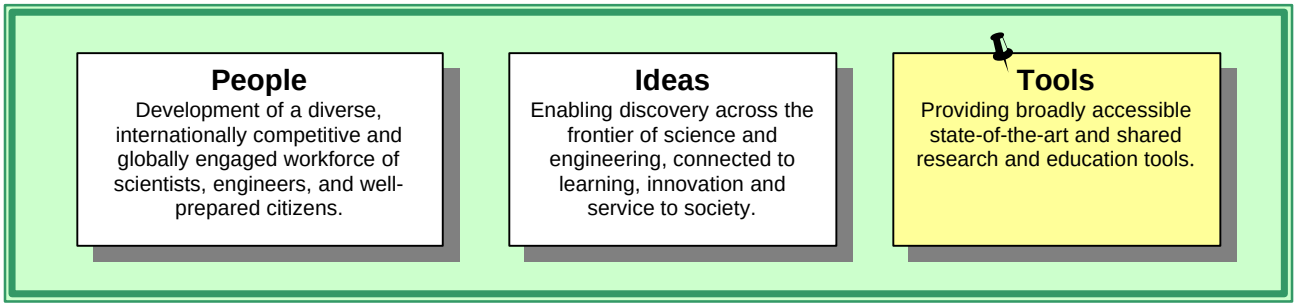
- "The current funding plan involving planning grants and Phase I proposals is an appropriate means to help increase the number of proposals that will meet the major goals of the IERI program. Most of the proposals funded under this initiative are multidisciplinary. … While the proportion of applications that directly address questions about scaling up has so far been limited, it is anticipated given the beginning nature of the field, that future proposals addressing these questions will involve innovative ideas and designs."

- "The number of proposals in this class [high risk] seems appropriate but certainly remains at a level where further expansion could be supported. The use of the division reserve to promote the funding of programs in this class is appropriate and supported by the COV. … In some important areas of research … there exists a diversity of theories as to the mechanism. Reviews in such cases can be quite divergent and the judgment of the PD is critical … The innovation exhibited in the proposals was remarkably high. This is a distinction that seems to show no age preference. The portfolio is very healthy in this regard. The growing representation of interdisciplinary and collaborative programs of research are notable and warrant recognition."

- "EHR employed an independent contractor to perform an independent analysis of awards made under the ROLE program. Sixty-seven jackets were reviewed. Seventeen percent of the proposals were determined to be high risk; 26% multidisciplinary, and 2% innovative."

NSF STRATEGIC OUTCOME GOALS

C. TOOLS



STRATEGIC OUTCOME GOAL III-3: Providing "broadly accessible, state-of-the-art and shared research and education tools."

✓ Goal Achieved

NSF invests in tools to provide widely accessible, up-to-date science and engineering infrastructure. This strategic outcome supports the parts of NSF's mission directed at (1) programs to strengthen scientific and engineering research potential and (2) an information base on science and engineering appropriate for development of national and international policy.

As emerging research opportunities increasingly involve phenomena at or beyond the limits of our measurement capabilities, many research areas can only be studied and problems solved through the use of new generations of powerful tools. NSF investments provide state-of-the-art tools for research and education, such as instrumentation and equipment, multi-user facilities, digital libraries, research resources, accelerators, telescopes, research vessels and aircraft and earthquake simulators. In addition, resources support large surveys and databases as well as computation and computing infrastructures for all fields of science and engineering research and education. Support includes funding for construction, upgrade, operations, and maintenance of facilities, and for personnel to assist scientists and engineers in conducting research and education at the facilities.

Our performance is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement in the majority (four of six) of the following indicators:

- Provision of facilities, databases or other infrastructure that enable discoveries or enhance productivity by NSF research or education communities;
- Provision of broadly accessible facilities, databases or other infrastructure that are widely shared by NSF research or education communities;
- Partnerships, e.g., with other federal agencies, national laboratories, or other nations, to support and enable development of large facilities and infrastructure projects;
- Use of the Internet to make SMET information available to the NSF research or education communities;
- Development, management, or utilization of very large data sets and information-bases; and
- Development of information and policy analyses that contribute to the effective use of science and engineering resources.

RESULT: Reports prepared by external experts during FY 2002 GPRA reporting provided assessments and retrospective examples of NSF-supported projects that document significant achievement. Comments by the AC/GPA and examples they selected are presented for each of the performance indicators and areas of emphasis for this goal.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: This goal will be continued in FY 2003.

TOOLS: Comments by the Advisory Committee for GPRA Performance Assessment

The following statements concerning NSF achievement with respect to the Indicators and Areas of Emphasis for the TOOLS goal are excerpted from the AC/GPA Report on NSF's TOOLS portfolio. Additional comments as well as examples in support of significant achievement for each indicator are available at http://www.nsf.gov/od/gpra/reports/final_report_1107.doc

"The Committee concluded that NSF made significant achievements across the entire set of Tools indicators and emphasis areas. The Committee selected a number of illustrative achievements and examples to support this finding. A detailed discussion of specific indicators can be found in Appendix III. NSF support for Tools allowed wider and more effective dissemination of data and materials, enhanced the abilities of scientists, engineers, and educators to do their work, and increasingly expanded access to and availability of resources. In several cases (particularly astronomy and earth sciences), NSF-supported resources directly impacted the rate of progress for the discipline as a whole. Examples of new Tools that support the Committee's finding include: supercomputing resources, new large-scale experimental instruments, national-scale digital libraries, and repositories of data from unique sources ranging from radio astronomy to real-time oceanographic data from widely separated locations."

INDICATOR 1: Provision of facilities, databases or other infrastructure that enable discoveries or enhance productivity by NSF research or education communities.

RESULT: *Demonstrated significant achievement.*

"NSF supports facilities/infrastructure thoughout its portfolio, including as part of awards to individual investigators and through large community-based resources such as telescopes, ships, global sensor networks, accelerators, high-performance computers and community databases. By their very nature, these large facilites are beyond the ability of single institutions or PIs to support. Thus they truly *enable discoveries* that would not be possible without the level of support and coordination that NSF can provide. At the same time, they *enhance productivity* through economies of scale and prioirty setting by the user community. NSF investments in these areas tend to be long term. While incremental improvements and activities can be highlighted on an annual basis, the continued existence and on-going operation of these tools in itself is an important part of the NSF portfolio.

Clusters of these types of resources can be found in the nuggets for this indicator; e.g.,

Arctic/Antarctic support
Radio/Optical telescope
SBS databases
Nanotechnology facilities
Earth/Ocean observational systems."

INDICATOR 2: Provision of broadly accessible facilities, databases or other infrastructure that are widely shared by NSF research or education communities.

RESULT: *Demonstrated significant achievement.*

"The NSF'S investments in projects addressing this indicator of the Tools goal have provided returns that significantly advance the achievement of the overall goal. This is especially true of the astronomical sciences; indeed, education, research, and a well-trained scientific workforce would be inconceivable in the absence of the broadly accessible facilities, databases and shared infrastructure for which the NSF provides the major support. Other efforts are making advances in the assessment of children's attention available to large numbers of researchers. Such efforts hold considerable promise for improving our understanding of the teaching/learning process, and could grow to have a major influence on programs of the newly- established NSF Centers for Learning and Teaching. The activities addressing this indicator are balanced with respect to facilities and databases."

INDICATOR 3: Partnerships, e.g., with other federal agencies, national laboratories, or other nations, to support and enable development of large facilities and infrastructure projects.

RESULT: *Demonstrated significant achievement.*

"The NSF has demonstrated significant achievement in implementing partnerships with other federal agencies, national laboratories, and other nations to support and enable the development of large facilities and infrastructure projects. These partnerships include several other federal agencies; examples include: Department of Energy, EPA, NASA, NIH, NOAA, Library of Congress, Air Force, and the Navy. Examples of partnerships with national laboratories include Argonne National Laboratory, Brookhaven National Laboratory, and Los Alamos National Laboratory. Limited examples of partnerships with other nations were provided."

INDICATOR 4: Use of the Internet to make SMET information available to the NSF research or education communities.

RESULT: *Demonstrated significant achievement.*

"The NSF portfolio of investments in Tools as evidenced by achievements with respect to this indicator is characterized by activities that cover a broad spectrum of environments from software for the processing neutron scattering to the exchange of information on teaching practices among a community of almost 2000 K-12 teachers. There is a richness of diverse educational environments and subject matter, including non-doctoral institutions, non-profit research institutes and consortia. The subject matter includes seismic information, imaging and visualization programs, information on global change with highly developed conferencing capabilities, information on deep seafloor expeditions that are available to students via the internet, and information via the internet on income dynamics resulting in the transfer of qs many as 10,000 datasets annually. The return on the NSF's investments in this area is truly remarkable."

INDICATOR 5: Development, management, or utilization of very large data sets and information-bases.

RESULT: ***Demonstrated significant achievement.***

"The restrospective project nuggets showed investigation in key areas which are either pressing problems today, or are examples of problems that will increase in the future. Important issues in the retrospective examples included security and privacy issues, as well as large data sets with increased accessibility, utility and properties such as distributed, real-time and international sources. Examples illustrated the importance of the development, management and utilization of real-time and real-time sensory data, including that from human sources such as music, or related to human senses such as the olfactory. Among the more important data management issues covered were issues of data privacy and security, in both statistical and image databases. Among the more important data utilization issues were making large data sets (often gathered over long periods of time) available to scientists and the public through new dissemination channels."

INDICATOR 6: Development, management, or utilization of very large data sets and information-bases.

RESULT: ***Demonstrated significant achievement.***

"The retrospective projects described studies whiich provide information which contributes to policy analyses and the effective use of science and engineering resources. Significant retrospective achievements have been made in producing information in establishing rules to control Radio frequencies, in studying how landscape fragmentation affects demographic and genetic parameters ofselected migratory birds, in preparing science and engineering indicator reports that can be used by Congress and the President, and in developing an electronic publishing technique which protects authorship rights."

Area of Emphasis 1: Investments in Major Research Equipment and Facilities Construction (MREFC)

"The NSF has made significant investments in Major Research Equipment and Facilities Construction (MREFC). These investments have tremendous potential for future impacts by providing broadly accessible, state-of-the-art and shared research and education tools. These ongoing and prospective investments in research equipment and facilities are an excellent start and can easily be expanded to support additional equipment and facilities."

Areas of Emphasis 2: Continuing investments in Major Research Instrumentation (MRI)

"The MRI program is a highly effective mechanism to respond to instrumentation needs that lie between the individual project level and the Major Research Equipment account. Since these projects are usually proposed and evaluated with close linkages to established research programs, they tend to be strongly research driven (as opposed to technology innovation). Cost sharing with research directorates help to provide leverage and ensure prioritization by the user community. NSF has made outstanding selections of prospective projects that promises to create centers, develop modern instrumentation and assemble systems with existing instrumentation that will have high impact on science and engineering education."

Areas of Emphasis 3: Continuing investments in the National SMETE Digital Library (NSDL)

"As with science data sets and science database management techniques, this is an increasingly important area for NSF support. Many scientists use an unstructured search with a web search engine to augment their work (e.g., Google or NEC's Citeseer), yet the data, and the methodologies for locating and accessing them, are incomplete. The projects funded have been focused on leveraging the digital library medium to enhance knowledge bases in important disciplines. There was a notable and desirable flavor of collaboration to many of these projects. There were a notable number of women PIs and Co-PIs."

NSF MANAGEMENT GOALS

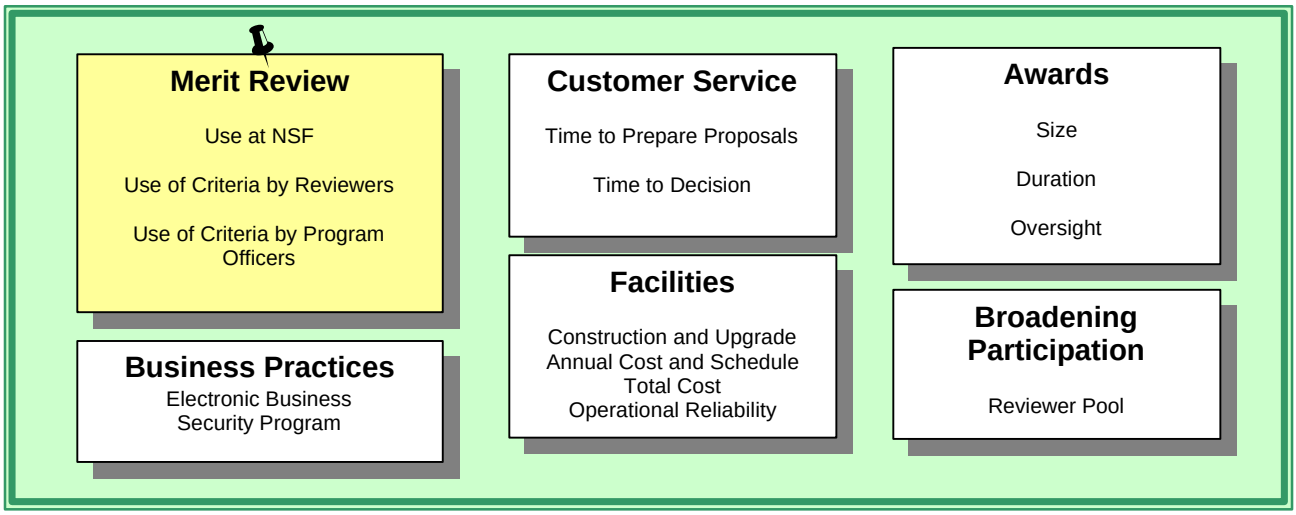
IV. NSF MANAGEMENT GOALS

Success in achieving our outcome goals is dependent upon the award portfolio developed by our program staff. The following sections provide information on how our management shapes the award portfolio and supports our outcome goals. Management goals focus on means and strategies for successful performance – in merit review and award oversight and management processes, broadening participation, and facilities oversight.

Summary of Results for Management Goals

We achieved 14 of our 19 Management Goals in FY 2002. We achieved our goals for allocation of funds to merit-reviewed projects, use of the two merit review criteria by reviewers, use of the two merit review criteria by program officers, the time it takes to make a decision on funding or declining a proposal, average annualized award size, developing and initiating a risk assessment / risk management plan for awards, annual and total cost of construction and upgrade projects, advancing the role of "e-business" in review, award, and management processes, implementing an agency-wide security program in response to the Government Information Security Reform Act, showing an increase over FY 2000 in the total number of hires to NSF science and engineering positions from underrepresented groups, establishing an internal NSF Academy to promote continuous learning for NSF staff, initiating a strategic business analysis to provide a comprehensive perspective on future workforce requirements, and developing an employee survey to establish various baselines that will enable management to better assess the quality of worklife and work environment within the Foundation.

We did not meet our Management Goals for time for the science and engineering community to prepare proposals, for establishing a baseline for the diversity of our reviewer pool, the average award duration, and annual construction/upgrade schedules and operating efficiency of facilities.



PROPOSAL AND AWARD PROCESS

A. MERIT REVIEW

Merit review is the keystone to identification of the most promising People, Ideas, and Tools and is critical to fostering the highest standards of excellence and accountability—standards for which NSF is globally recognized. We evaluate proposals for research and education projects using two criteria—the intellectual merit of the proposed activity and the broader impacts of the proposed activity.

Evaluations of proposals and funding decisions made through the process of merit review rely on evaluation by experts. Each year, more than 200,000 merit reviews are conducted to help program officers evaluate the proposals submitted for consideration.

The two NSF merit review criteria are:

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Goal IV-1 – Use of Merit Review
✓ Goal Achieved

Goal IV-1: At least 85% of basic and applied research funds will be allocated to projects that undergo merit review.

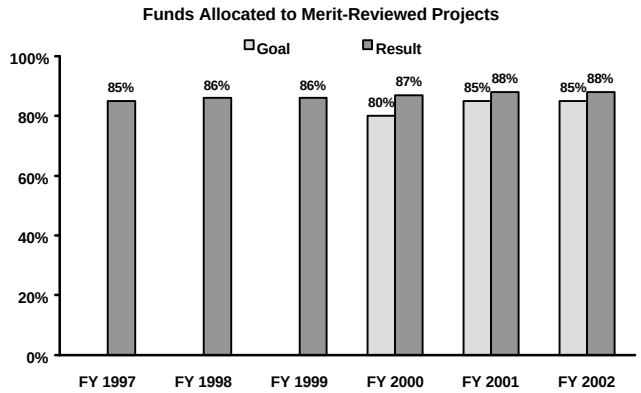
The vast majority of proposals we receive undergo external merit review. The Foundation makes a small number of exceptions to this general requirement in situations where timeliness is crucial such as for studies of volcanic eruptions or earthquakes or where objective external reviewers may be difficult to find. It also considers exceptions when researchers propose such new ideas that knowledgeable external reviewers do not exist.

As of FY 2000 NSF utilizes OMB's definition of merit-reviewed scientific research[13]. This performance goal applies to federal science, space, and technology agencies. NSF has established the 85% target to be consistent with the OMB recommended range of 70% to 90%.

RESULTS: NSF successfully achieved this goal.

PERCENT OF FUNDS TO PROJECTS THAT UNDERGO MERIT REVIEW							
	FY 1997	**FY 1998**	**FY 1999**	**FY 2000**	**FY 2001**	**FY 2002**	**FY2003**
Baseline	85%						
Goal			N/A	80%*	85%	85%	85%
Result		86%	86%	87%	88%	✓**88%**	

* The 80% estimated goal, recalculated from NSF's original goal of 90%, is based on the FY 2000 OMB definition of merit-reviewed scientific research.



IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: An examination of our performance over the last four years shows that we have consistently exceeded our current goal of 85%. Furthermore, we are showing a small increase in the funds allocated to merit-reviewed proposals each year. We will continue to maintain the goal of at least 85% in FY 2003.

*Goal not established for FY 1997 – FY 1998, related goal for FY 1999.

[13] *"Merit-reviewed scientific research with competitive selection and external (peer) evaluation. Intramural and extramural research programs where funded activities are competitively awarded from a pool of qualified applicants following review by a set of external scientific or technical reviewers (often called peers) for merit. The review is conducted by appropriately qualified scientists, engineers, or other technically-qualified individuals who are apart from the people or groups making the award decisions, and serves to inform the program manager or other qualified individual who makes the award."*

Goal IV-2 – Reviewer Use of Both Merit Review Criteria
✓ Goal Achieved

Goal IV-2: Reviewers will address the elements of both generic review criteria at a level above that of FY 2001.

Performance Indicator: Percent of reviews using both merit review criteria

On September 20, 1999, NSF issued Important Notice #125 to Presidents of Universities and Colleges, encouraging Principal Investigators to address the merit review criterion, "the broader impacts of the proposed activity", in their proposals and reviews.

RESULTS: This goal was achieved[14]. NSF data indicates that 84% of reviews received by NSF address both review criteria compared with the 69% response rate in FY 2001. In FY 2001 assessment focused on the percent of reviews that addressed only the broader impacts criterion. Based on the assumption that all reviews address the intellectual merit criterion, the 69% value shown here represents a maximum percent for proposals addressing both review criteria.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: In FY 2003, NSF will continue to develop and apply procedures focused on strategies that stress the importance of using both criteria.

[14] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used to calculate results for this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.

Goal IV-3 – Program Officer Use of Both Merit Review Criteria
✓ Goal Achieved

Goal IV-3: Program Officers will consider elements of both generic review criteria in making decisions to fund or decline proposals.

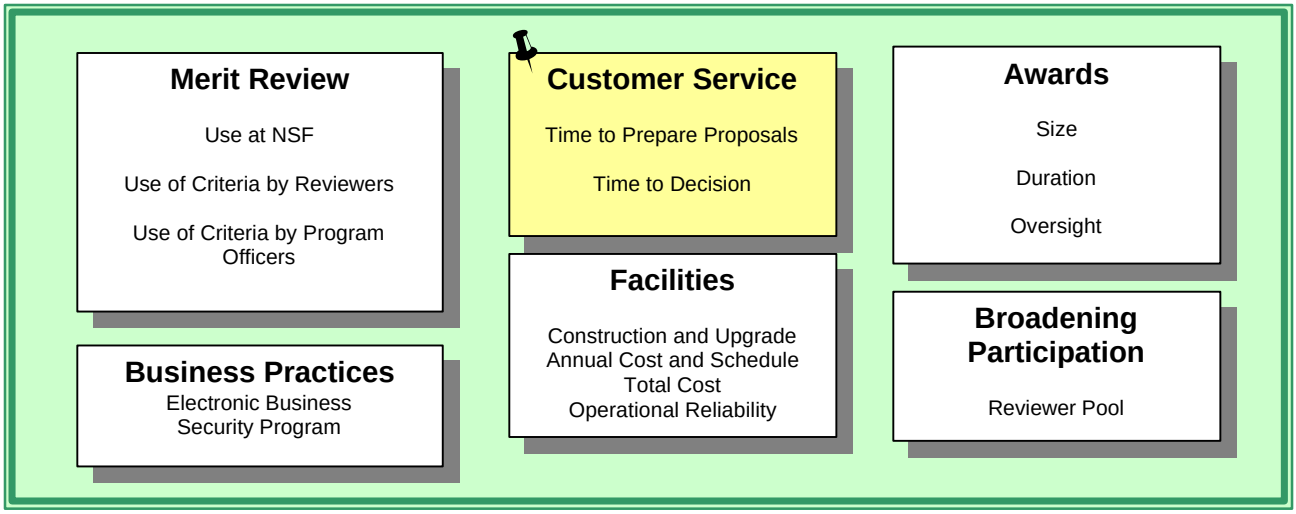
Performance Indicator: Percent of review analyses (Form 7s) that comment on aspects of both merit review criteria as determined by directorate or advisory committee sampling.

After a proposal has been subjected to external peer review a NSF Program Officer makes a recommendation concerning support of the proposal. The matters to be discussed in this recommendation are described in our Proposal and Award Manual, Chapter VI, Section B-4. We state that "*Program Officers must comment on the intellectual merit of the proposed activity and the broader impacts of the proposed activity*."

RESULTS: NSF is successful for this goal[15]. During FY 2002 we examined a statistically determined sample of FY 2002 review analyses to determine the extent of Program Officer usage of both review criteria. We found, overall, that approximately 77.8% of review analyses used both merit review criteria.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: In FY 2003 this goal will have a target to reflect our expectation of increasing use of both criteria in FY 2003. In FY 2003, for at least 80 percent of decisions to fund or decline proposals, program officers will comment on aspects of both generic review criteria.

[15] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used to calculate results for this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.



PROPOSAL AND AWARD PROCESS

B. CUSTOMER SERVICE

Customer service has a potential impact on the number and quality of proposals received and thus on our ability to meet all Outcome goals. In 1995, we adopted a set of customer service standards, primarily related to the merit review process, treating grantees and potential grantees (*applicants*) as the primary *customers* for NSF's administrative processes. In a survey, applicants valued three standards most highly: (1) clear guidelines for proposal content and preparation, (2) a minimum of three months between release of program announcements and proposal deadlines, and (3) notification of proposal funding recommendation within six months of proposal submission.

For our FY 2001 Performance Plan, we focused on the latter two of these standards, ones to which our staff have devoted special attention since the standards were adopted. The first of these standards (provision of clear guidelines) is being addressed in internal processes.

Goal IV-4: – Time to Prepare Proposals
✖ Goal Not Achieved

Goal IV-4: Ninety-five percent of program announcements will be available to relevant individuals and organizations at least three months prior to the proposal deadline or target date.

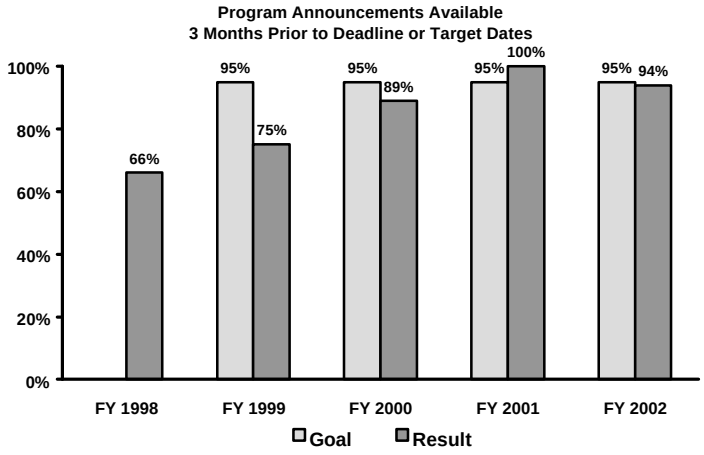
We realize that researchers and educators require sufficient time to prepare submissions. To encourage new investigators and solicit quality proposals, and based on responses to customer surveys, program announcements and solicitations should be available a minimum of 90 days prior to the deadline for submission. We define this time as the time between the posting of the announcement on the web and the deadline for proposal submission given in the web posting.

RESULTS: We were not successful in achieving this goal. In FY 2002, 94% (111 out of 118) of program announcements and solicitations were made available at least 90 days before the proposal deadline[16].

PERCENT OF PROGRAM ANNOUNCEMENTS AND SOLICITATIONS AVAILABLE AT LEAST 3 MONTHS PRIOR TO PROPOSAL DEADLINE OR TARGET DATES

	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003
Baseline	66%					
Goal		95%	95%	95%	95%	95%
Actual		75%	89%	100%	**94%**	

*No goal established for FY 1998



WHY WE DID NOT ACHIEVE THIS GOAL: Inadequate oversight led to the failure of these announcements to meet the 90-day deadline.

STEPS WE WILL TAKE IN FY 2003 TO ACHIEVE THIS GOAL: In FY 2003 NSF will work toward this goal by planning for competitions requiring individual announcements and solicitations as far in advance as possible and initiating clearance processes in a timely manner.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: This goal will be maintained in FY 2003.

[16] A number of continuing programs have standing or previously established deadline dates. Some of these programs reissue announcements within 90 days of a proposal due date. As long as that deadline date was previously announced, thereby providing the community with at least 90 days to prepare a proposal, the announcement is considered to be in compliance with this GPRA goal.

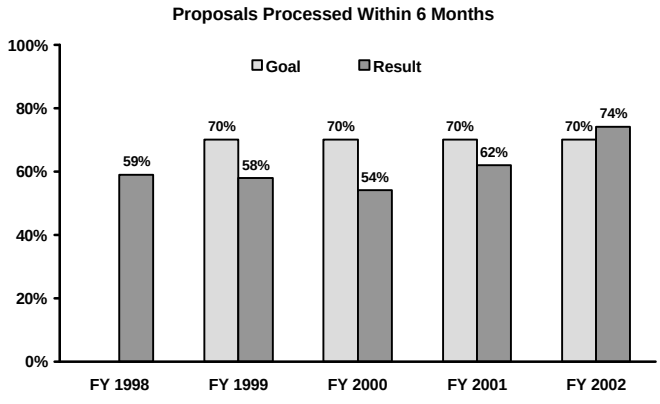
Goal IV-5 – Time to Decision
✓ Goal Achieved

Goal IV-5: For 70 percent of proposals, be able to tell applicants whether their proposals have been declined or recommended for funding within six months of receipt.

One of the most significant issues raised in customer satisfaction surveys is the amount of time it takes us to process proposals. We recognize the importance of this issue, and we are continually reviewing the steps needed to decrease proposal processing time. We will continue to use brainstorming sessions for staff at all levels within the organization to discuss issues, concerns, and effective practices related to proposal processing time.

RESULTS: We were successful in achieving this goal. In FY 2002, we processed 74% of all proposals within six months of receipt.

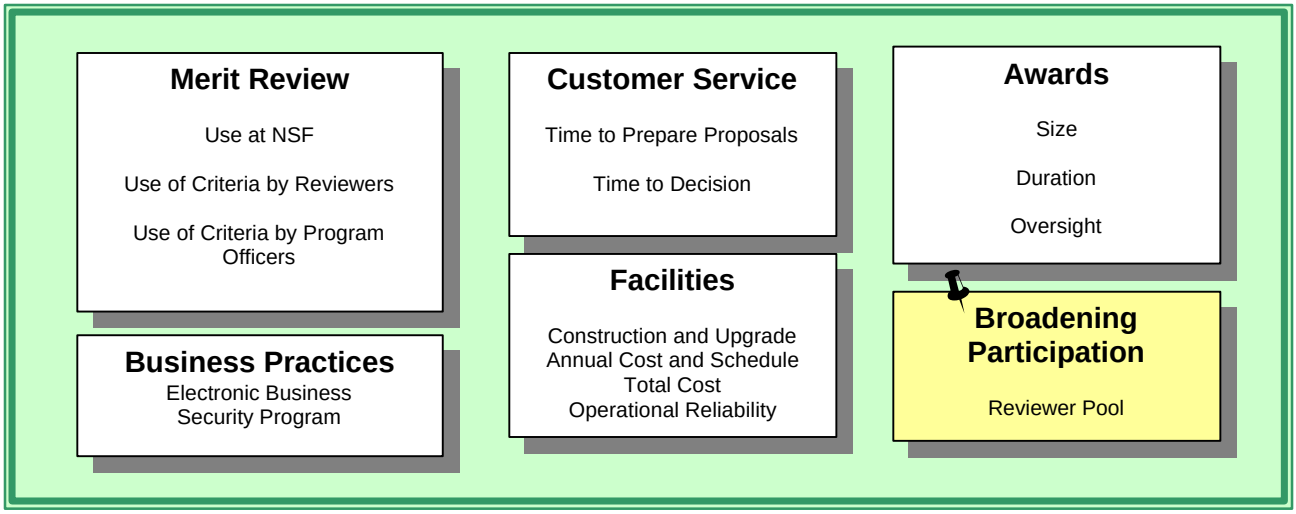
PERCENT OF PROPOSALS PROCESSED WITHIN 6 MONTHS OF RECEIPT							
	FY 1997	**FY 1998**	**FY 1999**	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**
Baseline	61%						
Goal			70%	70%	70%	70%	70%
Actual		59%	58%	54%	62%	✓**74%**[17]	



In FY 2003, we will continue to focus on improving the efficiency of proposal processing, including the dissemination of best practices to program staff.

IMPLICATIONS FOR THE FY2003 PERFORMANCE PLAN: This goal will be maintained in FY 2003. We believe that the expanded use of electronic processing of proposals and the adoption of effective practices identified in staff brainstorming sessions will lead to our continued success in meeting the 70% goal.

[17] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used to calculate results for this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.



PROPOSAL AND AWARD PROCESS

C. BROADENING PARTICIPATION

We are strongly committed to increasing the participation of science and engineering researchers, educators and students from groups currently underrepresented in the science and engineering enterprise in all NSF activities. Congress has enacted legislation giving NSF explicit responsibility for addressing issues of equal opportunity in science and engineering. This assignment of responsibility reflected the serious underrepresentation of women, minorities, and persons with disabilities in the science and engineering workforce, and, although progress has been made, underrepresentation persists.

Recognizing that progress toward all outcome goals for research and education requires maximum diversity of intellectual thought, NSF is focusing its attention on enhancing the participation of groups currently underrepresented in science and engineering in all its programs. In order to realize this increased participation, and so contribute to the development of a dynamic, diverse, human resource pool in science and engineering, over the next decade NSF seeks to:

- Increase the participation of scientists and engineers from underrepresented groups in NSF's merit review process;
- Increase the participation of scientists and engineers from underrepresented groups in NSF's workshops and conferences;
- Increase the number of proposals submitted by and awards made to scientists and engineers from underrepresented groups; and
- Increase the number of scientists and engineers from underrepresented groups appointed by NSF to its staff.

At present we are focusing on the first and fourth of these efforts. NSF is committed to maintaining openness in the system and strives to increase the percentage of awards to new investigators.

Goal IV-6 – Broadening Participation: Reviewer Pool Diversity
✖ Goal Not Achieved

Goal IV-6: Establish a baseline for participation of members of underrepresented groups in NSF proposal review activities.

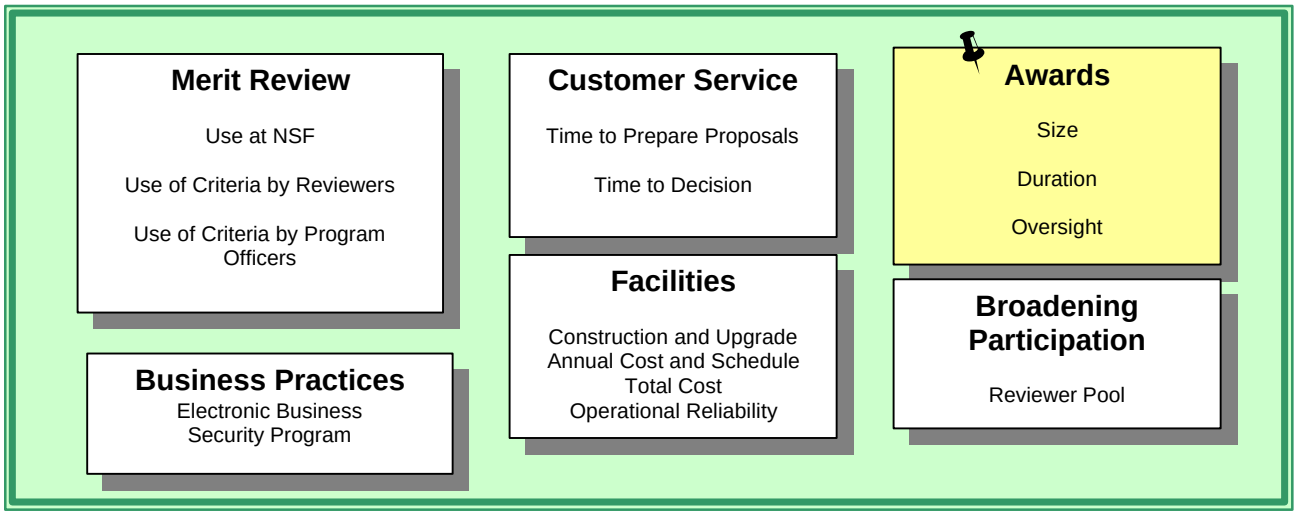
NSF is strongly committed to increasing the participation of science and engineering researchers, educators and students from groups currently underrepresented in the science and engineering enterprise in all NSF activities. Congress has enacted legislation giving NSF explicit responsibility for addressing issues of equal opportunity in science and engineering.

FY 2001 marked the first time we have formally focused attention on reviewer pool data. To establish the baseline, we began, in FY 2002, to gather the appropriate voluntary data from the reviewers with the intent of deriving a baseline from this data.

RESULTS: We were not successful in achieving this goal.

WHY WE DID NOT ACHIEVE THIS GOAL: NSF cannot legally require reviewers to provide demographic information. Provision of such data is voluntary. NSF requested and collected demographic data from reviewers but given the low response rate there is not enough information to establish a baseline. A total of 37,943 distinct reviewers returned their reviews on proposals decided upon in FY 2002. Demographic information is available for 3,507 of these reviewers and 1,168 (33%) of these 3,507 reviewers are members of an underrepresented group.

STEPS WE WILL TAKE IN FY 2003 TO ACHIEVE THIS GOAL: The goal of establishing a baseline for participation of members of underrepresented groups in NSF proposal review activities will not be continued in FY 2003. Nevertheless, we will continue to attempt to gain more information on the demographic composition of our reviewers by continuing to request demographic information from them.



AWARD PORTFOLIO

D. AWARDS

The size and duration of NSF awards impact research and education activities at many institutions. Increasing award size and duration will allow scientists and engineers to devote more time to productive research and education in comparison to the time spent preparing proposals. Adequate award size and duration are important both to obtaining high quality proposals and to ensuring that proposed work can be accomplished as planned.

Goal IV-7a – Increased Average Annualized Award Size
✓ Goal Achieved

Goal IV-7a: NSF will increase the average annualized award size for research projects to a level of $113,000, compared to a goal of $110,000 in FY 2001.

Increasing award size was a new goal in FY 2001 and is continued in FY 2002[18]. Our long-term goal is to reach an average annualized award size of $250,000.

Adequate award size is important both for attracting high-quality proposals and for ensuring that proposed work can be accomplished as planned. Larger awards increase the efficiency of the system by allowing scientists and engineers to devote a greater portion of their time to actual research rather than to proposal writing and other administrative work.

RESULTS: We were successful in achieving and exceeding this goal.

AVERAGE ANNUALIZED AWARD SIZE FOR RESEARCH PROJECTS						
	FY 1998	**FY 1999**	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**
Baseline	$90,000					
Goal				$110,000	$113,000	$125,000
Actual		$94,000	$105,800	$113,601	✓**$115,666**[19]	

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: Our goal for FY 2003 will be an average annualized award size of $125,000.

[18] The award size and duration performance goals are applicable only to competitive research grants (a subset of awards that focuses on awards to individual investigators and small groups).

[19] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used to calculate results for this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals we report were verifiable and the results valid, in Appendix III.

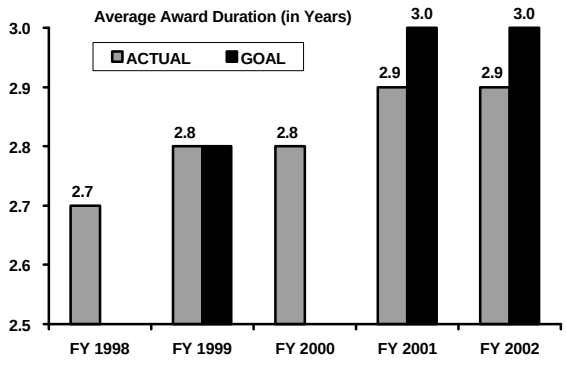
Goal IV-7b – Increased Average Award Duration
✖ Goal Not Achieved

Goal IV-7b: NSF will maintain the FY 2001 goal of 3.0 years for the average duration of awards for research projects.

Our long-term goal is to reach an average award duration of 5 years[20]. Increasing award duration was a new goal in FY 2001 and is continued in FY 2002. The award duration goal built on a FY 1999 goal (the duration goal was dropped in FY 2000 and reinstated in FY 2001).

RESULTS: We were not successful in achieving this goal.

AVERAGE AWARD DURATION FOR RESEARCH PROJECTS						
	FY 1998	**FY 1999**	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**
Baseline	2.7 years					
Goal		2.8 years	N/A	3.0 years	3.0 years	3.0 years
Actual		2.8 years	2.8 years	2.9 years	**✖2.9 years**[21]	



WHY WE DID NOT ACHIEVE THIS GOAL: Sufficient resources were not available to achieve both the award size and award duration goals for FY 2002. NSF focused its efforts on increasing average annualized award size.

STEPS WE WILL TAKE IN FY 2003 TO ACHIEVE THIS GOAL: Progress on this goal is budget dependent. Program Directors must balance competing requirements: increasing award size, increasing duration of awards, and/or making more awards. NSF will continue to focus on increasing award size and duration in order to improve the efficiency of the research process.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: We will maintain the FY 2002 goal of 3.0 years for the average duration for research and education grants.

[20] The award size and duration performance goals are applicable only to competitive research grants (a subset of awards that focuses on awards to individual investigators and small groups).

[21] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used in this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals we report were verifiable and the results valid, in Appendix III.

E. AWARD OVERSIGHT AND MANAGEMENT

AWARD OVERSIGHT

Goal IV-8 – Risk Assessment/Risk Management
✓ Goal Achieved

Goal IV-8: NSF will develop and initiate a risk assessment / risk management plan for awards.

Performance Indicators:

- **Development of an appropriate risk assessment model.**
- **Development of an effort analysis to determine necessary resource allocation (personnel, travel and training).**
- **Completion of a pilot program testing the risk assessment monitoring tools at several high-risk awardee institutions.**

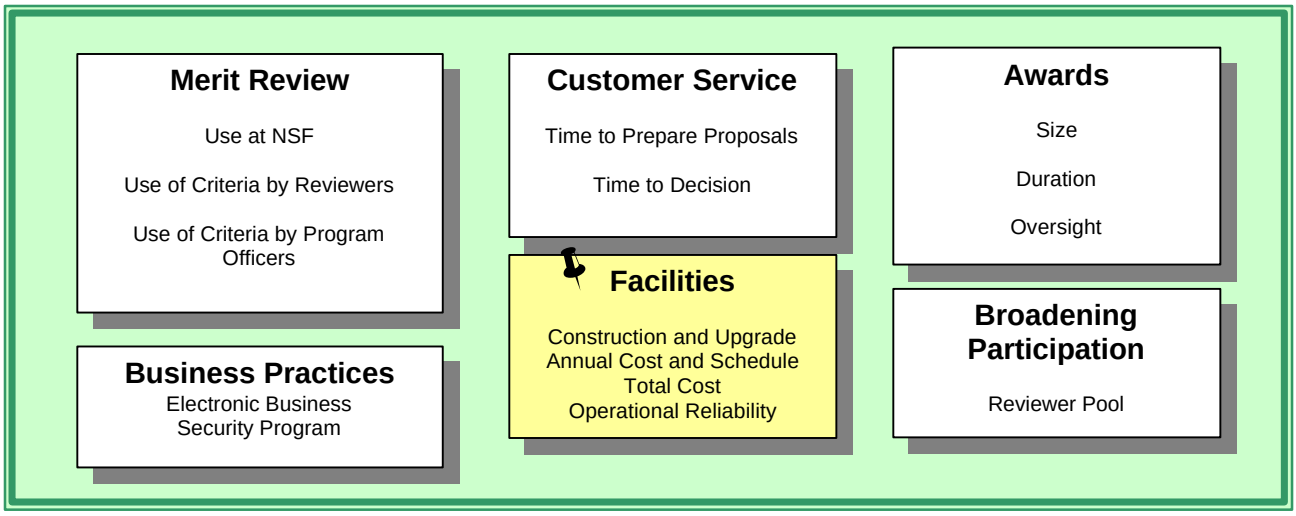
The emphasis of this performance area is on award monitoring and oversight. At any given time, NSF has approximately 30,000 active awards in its portfolio, including grants, cooperative agreements, and interagency activities. Of this number, the agency makes 10,000 new awards annually. The volume of awards and increases in the agency's budget require improvement in the management of effective award monitoring.

NSF's current internal control activities on awards include grant policy reviews, awardee and staff assistance outreach, and both desk and on-site monitoring reviews. All controls are aimed at reducing potential problems through the pre-award, award and post-award administration continuum.

In FY 2002, to better focus award-monitoring efforts, NSF's goal was the development and initiation of a risk assessment/risk management protocol focused towards on-site monitoring efforts. A new position was created to provide a focus for award monitoring. A primary responsibility of the incumbent in this position is to develop a risk-based review approach for all NSF awardees and projects. NSF's intent is to maximize the effectiveness of available award monitoring resources by focusing on awards identified as having significant risk.

RESULTS: We were successful in achieving this goal. NSF collected information on post-award monitoring activities of other federal grant-making agencies. This information was modified to fit NSF needs and a risk framework was developed. A pilot test effort involving 15 NSF-supported organizations was conducted. A risk assessment approach was developed and a pilot test effort initiated. In parallel with these efforts NSF developed the *Risk Assessment and Award Monitoring Guide*.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: Although there is no risk management goal for FY 2003, a series of activities to further enhance risk assessment and management is planned.



AWARD OVERSIGHT AND MANAGEMENT

F. FACILITIES

NSF has responsibility for supporting the operation of multiple user facilities that provide state-of-the-art equipment with unique capabilities. In addition, we put a high premium on initial planning for construction and upgrade of facilities. Planning for unique, state-of-the-art facilities must take into account the exploratory nature of the facilities themselves as such facilities test the limits of technological capability.

In FY 2002 24% of our budget was allocated to the support of "Tools." Within Tools, FY 2002 funding for the Major Research Equipment and Facilities Construction (MREFC) account was approximately $139 million, an increase of $20 million over FY 2001.

Although we have done well in the past in keeping large projects on schedule and within budget, OMB asked us to develop a plan for costing, approval, and oversight of major facility projects. In response, we have completed a Large Facility Projects Management and Oversight Plan that was submitted to OMB in September 2001. This new facilities plan has four major foci:

- Enhance organizational and staff capabilities to improve coordination, collaboration, and shared learning among our staff and external partners;
- Implement comprehensive guidelines and procedures for all aspects of facilities planning, management, and oversight;
- Improve the process for reviewing and approving Large Facility Projects; and
- Practice coordinated and proactive oversight of all facility projects to ensure success.

Further development and implementation of the plan is continuing.

We have established a new position–Deputy, Large Facility Projects–to enable the efficient and effective evolution of our large facility projects from their pre-formulation through operations. This position will be filled in on a permanent basis in FY 2003. An Interim Deputy was appointed in FY 2002.

In order to report on the government performance goals related to Facility Operations and Construction and Upgrades, we initiated, in FY 1999, development of a Facilities Reporting System. This is linked to the Performance Reporting System, a module of the existing FastLane system. The module is used to collect information on operations and construction from Facilities Managers external to NSF. As is the case with any new data collection effort, we expect the quality of the information provided to improve as NSF's Program Officers and external facilities managers gain experience with gathering and reporting the required data.

In FY 2001[22] and FY 2002 NSF engaged IBM Business Consulting Services to review the process for collection and reporting of GPRA data for the facilities goals. IBM Business Consulting Services' recommendations, along with NSF's own review of the facilities goals and associated data collection methods, were further examined by NSF staff in FY 2002. Necessary changes to data collection systems and procedures have been identified and will be implemented starting in FY 2003.

[22] In FY 2001 the firm we engaged was PricewaterHouse Coopers, LLP. The unit that conducted the review has been sold to IBM and is now part of IBM Business Consulting Services.

Goal IV-9a – Annual Construction and Upgrade Expenditures
✓ Goal Achieved

Goal IV-9a: For 90 percent of facilities, keep construction and upgrades within annual expenditure plan, not to exceed 110 percent of estimates.

In FY 2000 100% of facilities were required to meet the goal for NSF to be considered successful. In FY 2001 the goal was revised so that we were considered successful if at least 90% of facilities kept construction and upgrade expenditures within 110% of their estimates. This change was made because state-of-the-art projects being supported stretch the limits of technological capability and there may be unforeseen expenditures. Nevertheless, we expect that the vast majority of our projects will be within budget. To assure that we have realistic and achievable goals, we reestablished the target level of success at 90% of the facilities for FY 2001 and beyond.

RESULTS: We were successful in achieving this goal. Of the 28 construction and upgrade projects supported by NSF, 26 (93%) were within 110% of annual expenditure plans.

ANNUAL CONSTRUCTION AND UPGRADE EXPENDITURES					
	FY 1999	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**
Goal	Keep within annual expenditure plan, not to exceed 110% of estimates.	Keep within annual expenditure plan, not to exceed 110% of estimates.	For 90% of facilities, keep within annual expenditure plan, not to exceed 110% of estimates.	For 90% of facilities, keep within annual expenditure plan, not to exceed 110% of estimates.	New goal developed for FY 2003; see discussion on implications for FY 2003.
Actual	Majority of projects were within 110% of estimates.	11 of 11 (100%) projects were within 110% of estimates.	✓24 of 25 (96%) projects were within 110% of estimates.	**✓26 of 28 (93%) projects were within 110% of estimates**[23].	

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: The lessons learned from several years of experience reporting GPRA results for this performance area led to a comprehensive internal review in FY 2001 and FY 2002 of the facilities goals. In FY 2003, NSF will improve the construction goals by combining cost and schedule performance into a single goal. The revised goals are calculated using the Earned Value technique, a widely accepted project management tool for measuring progress that recognizes that cost or schedule data alone can lead to distorted perceptions of performance.

[23] IBM Business Consulting Services recalculated the results for this goal. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.

Goal IV-9b – Meeting Annual Schedule Milestones
✖ Goal Not Achieved

Goal IV-9b: Ninety percent of facilities will meet all annual schedule milestones.

In FY 2001, for NSF to be considered successful, 90% of facilities were required to meet all annual schedule milestones by the end of the reporting period. In FY 2002 this was changed to having at least 90% of facilities meet all major schedule milestones.

RESULTS: For FY 2002, of the 27 construction and upgrade projects we supported, 13 (48%) met all annual schedule milestones.

ANNUAL SCHEDULE MILESTONES					
	FY 1999	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**
Goal	Construction and upgrades within annual schedule, time required for major components within 110% of estimates.	Construction and upgrades within annual schedule, time required for major components within 110% of estimates.	90% of facilities will meet all major annual schedule milestones by the end of the reporting period.	90% of facilities will meet all major annual schedule milestones.	New goal developed for FY 2003; see discussion on implications for FY 2003.
Actual	Majority of projects were within 110% of estimates.	7 of 11 (64%) projects were within 110% of estimates.	✖21 of 25 (84%) projects met all major annual schedule milestones by the end of the reporting period.	**✖13 of 27 (48%) projects met all major annual schedule milestones**[24]**.**	

WHY WE DID NOT ACHIEVE THIS GOAL: In FY 2001, milestones reached at any time within the fiscal year were considered successful. In FY 2002, milestones had to be reached by the specified date determined during project development. In some instances contract negotiations caused project delays.

STEPS WE WILL TAKE IN FY 2003 TO ACHIEVE THIS GOAL: NSF program staff will continue to work with project managers to identify obstacles to successful performance and to ensure that progress will be made toward the achievement of this goal in FY 2003.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: As discussed in Goal V-9a, this goal will be combined with the annual cost goal.

[24] IBM Business Consulting Services recalculated the results for this goal. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.

Goal IV-9c – Total Cost
✓ Goal Achieved

Goal IV-9c: For all construction and upgrade projects initiated after 1996, when current planning processes were put in place, keep total cost within 110 percent of estimates made at the initiation of construction.

We recognize that construction and upgrade projects may experience both cost and schedule overruns. Our goal, since FY 1999, is that all construction and upgrade projects will keep within 110% of their initial estimated total costs.

RESULTS: We were successful in achieving this goal. Two projects were completed in FY 2002, one of which had been initiated prior to 1996.

CONSTRUCTION AND UPGRADE TOTAL COST					
	FY 1999	**FY 2000**	**FY 2001**	**FY 2002**	
Goal	For all construction and upgrade projects initiated after 1996, keep total cost within 110% of estimates made at the initiation of construction.	For all construction and upgrade projects initiated after 1996, keep total cost within 110% of estimates made at the initiation of construction.	For all construction and upgrade projects initiated after 1996, keep total cost within 110% of estimates made at the initiation of construction.	For all construction and upgrade projects initiated after 1996, keep total cost within 110% of estimates made at the initiation of construction.	New goal developed for FY 2003; see discussion on implications for FY 2003.
Actual	No projects completed.	No projects completed.	✓ One project was completed.	✓ **Two projects were completed.** [25]	

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: The many lessons learned from several years of experience reporting GPRA results for this performance area led to a comprehensive internal review of the goals that focused on how best to measure success in constructing and operating facilities. The review led to revised goals for facilities construction that more accurately capture NSF's performance. In FY 2003, NSF will improve the construction goals by combining cost and schedule performance into a single goal. The revised goals are calculated using the Earned Value technique, a widely accepted project management tool for measuring progress that recognizes that cost or schedule data alone can lead to distorted perceptions of performance.

[25] IBM Business Consulting Services recalculated the results for this goal. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.

Goal IV-10 – Operating Time
✖ Goal Not Achieved

Performance Goal IV-10: For 90 percent of facilities, keep operating time lost due to unscheduled downtime to less than 10 percent of the total scheduled operating time.

To provide the flexibility necessary for NSF to report realistic goals, we maintained the level deemed "successful" at 90% of the facilities.

RESULTS: We were not successful in achieving this goal. Of the 31 reporting facilities, 26 (84%) met the goal of keeping unscheduled downtime to below 10% of the total scheduled operating time.

OPERATING TIME					
	FY 1999	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**
Goal	Keep operating time lost due to unscheduled downtime to less than 10% of the total scheduled operating time.	Keep operating time lost due to unscheduled downtime to less than 10% of the total scheduled operating time.	For 90% of facilities, keep operating time lost due to unscheduled downtime to less than 10% of the total scheduled operating time.	For 90% of facilities, keep operating time lost due to unscheduled downtime to less than 10% of the total scheduled operating time.	For 90% of operational facilities, keep scheduled operating time lost to less than 10%.
Actual	Majority of facilities successful.	22 of 26 (85%) reporting facilities met goal.	✖ 25 of 29 (86%) reporting facilities met goal.	**✖ 26 of 31 (84%) reporting facilities met goal[26].**	

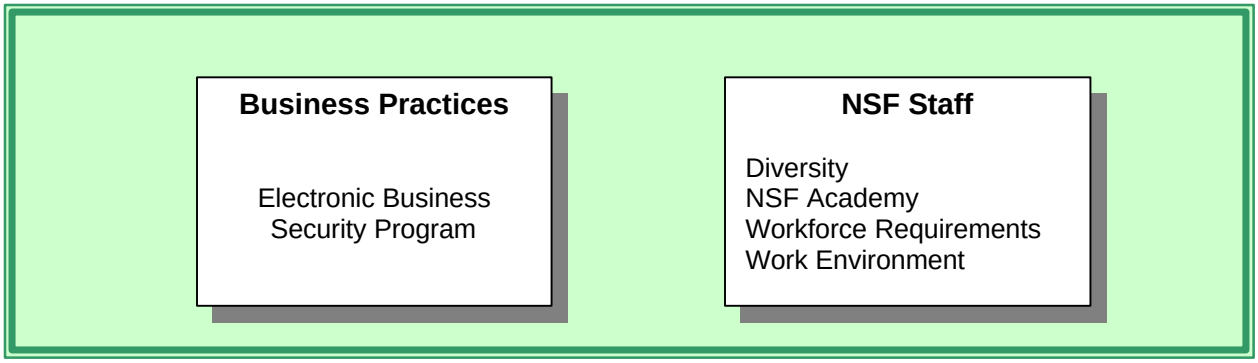
WHY WE DID NOT ACHIEVE THIS GOAL: Some causes of unscheduled downtime in excess of 10% of total scheduled operating time were outside the control of the facility manager, such as unfavorable weather or electric power supply interruption. Other causes of failure were related to technical problems such as sub-par performance of new instrumentation early in its commissioning stage.

In FY 2003, 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. NSF is also modifying this goal statement to improve clarity.

STEPS WE WILL TAKE IN FY 2003 TO ACHIEVE THIS GOAL: NSF program staff will continue to work with project managers to identify obstacles to successful performance and to ensure that progress will be made toward the achievement of this goal in FY 2003.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: An internal review of the facilities goals has led to a slight rewording of the goal for clarity. This goal will be continued in FY 2003.

[26] IBM Business Consulting Services recalculated the results for this goal. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.



G. BUSINESS PRACTICES

Goal IV-11 – Electronic Business
✓ Goal Achieved

Goal IV-11: NSF will continue to advance the role of "e-business" in review, award, and management processes.

> **Performance Indicator: NSF will double the FY 2001 number of paperless projects that manage the competitive review process in an electronic environment**.

NSF's multi-year initiative to create a paperless environment within the Foundation's grant-making process is aggressively moving forward, and incremental success continues to be achieved annually. In FY 2001 a pilot program was initiated to illustrate whether the competitive *review process* could be accomplished electronically. The initial pilot was successful. For FY 2002, the target level doubled (from ten to twenty pilot projects), and additional criteria (e-signatures) were added.

RESULTS: NSF is successful for this goal. *Thirty-one* programs within five Directorates participated in the pilot and successfully managed the review process electronically.[27] The success of the pilot further demonstrates the benefits of a paperless review process within NSF.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: The FY 2002 goal doubled the number of projects, included more directorates and divisions, and incorporated a new module. At this point, 83% (6 out of 7) of our Directorates have participated in, and successfully completed the paperless review pilot over the past two years. As a result, we will not monitor this effort as a separate goal in FY 2003. With nearly 100% of proposals now submitted electronically and the successful completion of the paperless review pilot, the capability and benefits of an internal paperless process have been successfully demonstrated.

[27] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used to calculate results for this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals were verifiable and the results valid, in Appendix III.

Goal IV-12 – Security Program
✓ Goal Achieved

Goal IV-12: NSF will implement an agency-wide security program in response to the Government Information Security Reform Act. (New Goal)

Performance Indicators:

- **Risk assessments and certification to operate will be documented and retained**
- **Policies will be developed and disseminated**
- **Security management structure will be implemented**
- **Security related changes to personnel policies (as necessary) will be documented**

This was a new goal in FY2002 developed in-line with requirements mandated by the Government Information Security Reform Act (Security Act or GISRA). The Security Act addresses program management and evaluation aspects of security, and was designed to ensure proper management and security for the information resources supporting Federal operations and assets.

RESULTS: NSF is successful for this goal. During the past year, NSF initiated actions to meet the requirements of the Security Act, OMB Circular A-130, and the National Institute of Standards and Technology Security Self-Assessment Guide for Information Technology Systems[28].

NSF's information security (IS) program encompasses all aspects of information security, including policy and procedures, risk assessments, security reviews, security plans, contingency plans, managed intrusion detection services, vulnerability assessments, and technical and management security controls. NSF's Security Program focuses on assuring that the NSF infrastructure and critical assets are appropriately protected while maintaining an open and collaborative environment for scientific research and discovery.

IMPLICATIONS FOR FY 2003 PERFORMANCE PLAN: Information security is an on-going goal. Based on progress achieved during FY 2002 enhancements will be made to strengthen the program and align it more closely with GISRA and OMB requirements. The FY 2003 goal will be expanded to include all NSF major applications, general support applications, and non-major applications.

NSF has a comprehensive plan for continued improvement of its IT security program and has taken action on ten findings and recommendations identified in the June 2002 GISRA audit conducted by the Office of Inspector General. NSF agreed with audit recommendations, but did not agree that three of the findings contained within the audit constitute a reportable condition.

[28] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used in this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals we report were verifiable and the results valid, in Appendix III.

H. HUMAN RESOURCES AND WORKPLACE

Goal IV-13 – Staff Diversity
✓ Goal Achieved

Goal IV-13: NSF will show an increase over FY 2000 in the total number of hires to NSF science and engineering positions from underrepresented groups.

The NSF Strategic Plan notes that a diverse, capable, and motivated staff is one of the critical factors for our success. We are committed to diversifying our staff of scientists and engineers (S&E) in both permanent and visiting positions.

RESULTS: NSF is successful for this goal. FY 2002 is the third year we exceeded our goal. The following table illustrates the progress that has been achieved since the diversity goal was established.

APPOINTMENTS TO SCIENCE & ENGINEERING POSITIONS FROM UNDERREPRESENTED GROUPS					
	FY 1999	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**
Baseline					
Goal	Efforts to attract underrepresented groups	More than 16 Female, 15 Minority	More than 16 Female, 15 Minority	More than 35 Female, 19 Minority	Being Revised
Actual	Achieved[29]	35 Female 19 Minority	38 Female 22 Minority	✓**41 Female**[30] **27 Minority**[31]	

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: For FY 2003 we will expand the scope of our reporting to include additional S&E positions in the agency. Broadening the base will allow us to measure our efforts throughout all professional recruitment opportunities, including Intergovernmental Personnel Act (IPA) assignments and executive hiring. The baseline to be used will be total S&E hires from underrepresented groups in FY 2000.

[29] In FY 1999, our goal was "In FY 1999, as all appointments for scientists and engineers are considered, the recruiting organization will demonstrate efforts to attract applications from groups that are underrepresented in the science and engineering staff as compared to their representation among Ph.D. holders in their fields."
[30] Includes 1 Female hired by OPP. FY 2001 is the first time OPP data is included.
[31] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used to calculate results for this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results.

Goal IV-14 – NSF Academy
✓ Goal Achieved

Goal IV-14: NSF will establish an internal NSF Academy to promote continuous learning for NSF staff. (New Goal)

Performance Indicator: Availability of new or revised courses that contribute to an organized curriculum for NSF staff.

This is a new goal for FY 2002 and reflects the Foundation's commitment to cultivate a world-class staff to sustain the level of excellence required to fulfill the NSF mission.

Originally conceived in September 2000, the Academy is evolving in incremental steps. Consolidation of training functions commenced in FY 2001, initial seed money was provided in FY 2002, and more substantive funding has been requested for FY 2003 to initiate a broader curriculum and expanded programs. Once fully operational, the Academy will serve as the central locus of learning, and provide continual learning opportunities for NSF staff. Development of new and revised courses reflected the needs and requirements of NSF staff.

RESULTS: NSF is successful for this goal. Development of new or revised courses that contributed to an organized curriculum for NSF staff was the criteria by which success was measured in FY 2002[32].

The Academy's courses are now organized in 5 curricula areas:

1. Business and Administrative,
2. Program and Project Management,
3. Leadership and Supervisory Skills,
4. Communication and Personal Effectiveness, and
5. Distance Learning and Technology.

During FY 2002, 76 courses were offered, 30 of which were new. In addition, 3 courses were revised to be more responsive to the needs and requirements of our staff. The FY 2003 Performance Plan contains a goal related to the NSF Academy.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: NSF has contracted with Booz Allen Hamilton for a comprehensive review of workforce competencies and skill mix. The results of this study will affect the direction the Academy takes in developing and offering new and revised curricula in the identified areas.

[32] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used in this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals we report were verifiable and the results valid, in Appendix III.

Goal IV-15 – Strategic Business Analysis
✓ Goal Achieved

Goal IV-15: NSF will initiate a strategic business analysis to provide a comprehensive perspective on its future workforce requirements.

Performance Indicators:

- **Request for Proposals to perform the strategic business analysis will be released.**
- **Skill mix/competencies of the current NSF workforce will be examined.**

NSF requires a multi-year strategic business analysis effort to assess its core business processes and supporting human capital and technology requirements in order to prepare for anticipated budget growth and an accompanying increase in the complexity of the NSF portfolio and to address new and existing management challenges presented by the President's Management Agenda and identified by NSF, the NSF Inspector General, the General Accounting Office, and others.

RESULTS: We were successful in achieving this goal[33]. A Request for Proposals was released in March 2002. A contract to conduct the business analysis was awarded to Booz Allen Hamilton in June 2002. An Initial Review of Workforce Competencies and Skill Mix was completed and delivered to NSF by Booz Allen Hamilton on September 30, 2002.

The initial review of workforce competencies and skill mix includes an initial workforce supply analysis as well as an initial competency modeling effort. In FY 2003 the workforce supply analysis will be completed and the NSF workforce will be benchmarked against comparable organizations. The competency model will be fully developed and will serve as the foundation for NSF's human capital management plan.

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: This goal was for one-time performance and will not be maintained in FY 2003. Other performance goals related to the development of a human capital management plan as part of an integrated assessment of business processes, human capital and technology requirements will be included in the FY 2003 plan.

[33] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used in this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals we report were verifiable and the results valid, in Appendix III.

Goal IV-16 – Work Environment
✓ Goal Achieved

Goal IV-16: NSF will establish various baselines that will enable management to better assess the quality of worklife and work environment within the Foundation.

Performance Indicator: Development of an employee survey

This is a continuation of a goal established last year, which NSF was unable to accomplish during FY 2001. The goal highlights the importance NSF places on its human resources, and reflects awareness that relevant data is needed in order to promote a more efficient workplace and ensure that the needs of our staff are being addressed.

Success in this goal was measured by the development of an employee survey. During FY 2002, the goal was achieved.

In lieu of designing an agency specific survey as originally planned, NSF participated in an Office of Personnel Management survey of the 24 Federal agencies comprising the President's Management Council. The survey addressed issues such as employee selection, retention and development, leadership, performance management, diversity on the extent to which workforce planning supports the agency's mission. NSF reviewed, commented and customized the draft survey to address agency specific needs. The U.S. Office of Personnel Management (OPM) distributed the survey electronically to a random selection of approximately 75% of NSF employees in May 2002. The Chief Information Officer (CIO) actively promoted employee participation in the voluntary survey.

Although results from the survey were expected during FY 2002, at this point OPM does not expect to release the results until the end of the calendar year. Data from the survey will provide agency specific information as well as comparative data against the other participating Federal agencies.

RESULTS: NSF was successful for this goal[34].

IMPLICATIONS FOR THE FY 2003 PERFORMANCE PLAN: Development of a future goal is predicated on the results from the survey. Once received, the survey data will be analyzed and the information will be used to inform the agency's human capital strategic planning efforts.

[34] IBM Business Consulting Services reviewed the data collection, maintenance, processing, and reporting procedures used in this goal. They concluded that the procedures related to this goal were sufficient and adequate and yielded valid results. We provide the Executive Summary of their entire report, as well as a table listing their conclusions as to whether the processes we used for selected goals we report were verifiable and the results valid, in Appendix III.

OTHER INFORMATION

V. ASSESSMENT AND EVALUATION PROCESS

We employ a mix of both qualitative and quantitative goals, and make use of both qualitative information and quantitative data in determining annual progress towards achieving goals. Our strategic outcome goals are generally expressed in a qualitative form, and most management goals are quantitative.

STRATEGIC OUTCOME GOALS

We have traditionally made use of various types of assessments and evaluations to monitor non-quantitative research and education outcomes, the quality of our investments, and the processes we use. Formalized examination takes place during merit review of proposals, COV and AC/GPA assessments, and GPRA reporting. Additionally, programs and plans are assessed and evaluated throughout the year on a continuing basis by NSF staff. Elements of GPRA reporting are highlighted in the figure below.

MANAGEMENT GOALS

We make use of internal data systems to monitor and report progress in achieving the quantitative management goals. For these goals, performance results are assessed and reviewed by our administrative staff and managers, with selected goals audited by external third parties. Selected results are verified and validated by a third party.

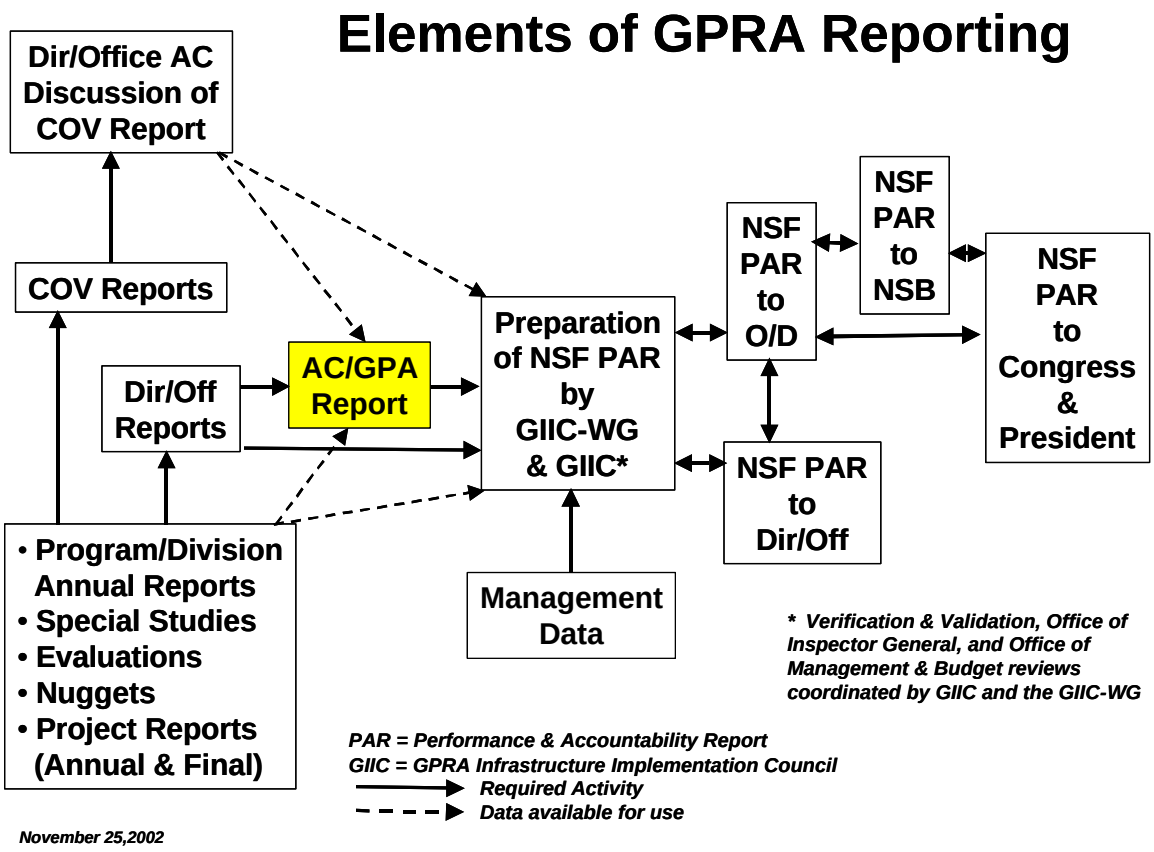
The assessment process for the quantitative goals is straightforward. We collect relevant data using internal corporate data systems and compare the result with the performance level targeted for the fiscal year. Progress towards achievement of most quantitative goals is reviewed by senior management on a quarterly basis. In FY 2000, an agency-wide GPRA module that collects data relevant to the quantitative goals was created to allow staff to track progress throughout the year. Development of that module continues.

Project Assessment During NSF Merit Review

Applicants and grantees provide results from previous NSF support, information about existing facilities and equipment available to conduct the proposed activity, biographical information on the Principal Investigators, other sources of support, federally required certifications and certifications specific to NSF. Such information is required at the time of application, at the time of an award, and in annual and final project reports. It is reviewed by NSF staff, is utilized during merit review, and is available to external committees (COVs and the AC/GPA) conducting performance assessment. The merit review process provides a rigorous, first phase of assessment of NSF's research and education portfolio. Thus, at the onset, this process selects for support only the most competitive one-third of proposals submitted for consideration.

Program Officers review the annual progress of awards. The progress report includes information on significant accomplishments, on progress achieved in the prior year, and on plans for the next year, and points out issues that may impact progress or completion of the project on schedule and within budget. On approval of this report by the Program Officer, NSF releases funds for the ensuing year.

All materials associated with the review of a proposal as well as subsequent annual reports are available to Committees of Visitors. NSF staff also prepares materials (reports, evaluations, highlights) for use by COVs and the AC/GPA in developing their reports and making their assessments.



Program Assessment by Committees of Visitors (COVs)

NSF's Committees of Visitors provide program assessments that are used both in program management and in annual GPRA reporting. Included are assessments for outcome goals and associated indicators and for the two qualitative investment process goals dealing with the implementation of the merit review criteria. In the past, COVs have traditionally assessed the integrity and efficiency of the processes for proposal review. With the full implementation of GPRA FY 1999, NSF added a retrospective GPRA assessment component (both outputs and outcomes) to their responsibilities.

Each COV typically consists of five to twenty external experts who review one or more programs over a two or three day period. These experts are selected to ensure independence, programmatic coverage, and balanced representation. They typically represent academia, industry, government, and the public sector.

All COVs are asked to complete a report template with questions addressing how programs contribute to NSF's goals. Committees of Visitors are asked to address (A) the integrity and efficiency of the *processes* involved in proposal review; and (B) the results, including quality and other factors, of NSF's investments. In determining whether there has been significant achievement with respect to the prescribed performance indicators, COV members use their individual or collective experienced-based norms.

The FY 2002 COVs were asked to judge whether our programs were successful or not in achieving Outcome Goals III-1a, III-2, and III-3, and in implementing the merit review criteria Management Goals IV-2 and IV-3). COVs are asked to justify their judgements and provide supporting examples or statements illustrating success and progress toward GPRA goals.

COVs are subcommittees of NSF Directorate Advisory Committees. As such, their reports, along with responses from the responsible Directorate addressing recommendations made by the COVs, are submitted to the parent Advisory Committee. The reports are also reviewed by NSF staff.

Advisory Committee (AC) Reporting on Directorate/Office Performance

Advisory Committees advise the seven directorates and the Office of Polar Programs. They are typically composed of 18-25 external experts who have broad experience in academia, industry, and government. Advisory Committees are chartered and hence are subject to Federal Advisory Committee Act (FACA) rules. The role of the ACs is to provide advice on priorities, address program effectiveness, review COV reports and directorate responses to COV recommendations.

In FY 2001 and previous years, directorate advisory committees assessed directorate progress in achieving NSF-wide GPRA goals. With the advent of the AC/GPA (see below), advisory committees no longer assess directorate progress towards these goals.

Advisory Committee for GPRA Performance Assessment

During FY 2002 NSF determined that a more effective and efficient process for the assessment of NSF performance with respect to the strategic outcome goals was to have a single external committee of experts review all Foundation accomplishments with respect to strategic goal indicators and areas of emphasis. This committee would then provide an assessment of NSF-wide performance with respect to these strategic goal indicators.

A request to create such an advisory committee, named the Advisory Committee for GPRA Performance Assessment (AC/GPA), was approved in the summer of 2002. Its first meeting was held in September. The AC/GPA had access to information provided by each of the NSF Directorates and the Office of Polar Programs . It also had access to COV reports. The AC/GPA provided NSF with a report concerning NSF performance with respect to the indicators of each strategic goal. as well as all of the COV reports (discussed above). The report also discussed NSF areas of emphasis, the quality of the NSF portfolio, balance within the portfolio, and other topics.

Agency GPRA Reporting

The COV and AC/GPA reports prepared by external experts address a broad set of issues ranging from staffing and quality of merit review to specifics of a scientific project. The GPRA components of these reports are used in assessing NSF's progress toward achieving its People, Ideas, and Tools outcome goals (Goals III-1a, III-2 and III-3.) These reports also contain discussions of management goals related to use of merit review criteria by reviewers (Goal IV-2) and Program Officers (Goal IV-3). Both are stated in the alternative form. A quantitative goal (Goals III-1b) associated with the People outcome goal is evaluated using relevant quantitative data.

The criterion for success for each of the People, Ideas, and Tools outcome goals can be stated:

> *"NSF is successful when, in the aggregate, results reported in the period demonstrate significant achievement in the majority of the [associated indicators]."*

This criterion is utilized for judgements about agency success for GPRA People-Ideas-Tools outcome goals. For agency assessment, all goals and indicators are relevant and all are used in determining agency

success. The agency decision for NSF is based on analysis of the statements contained within the AC/GPA and COV reports.

NSF staff examine individual ratings or statements of significant accomplishment included in COV and AC/GPA reports to ensure that ratings for the qualitative outcome goals and indicators are justified. In addition, they check for supporting evidence or examples sujpporting such judgements.

Principal factors contributing to NSF's decision that the agency is successful in FY 2002 for our outcome goals related to People, Ideas, and Tools include:

- The AC/GPA report found that NSF indicator portfolios documented "significant achievement" with respect to all indicators for the strategic outcome goals.
- The extensive number and quality of retrospective examples demonstrating significant achievement for the 19 indicators associated with NSF's three outcome goals.
- The NSF COV reports.

Each year, selected goals are verified and validated (V&V) by external third parties. That V&V process and this year's results are discussed in Section VI of this Performance and Accountability Report.

VI. Verification and Validation (V&V)

The Foundation has both qualitative and quantitative GPRA goals. Its qualitative goals include the three broad strategic outcome goals related to People, Ideas, and Tools and two investment process goals related to implementation of merit review criteria. The outcome goals are presented in a format that requires qualitative assessment of achievement. These assessments are based largely on information included in reports prepared by committees of independent, external experts (e.g. Committees of Visitors and the Advisory Committee for GPRA Performance Assessment) who assess the quality of program results based on their collective experience-based norms. NSF's quantitative goals focus on management activities, with the majority presented in a format that enables quantitative assessment of progress toward goal achievement. Assessment for these goals is based on data collected with NSF's central data systems.

QUALITY OF REPORTED PERFORMANCE INFORMATION

NSF recognizes the ongoing need to improve data systems for collecting performance information and data, especially that related to facilities. We view the improvement of the quality of data and data systems as an evolutionary process and intend to maintain it as a priority as budget and time allow. Implementing GPRA has enabled NSF to gather information in a structured way and to address issues in a more formal, focused manner than in the past[35].

In their December 2002 report[36] IBM Business Consulting Services (IBMCS) addressed system aspects of NSF data quality for the Awards system, Enterprise Information System, Financial Accounting System, FastLane, Integrated Personnel System, and the Proposal, Principal Investigator (PI), and Reviewer System. IBM Business Consulting Services "*reviewed NSF's information systems to evaluate controls that are in place to produce reliable data. The control techniques presented in the table below are based on interviews with NSF managers and staff--rather than a full application review. Pursuant to GAO's assessment guide, we relied on previously conducted work and on departmental sources to determine whether there were any known problems with the data sources or the data itself that would cast doubt on the credibility of the information.*"

A data project was initiated in FY 2001 to substantially improve the quality, consistency and availability of data, reports and charts that are used by COVs. These committees, in addition to providing advice to the NSF organization, provide assessments that may be used in NSF's annual GPRA reporting. Currently, each NSF organization produces its own reports and charts for each of its committees. With the completion of this COV project it is expected that the reports will be generated centrally to reduce costs and improve quality and consistency across NSF.

DATA V&V ACTIVITIES

We used a V&V process similar to the one used in FY 2001 to verify and validate selected FY 2002 GPRA performance information. In FY 2000 and FY 2001, we engaged an external third party, (PricewaterhouseCoopers LLP (PwC), to verify and validate selected GPRA performance results as well as the process through which supporting data was compiled. The business unit within PwC responsible for this type of activity was sold to IBM in 2002 and is part of IBM Business Consulting Services. For FY 2002 data verification and analyses, we engaged IBMCS to document the processes we follow to collect,

[35] GPRA data quality was a management challenge cited by the OIG in FY 2002 (See Section X).
[36] Page 77 of the IBMCS report.

process, maintain, and report selected performance data. They identified relevant controls and commented on their effectiveness. Based on General Accounting Office (GAO) guidance, they provided an assessment of the validity and verifiability of the data, policies, and procedures we used to report results for the FY 2002 goals. For the outcome goals, IBM Business Consulting Services reviewed the processes NSF used to obtain external assessment of NSF activities with respect to these goals. IBM Business Consulting Services also provided high-level review of NSF's information systems based on GAO standards for application controls[37].

In their report[38] (December 2002), IBM Business Consulting Services concluded "*We determined that NSF has reported on all 19 management goals and one EHR performance goal under review in a manner such that any errors, should they exist, would not be significant enough to change the reader's interpretation of the Foundation's reported outcome in meeting the supporting performance goal. Overall, NSF relies on sound business processes, system and application controls, and manual checks of system queries to report performance. We believe that these processes are valid and verifiable."*

For reporting on goal achievement, all of our outcomes are compiled for programs and activities across the agency. To enable a uniform and systematic organization of reporting information for the strategic outcome goals, we have developed specially designed templates and reporting guidelines for use by committees of external experts (COVs and AC/GPA). These templates and guidelines are reviewed and refined annually. Options for rating NSF are limited to either successful or not successful.

TYPES AND SOURCES OF PERFORMANCE DATA AND INFORMATION

Most of the data that underlie achievement assessments for strategic outcome goals originate outside the agency and are submitted to us through the Project Reporting System, which includes annual and final project reports for all awards. Through this system, performance information/data (compiled by our staff) such as the following are available to program staff, third party evaluators, and other external committees:

- Information on People – student, teacher and faculty participants in NSF activities; demographics of participants; descriptions of student involvement; education and outreach activities under grants; demographics of science and engineering students and workforce; numbers and quality of educational models, products and practices used/developed; number and quality of teachers trained; and student outcomes including enrollments in mathematics and science courses, retention, achievement, and science and mathematics degrees received;
- Information on Ideas – published and disseminated results, including journal publications, books, software, audio or video products created; contributions within and across disciplines; organizations of participants and collaborators (including collaborations with industry); contributions to other disciplines, infrastructure, and beyond science and engineering; use beyond the research group of specific products, instruments, and equipment resulting from NSF awards; and role of NSF-sponsored activities in stimulating innovation and policy development; and
- Information on Tools – published and disseminated results; new tools and technologies, multidisciplinary databases; software, newly-developed instrumentation, and other inventions; data, samples, specimens, germ lines, and related products of awards placed in shared repositories; facilities construction and upgrade costs and schedules; and operating efficiency of shared-use facilities.

Most of the data supporting management goals can be found in NSF's central systems. These central systems include the Enterprise Information System (EIS); FastLane, with its Performance Reporting

[37] An executive summary of the IBMCS report is provided in Appendix III of this Chapter.
[38] Page 2 of the IBMCS report.

System and its Facilities Reporting System; the Online Document System (ODS); the Proposal, PI, and Reviewer System (PARS); the Awards System; the Electronic Jacket; and the Financial Accounting System (FAS). These systems are subject to regular checks for accuracy and reliability.

The Division of Human Resources Management/Office of Information and Resource Management (HRM/OIRM) maintains information related to staff recruitment and staff training, under the guidance of the Chief Information Officer. The Office of Equal Opportunity Programs (OEOP) databases are also available for reporting purposes.

The qualitative aspects associated with the goals on implementation of both merit review criteria are addressed in reports of external committees (COVs and AC/GPA) and/or staff analyses.

Data / Information Limitations

For outcome goals, the collection of qualitative data during assessment may be influenced by factors such as a lack of long-term data/information to assess the impact of outcomes, the potential for self-reporting bias, the unpredictable nature of discoveries, and the timing of research and education activities. For the quantitative management goals, the assessment may be influenced by factors such as accuracy of data entry into central computer systems, lack of experience in using new reporting systems or modules, or individual non-responsiveness (e.g., self-reporting of diversity information; workplace surveys).

Finally, external expert assessments (presented in COV and AC/GPA reports) may lack sufficient justification for ratings or may provide incomplete information. To address this issue NSF is continuing to modify its reporting templates and improve guidance to committees and staff in order to improve the completeness and consistency of the reports. This will aid in compiling qualitative information. Additionally, we have focused on clarifying language in goal and indicator statements.

VII. TRANSITION FROM FY 2001 TO FY 2002

The following goals, which were presented in the FY 2001 Performance Plan, have been modified or removed from the FY 2002 Revised Final Performance Plan. The significance and rationale for changes or exclusion are discussed below.

ANNUAL PERFORMANCE GOALS FOR NSF STRATEGIC OUTCOMES

FY 2001 Performance Goal III-1a: People Strategic Outcome -- Development of "a diverse, internationally competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens."

FY 2001 Performance Indicators:

NSF is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:

- 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.
- A science and technology and instructional workforce that reflects America's diversity.
- Globally engaged science and engineering professionals who are among the best in the world.
- A public that is provided access to the benefits of science and engineering research and education.

FY 2002 Performance Indicators:

NSF's performance is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement in the majority (4 of 7) of the following indicators:

- Development of well-prepared scientists, engineers or educators whose participation in NSF activities provides them with the capability to explore frontiers and challenges of the future;
- Improved science and mathematics performance for U.S. K-12 students involved in NSF activities;
- Professional development of the SMET instructional workforce involved in NSF activities;
- Contributions to development of a diverse workforce through participation of underrepresented groups (women, underrepresented minorities, persons with disabilities) in NSF activities;
- Participation of NSF-supported scientists and engineers in international studies, collaborations, or partnerships;
- Enhancement of undergraduate curricular, laboratory or instructional infrastructure; and
- Awardee communication with the public in order to provide information about the process and benefits of NSF-supported science and engineering activities.

Explanation of change: The set of performance indicators related to the People Goal has been expanded and modified to appropriately reflect the breadth of NSF activities. The criterion for successful performance was raised from significant achievement in at least one indicator to successful achievement in a majority of indicators.

FY 2001 Performance Goal III-1b: After three years of support, over 80% 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.

FY 2002 Performance Goal III-1b: After three years of NSF support, over 80% of schools participating in systemic initiative programs will (1) implement a standards-based curriculum in science and mathematics with at least one-third of their teachers; (2) provide professional development for at least one-third of their teachers; and (3) improve student achievement on a selected battery of math and science tests at one or more of three educational levels (elementary, middle and high school).

Explanation of change: The revised wording of the goal clarifies the threshold for success.

FY 2001 Performance Goal III-1c: Through systemic initiatives and related teacher enhancement programs, NSF will provide intensive professional development experiences for at least 65,000 pre-college teachers.

FY 2002 Performance Goal: Not included.

Explanation of change: This performance goal is not part of our FY 2002 Performance Plan. For FY 2002 NSF has reapportioned a substantial amount of the funds for the Systemic Initiatives to support the new Presidential Math and Science Partnership (MSP) activity. No new competitions or awards are anticipated under the Systemic programs. A goal related to the MSP has been included in the FY 2003 GPRA Performance Plan.

FY 2001 Performance Goal III-2: Ideas Strategic Outcome -- Enabling discovery across the frontier of science and engineering, connected to learning, innovation and service to society.

FY 2001 Performance Indicators:

NSF is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement in one or more of the following indicators:

- A robust and growing fundamental knowledge base that enhances progress in all science and engineering areas including the science of learning;
- Discoveries that advance the frontiers of science, engineering, and technology;
- Partnerships connecting discovery to innovation, learning, and societal advancement;
- Research and education processes that are synergistic.

FY 2002 Performance Indicators:

NSF's performance is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement in the majority (4 of 6) of the following indicators:

- Discoveries that advance the frontiers of science, engineering, or technology;
- Discoveries that contribute to the fundamental knowledge base;
- Leadership in fostering newly developing or emerging areas;
- Connections between discoveries and their use in service to society;
- Connections between discovery and learning or innovation; and
- Partnerships that enable the flow of ideas among the academic, public or private sectors.

Explanation of change: The set of performance indicators related to the Ideas Goal has been revised to better enable qualitative assessment and reflect the breadth of NSF activities. The criterion for successful performance was raised from significant achievement in at least one indicator to successful achievement in a majority of indicators.

FY 2001 Performance Goal III-3: Tools Strategic Outcome -- Providing "broadly accessible, state-of-the-art and shared research and education tools."

FY 2001 Performance Indicators:

NSF's performance is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement for one or more of the following indicators:

- Shared use platforms, facilities, instruments, and databases that enable discovery and enhance the productivity and effectiveness of the science and engineering workforce;
- Networking and connectivity that take full advantage of the Internet and make SMET information available to all citizens;
- Information and policy analyses that contribute to the effective use of science and engineering resources.

FY 2002 Performance Indicators:

NSF's performance is successful when, *in the aggregate*, results reported in the period demonstrate significant achievement in the majority (4 of 6) of the following indicators:

- Provision of facilities, databases or other infrastructure that enable discoveries or enhance productivity by NSF research or education communities;
- Provision of broadly accessible facilities, databases or other infrastructure that are widely shared by NSF research or education communities;
- Partnerships, e.g., with other federal agencies, national laboratories or other nations, to support and enable development of large facilities and infrastructure projects;
- Use of the Internet to make SMET information available to the NSF research or education communities;
- Development, management, or utilization of very large data sets and information-bases; and
- Development of information and policy analyses that contribute to the effective use of science and engineering resources.

Explanation of change: The set of performance indicators related to the Tools Goal has been expanded and modified to appropriately reflect the breadth of NSF activities. The criterion for successful performance was raised from significant achievement in at least one indicator to successful achievement in a majority of indicators.

ANNUAL PERFORMANCE GOALS FOR NSF MANAGEMENT

FY 2001 Performance Goal IV-1: Ninety-five percent of full proposals will be received electronically through FastLane.

FY 2002 Performance Goal: Not included.

Explanation of Change: This goal will not be continued in FY 2002. Electronic submission of proposals via FastLane is now standard operating procedure at NSF.

FY 2001 Performance Goal IV-3: By the end of FY 2001, NSF will increase usage of a broad-range of video-conferencing/long distance communications technology by 100% over the FY 1999 level.

FY 2002 Performance Goal: Not included.

Explanation of change: By the end of FY 2001, videoconferencing was viewed as a functioning, rather than experimental, technology. Because videoconferencing is an established practice for us, it will not be

continued as a goal in the future. We will, however, continue to emphasize this technology for current and emerging business applications.

FY 2001 Performance Goal V-7: NSF will award 30% of its research grants to new investigators.

FY 2002 Performance Goal: Not included.

Explanation of change: This openness goal is not included in the FY 2002 performance plan because we wish to fully consider whether this particular goal provides a good measure of openness in the system.

FY 2001 Performance Goal V-8: NSF will begin to request voluntary demographic data electronically from all reviewers to determine participation levels of underrepresented groups in the NSF reviewer pool.

FY 2002 Performance Goal IV-6: Establish a baseline for participation of members of underrepresented groups in NSF proposal review activities.

Explanation of change: The FY 2002 goal is a continuation of the FY 2001 goal. To enable the development of robust baselines, we will continue to gather the appropriate voluntary data from reviewers.

FY 2001 Performance Goal V-9b: Ninety percent of facilities will meet all major annual schedule milestones by the end of the reporting period.

FY 2002 Performance Goal IV-9b: Ninety percent of facilities will meet all major annual schedule milestones.

Explanation of change: This goal was adjusted based on actual performance reporting experience in FY 2001 and feedback from facilities managers, NSF program officers and IBM Business Consulting Services.

VIII. TRANSITION FROM FY 2002 TO FY 2003

This section compares goals contained in the FY 2002 Revised Final GPRA Performance Plan with those contained in the FY 2003 GPRA Revised Final Performance Plan. Significant changes are discussed. Minor wording revisions that were made to clarify goals are not included.

ANNUAL PERFORMANCE GOALS FOR NSF STRATEGIC OUTCOMES

FY 2002 Performance Goal: People – Developing "a diverse, internationally competitive and globally engaged workforce of scientists, engineers and well-prepared citizens."

FY 2002 Performance Indicators:

- Development of well-prepared scientists, engineers or educators whose participation in NSF activities provides them with the capability to explore frontiers and challenges of the future;
- Improved science and mathematics performance for U.S. K-12 students involved in NSF activities;
- Professional development of the SMET instructional workforce involved in NSF activities;
- Contributions to development of a diverse workforce through participation of underrepresented groups (women, underrepresented minorities, persons with disabilities) in NSF activities;
- Participation of NSF-supported scientists and engineers in international studies, collaborations, or partnerships;
- Enhancement of undergraduate curricular, laboratory or instructional infrastructure; and
- Awardee communication with the public in order to provide information about the process and benefits of NSF-supported science and engineering activities.

FY 2003 Performance Goal: People – Developing "a diverse, internationally competitive and globally engaged workforce of scientists, engineers and well-prepared citizens." (Unchanged)

FY 2003 Performance Indicators:

- Development of well-prepared researchers, educators or students whose participation in NSF activities provides experiences that enable them to explore frontiers or challenges of the future;
- Contributions to development of a diverse workforce through participation of underrepresented groups* in NSF activities;
- Development or implementation of other notable approaches or new paradigms** that promote progress toward the PEOPLE outcome goal.

* For example, women, underrepresented minorities or persons with disabilities

** For example, broad-based, program-wide results that demonstrate success related to improved math and science performance for preK-12 students, or professional development of the STEM instructional workforce, or enhancement of undergraduate curricular/laboratory/instructional infrastructure, or highly synergistic education and research activities, or international collaborations, or communication with the public regarding science and engineering.

Explanation of change: In order to facilitate and focus reporting activities, the People, Ideas, and Tools outcome goals in the FY 2003 plan have fewer indicators than did the FY 2002 outcome goals. The new set of indicators is largely derived from the FY 2002 set.

FY 2002 Performance Goal: After three years of NSF support, over 80 percent of schools participating in systemic initiative programs will:

(1) implement a standards-based curriculum in science and mathematics with at least one-third of their teachers;

(2) provide professional development for at least one-third of their teachers; and

(3) improve student achievement on a selected battery of math and science tests at one or more of three educational levels (elementary, middle and high school).

FY 2003 Performance Goal: No goal included.

Explanation of Change: For FY 2002 NSF has reapportioned a substantial amount of the funds for the Systemic Initiatives to support the new Presidential Math and Science Partnership (MSP) activity. No new competitions or awards are anticipated under the Systemic programs. A goal related to the MSP has been included in the FY 2003 GPRA Performance Plan.

FY 2002 Performance Goal: IDEAS – Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."

FY 2002 Performance Indicators:

- Discoveries that expand the frontiers of science, engineering, or technology;
- Discoveries that contribute to the fundamental knowledge base;
- Leadership in fostering newly developing or emerging areas;
- Connections between discoveries and their use in service to society;
- Connections between discovery and learning or innovation; and
- Partnerships that enable the flow of ideas among the academic, public or private sectors.

FY 2003 Performance Goal: IDEAS – Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society." (Unchanged)

FY 2003 Performance Indicators:

- Discoveries that expand the frontiers of science, engineering, or technology;
- Connections between discoveries and their use in service to society;
- Partnerships that enable the flow of ideas among the academic, public or private sectors;
- Leadership in fostering newly developing or emerging areas.

Explanation of change: In order to facilitate and focus reporting activities, the People, Ideas, and Tools outcome goals in the FY 2003 plan have fewer indicators than did the FY 2002 outcome goals. The new set of indicators is largely derived from the FY 2002 set.

FY 2002 Performance Goal: TOOLS – Providing "broadly accessible, state-of-the-art and shared research and education tools."

FY 2002 Performance Indicators:

- Provision of facilities, databases or other infrastructure that enable discoveries or enhance productivity by NSF research or education communities;
- Provision of broadly accessible facilities, databases or other infrastructure that are widely shared by NSF research or education communities;
- Partnerships, e.g., with other federal agencies, national laboratories, or other nations to support and enable development of large facilities and infrastructure projects;
- Use of the Internet to make SMET information available to the NSF research or education communities;

- Development, management, or utilization of very large data sets and information-bases; and
- Development of information and policy analyses that contribute to the effective use of science and engineering resources.

FY 2003 Performance Goal: TOOLS – Providing "broadly accessible, state-of-the-art and shared research and education tools." (Unchanged)

FY 2003 Performance Indicators:

- Development or provision of tools* that enables discovery or enhances productivity of NSF research or education communities;
- Partnerships with local, state or federal agencies, national laboratories, industry or other nations to support and enable development of large facilities or other infrastructure;
- Development or implementation of other notable approaches or new paradigms** that promote progress toward the TOOLS outcome goal.

* For example, includes research and education infrastructure such as large centralized facilities, or integrated systems of leading-edge instruments, or databases, or widely utilized, innovative computational models or algorithms, or information that provides the basis for a shared-use networked facility.

** For example, broad-based, program-wide results that demonstrate success related to management/utilization of large data sets/information bases, or development of information and policy analyses, or use of the Internet to make STEM information available to NSF research or education communities, or exceptional examples of broadly accessible tools shared by NSF research and education communities.

Explanation of change: In order to facilitate and focus reporting activities, the People, Ideas, and Tools outcome goals in the FY 2003 plan have fewer indicators than did the FY 2002 outcome goals. The new set of indicators is largely derived from the FY 2002 set.

ANNUAL PERFORMANCE GOALS FOR NSF MANAGEMENT

FY 2002 Performance Goal: Reviewers will address the elements of both generic review criteria at a level above that of FY 2001.

FY 2002 Performance Indicator: Percent of reviews using both merit review criteria.

FY 2003 Performance Goal: At least 70 percent of reviews with written comments will address aspects of both generic review criteria.

Explanation of change: The goal was modified based on internal deliberations.

FY 2002 Performance Goal: Program Officers will consider elements of both generic review criteria in making decisions to fund or decline proposals.

FY 2002 Performance Indicator: Percent of review analyses (Form 7s) that comment on aspects of both merit review criteria as determined by directorate or advisory committee sampling.

FY 2003 Performance Goal: For at least 80 percent of decisions to fund or decline proposals, program officers will comment on aspects of both generic review criteria.

Explanation of change: The goal was modified based on internal deliberations.

FY 2002 Performance Goal: Establish a baseline for participation of members of underrepresented groups in NSF proposal review activities.

FY 2003 Performance Goal: No goal included.

Explanation of change: Collection of voluntarily-provided demographic data from reviewers began in FY 2001 and is ongoing. This data is still being assessed. The information obtained will allow NSF to consider the feasibility of developing future performance goals in this area.

FY 2002 Performance Goal: NSF will develop and initiate a risk assessment/risk management plan for awards.

FY 2002 Performance Indicators:

- Development of an appropriate risk assessment model.
- Development of an effort analysis to determine necessary resource allocation (personnel, travel and training).
- Completion of a pilot program testing the risk assessment monitoring tools at several high-risk awardee institutions.

FY 2003 Performance Goal: No goal included.

Explanation of change: As a result of the development and implementation of a risk assessment / risk management plan in FY 2002, improved award monitoring and oversight will be embedded throughout NSF activities. Therefore this goal will be completed in FY 2002 and will be discontinued in FY 2003.

FY 2002 Performance Goals:

- For ninety percent of facilities, keep construction and upgrades within annual expenditure plan, not to exceed 110 percent of estimates.

- Ninety percent of facilities will meet all major annual schedule milestones.

- For all construction and upgrade projects initiated after 1996, when current planning processes were put in place, keep total cost within 110 percent of estimates made at the initiation of construction.

FY 2003 Performance Goal: For ninety percent of construction, acquisition and upgrade projects, keep any negative cost and schedule variances to less than 10 percent of the approved project plan.

Explanation of change: NSF has improved the construction goals by combining cost and schedule performance into a single goal based on the Earned Value technique, a widely accepted project management tool for measuring progress. This change recognizes that cost or schedule data alone can lead to distorted perceptions of performance.

FY 2002 Performance Goal: NSF will continue to advance the role of "e-business" in review, award, and management processes.

FY 2002 Performance Indicator: NSF will double the FY 2001 number of paperless projects that manage the competitive review process in an electronic environment.

FY 2003 Performance Goals:

- NSF will continue to advance "e-business" by receiving through FastLane and processing electronically 90 percent of Principal Investigator award transfers.
- NSF will continue to advance "e-business" by implementing Phase III of the Electronic Jacket application.

FY 2003 Performance Indicator: Implementation of the electronic capability for assigning proposal processing tasks, forwarding proposals to other programs as necessary, and delegating proposal action authority.

Explanation of change: The Foundation is moving towards an electronic environment capable of performing all internal and external functions from proposal submission through final project closeout. The FY 2003 goal retains the emphasis on e-business while continuing progress on new tasks in this area.

FY 2002 Performance Goal: NSF will implement an agency-wide security program in response to the Government Information Security Reform Act.

FY 2002 Performance Indicators:

- Risk assessments and certification to operate will be documented and retained.
- Policies will be developed and disseminated.
- Security management structure will be implemented.
- Security related changes to personnel policies (as necessary) will be documented.

FY 2003 Performance Goal: NSF will maintain and enhance the agency-wide security program to ensure adequate protection of NSF's Information Technology (IT) infrastructure and critical assets.

FY 2003 Performance Indicators:

- 95 percent of major systems will have approved security plans on file.
- 95 percent of major systems will have documented certification and accreditation.

Explanation of change: The Foundation is continuing to focus on assuring that NSF infrastructure and critical assets are protected. The FY 2003 goal is an extension of the efforts initiated in FY 2002 to establish a security program. The goal retains the emphasis on IT security, complies with the Government Information Security Reform Act, recognizes identified management challenges and audit findings, and is supportive of the government-wide emphasis on security.

FY 2002 Performance Goal: NSF will show an increase over FY 2000 in the total number of hires to NSF science and engineering positions from underrepresented groups.

FY 2003 Performance Goal: NSF will show an increase over FY 2000 in the total number of appointments to NSF science and engineering staff and management from underrepresented groups.

Explanation of change: The goal statement has been adjusted based on actual performance data from FY 2002. Recognizing that we have achieved this goal in each of the 3 years we've monitored this effort, the Foundation has decided to expand the previous goal to include Assistant Directors, Division Directors and others in order to ensure the goal is continuously challenging.

FY 2002 Performance Goal: NSF will establish an internal NSF Academy to promote continuous learning for NSF staff.

FY 2002 Performance Indicator: Availability of new or revised courses that contribute to an organized curriculum for NSF staff.

FY 2003 Performance Goal: NSF will align or develop competency-based curricula, through the NSF Academy, that provide cross-functional, work-based team learning opportunities.

FY 2003 Performance Indicator: Initiate development of new courses or revision of existing courses to address program management, leadership development, and technology and business process training.

Explanation of change: The Foundation is continuing to focus on assuring that continued professional development opportunities are available for NSF staff. The FY 2003 goal reflects this commitment and is an extension of the effort initiated in FY 2002 to establish an Academy. Further development of curricula and deployment of new course offerings will be the primary focus in FY 2003, with emphasis on workforce learning. Curricula addressing those functions most essential to the efficient operation and management of the Foundation will be the highest priority.

FY 2002 Performance Goal: NSF will initiate a strategic business analysis to provide a comprehensive perspective on its future workforce requirements.

FY 2002 Performance Indicators:

- Request for Proposals to perform the strategic business analysis will be released.
- Skill mix / competencies of the NSF workforce will be examined.

FY 2003 Performance Goal: NSF will develop competency-based, occupation classification alternatives that support the agency's strategic business processes and capitalize on its technology enabled business systems.

FY 2003 Performance Indicators:

- Identification of workforce competencies for all current NSF job families.
- Initiate identification of competency-based, classification alternatives.

Explanation of change: The FY 2003 goal reflects and is an extension of the FY 2002 effort to initiate a strategic business analysis. While the FY 2003 goal retains an emphasis on assessing future workforce needs, it also represents a transition towards implementation of the preliminary findings / results of the strategic business analysis. The FY 2003 effort includes initial development of human resource standards that link employee competencies with critical business processes and emerging technology.

FY 2002 Performance Goal: NSF will establish various baselines that will enable management to better assess the quality of worklife and work environment within the Foundation.

FY 2002 Performance Indicator: Development of an employee survey.

FY 2003 Performance Goal: No goal included.

Explanation of change: In FY 2002 NSF staff participated in a work environment survey administered by the Office of Personnel Management. The results of this survey are still undergoing assessment.

IX. OTHER FEATURES

INFORMATION ON USE OF NON-FEDERAL PARTIES

This GPRA performance report was written and prepared solely by NSF staff.

Non-Federal external sources of information we used in preparing this report include:

- Reports from awardees demonstrating results.
- Reports prepared by evaluators – Committees of Visitors (COV) and Advisory Committees – in assessing our programs for progress in achieving Outcome Goals.
- Reports prepared by a consulting firm to assess the procedures we use to collect, process, maintain, and report performance goals and measures.
- Reports from facilities managers on construction/upgrade costs and schedules and on operational reliability.

Specific examples:

Highlights or sources of examples shown as results may be provided by Principal Investigators who received support from NSF.

We use external committees to assess the progress of our programs toward qualitative goal achievement. External evaluators provide us with reports of programs, and provide feedback to us on a report template we prepare. Examples are COV and Advisory Committee reports that provide an independent external assessment of NSF's performance.

We engaged an independent third-party IBM Business Consulting Services to conduct a review of data and information used in performance reporting. IBM Business Consulting Services reviewed NSF's performance data and information pertaining to selected outcome goals, management goals, and investment process goals. This additional independent review helped to eliminate potential reporting bias that can develop in self-assessments. It also provides assurance of the credibility of performance reporting information and results.

BUDGET INFORMATION:

NSF obligated $4.8 billion in FY 2002. Administrative support for the Foundation was approximately 5% of the total NSF budget.

CLASSIFIED APPENDICES NOT AVAILABLE TO THE PUBLIC

None to report.

ANALYSIS OF TAX EXPENDITURES

None to report.

WAIVERS OF ADMINISTRATIVE REQUIREMENTS

None to report.

MANAGEMENT CHALLENGES

X. - MANAGEMENT CHALLENGES AND REFORMS

Federal agency management challenges are discussed in the President's Management Agenda (PMA). For NSF, they are also identified internally by NSF staff and by OMB, GAO, and the NSF Office of the Inspector General (OIG).

The **President's Management Agenda** lists five government-wide initiatives. The first four of these initiatives (Strategic Management of Human Capital, Competitive Sourcing, Improved Financial Performance, and Expanded Electronic Government) are discussed in NSF's FY 2003 Revised Final Performance Plan[39]. NSF's implementation of the remaining initiative, Budget and Performance Integration, is currently under discussion within NSF and between NSF and OMB. We have contracted with IBM Business Consulting Services Global Services to provide formal recommendations to improve our approach on integrating the budget, performance and cost of performance, within the intent of the Government Performance and Results Act (GPRA), Statement of Federal Financial Accounting Standard (SFFAS) 4, and Managerial Cost Accounting Concepts and Standards for the Federal Government.

The **OIG** issues addressed below are those included in a January 2002 statement by the Inspector General on NSF's management and performance challenges. This statement was released on January 30, 2002 and is contained in the NSF FY 2001 Accountability Report. In many instances, the management and performance challenges contained in the PMA, OMB, GAO, and the OIG documents are very similar.

For FY 2002, the NSF OIG identified 10 areas for NSF to monitor:

FY 2002 OIG Major Management Challenges

1. Work Force Planning and Training
2. Management of Large Infrastructure Projects
3. Award Administration
4. Cost Sharing
5. Data Security
6. GPRA Data Quality
7. Cost Accounting Systems
8. Management of U.S. Antarctic Program
9. Merit Review and its Role in Fostering Diversity
10. The Math and Science Partnership Program

[39] http://www.nsf.gov/od/gpra/

1. WORK FORCE PLANNING AND TRAINING

NSF OIG COMMENT: "The strategic management of human capital is recognized as an important priority throughout government and is an important element of the President's Management Agenda. This past year, the General Accounting Office (GAO) also added human capital management to the government-wide high-risk list. NSF management has acknowledged the seriousness of its human resource management challenge. The agency is vulnerable to a wave of retirements in key areas as 63% of the agency's executive workforce, as well as a large percentage of the science and engineering staff, are eligible to retire within 5 years. Meanwhile NSF's budget for salaries and expenses continues to lag behind the growth of NSF's overall program budget. NSF's Management Controls Committee evaluated this issue as a medium risk, and warned that it could worsen in the not too distant future. The agency is expected to begin to address these issues as part of a 5 year plan it is submitting to the Office of Management and Budget (OMB). The plan will serve as a blueprint for enabling the agency to cope with the increase in workload that NSF has received during the past few years. As part of the OIG's FY 2002 appropriations bill, Congress requested that our office analyze the adequacy of the agency's staffing and management plan. Planning for our review is underway, and our final report is due in the summer of 2002.

In the interim, NSF reports that it is engaged in an effort to introduce fundamental changes in NSF business processes and practices, including redefining NSF position descriptions. The agency is also in the process of establishing an NSF Academy to provide all education and training needed by the agency. We view the development of a training program appropriate for NSF's needs as an urgent priority, particularly in light of NSF's dependence on Intergovernmental Personnel Act (IPA) personnel, who serve at NSF on a temporary basis and comprise a significant percentage of the workforce that requires continual training."

THE PRESIDENT'S MANAGEMENT AGENDA (2002) includes strategic management of human capital as a government-wide initiative.

GAO *(GAO-01-236, April 2001)* has identified shortcomings of many agencies involving key elements of modern strategic human capital management, including (1) strategic planning and organizational alignment; (2) leadership continuity and succession planning; and (3) acquiring and developing staff whose size, skills, and deployment meet agency needs.

FOCUSED NSF ACTIVITIES IN THIS AREA: NSF's flexible and motivated workforce currently includes approximately 650 permanent and visiting scientists and engineers (about 65% of whom are permanent government employees), 450 administrative personnel who provide business operations support, and approximately 300 program support personnel.

NSF has a steadfast commitment to empower a workforce of teams and individuals who are continuously expanding their capabilities to shape the agency's future. To sustain its high-performing workforce, NSF is exploring ways to recruit and retain excellent employees. New initiatives include an updated telecommuting program, strategic recruiting techniques that also seek to increase representation of underrepresented groups in the NSF science and engineering workforce, a renewed focus on continuous learning and an increased emphasis on leadership and succession planning.

NSF has entered into a multi-year contract to perform a Strategic Business Analysis which will examine organizational alignment and the workforce size, skill mix, and deployment necessary to ensure mission accomplishment. This effort continues through FY 2005; NSF will develop and implement human capital strategies and an human resource accountability system during this timeframe as findings and recommendations are received.

2. MANAGEMENT OF LARGE INFRASTRUCTURE PROJECTS

NSF OIG COMMENT: "In response to an OIG audit report, as well as concerns expressed by Congress and OMB, NSF began updating its policies and procedures during 2001 to strengthen the management and oversight of large facility projects. As part of this process, NSF developed a *Large Facility Projects Management and Oversight Plan.* NSF sought OIG input as it developed this plan, and we believe it is an important first step in ensuring that NSF's large facility projects provide appropriate stewardship over public funds, while not unduly constraining the freedom needed to pursue scientific research.

However, much work lies ahead. The plan constitutes a broad outline of NSF's intentions and more-detailed guidelines are required in order for corrective action to be effective. Congress has indicated its concern over the implementation of the plan and expressed a desire for NSF to demonstrate significant progress in implementing it before February 28, 2002. We will continue to monitor NSF's progress, particularly with regard to areas of accountability, authority, and post-award project management, to ensure that sound business and management practices are employed in advancing NSF's scientific goals."

FROM OMB: OMB has noted that NSF has several multi-year, large facility projects awaiting approval for funding. Although the agency has done well in keeping past projects on schedule and within budget, OMB believes that NSF's capability to manage proposed projects needs to be enhanced given the magnitude and costs of future projects. NSF was asked to develop and submit a plan to OMB that documents its costing, approval, and oversight of major facility projects.

FOCUSED NSF ACTIVITIES IN THIS AREA: NSF continues its efforts to improve management and oversight of its large facility projects in accordance with the plans laid out in the *Large Facility Projects Management & Oversight Plan* (submitted to OMB in September 2001). Organizationally, NSF has named an interim Deputy Director for Large Facility Projects to provide expert project management and business operations advice and oversight. This individual and other NSF staff are developing the comprehensive guidelines and procedures for all aspects of facilities planning, management and oversight. Staff capabilities are being enhanced through introduction of a project management training curriculum and through consistent representation on all Project Advisory Teams for the purpose of sharing lessons learned. A manual for conducting on-site monitoring is also being developed.

This new facilities plan has four major foci:

- Enhance organizational and staff capabilities and improve coordination, collaboration, and shared learning among NSF staff and external partners;
- Implement comprehensive guidelines and procedures for all aspects of facilities planning, management and oversight;
- Improve the process for reviewing and approving Large Facility Projects; and
- Practice coordinated and proactive oversight of all facility projects.

Further development and implementation of the plan is continuing.

A new search for a Deputy Director for Large Facilities Projects was launched in August 2002.

3. AWARD ADMINISTRATION

NSF OIG COMMENT: "At any point in time, approximately 1,150 NSF staff are engaged in administering as many as 20,000 active awards. This is in addition to their responsibility for soliciting and awarding approximately 10,000 new grants and cooperative agreements annually. While NSF has demonstrated its efficiency in making awards, we believe that the agency should improve post-award monitoring by establishing written policies and procedures to ensure financial and administrative compliance.

In the course of performing financial and compliance audits on a variety of awardees, we have found that some are at greater risk for compliance problems than others. Since NSF staff resources are limited, factors such as award size, type of entity, and amount of experience with federal grants should be considered when determining which awardees should be accorded greater oversight. For awardees deemed to be higher risk, the procedures might include conducting a more rigorous analysis of their grant management systems prior to the start of an award, providing more-detailed instruction to high risk awardees, and monitoring award activity more closely to assure financial and administrative compliance. NSF's Division of Grants and Agreements (DGA) is developing a risk-management approach to post-award monitoring activities. We look forward to working with DGA on the development of new procedures that will address this challenge."

FOCUSED NSF ACTIVITIES IN THIS AREA: To address the need for increased oversight of the agency's complex and diverse portfolios, the NSF A&M Strategic Plan includes a framework for Award Management and Oversight that focuses on a collaborative, multi-functional award management and oversight process that is informed by risk management strategies and verifies that projects are in compliance.

NSF has drafted a strategic plan and a *Risk Assessment and Award Monitoring Guide* for assessing and managing awardee risks and assets focusing on financial and administrative monitoring to insure proper stewardship of federal funds at awardee institutions. This draft plan is being piloted at a number of institutions and will be refined based on our assessment of these reviews.

4. COST SHARING

NSF OIG COMMENT: "Cost sharing leverages the government's investment in basic research by obtaining contributions from grantees and others. In FY 2000 NSF made 3,111 awards that required cost sharing amounting to $508,516,513. Our audits of awardees continue to reveal problems with cost sharing that include shortfalls in contributions, instances of missing or insufficient documentation, and systems that are inadequate to ensure their proper accounting.

Given the large amount of these commitments, the failure to honor cost sharing obligations or to keep proper accounts can have serious consequences for NSF's awards. When an awardee promises cost sharing, it accepts an obligation to contribute a certain amount of money and/or resources to the project costs. The government requires that these funds be fully accounted for so it can determine whether the obligation has been fulfilled. Therefore, if promised cost sharing is not realized, either the programmatic objectives are not met or the project is not funded as originally projected. In either case, NSF has paid a larger share than what was agreed to and opportunities for the agency to fund other awards are curtailed. For these reasons, we believe that NSF should re-examine its policies on the reporting of cost sharing and resolving of any questioned amounts to ensure compliance with federal guidelines."

FOCUSED NSF ACTIVITIES IN THIS AREA: During FY 2002, the Division of Budget and Financial Administration (BFA) began development of the Risk Assessment and Award Monitoring Guide. This document establishes the strategic framework for assessing and managing awardee risks and assets. Cost sharing is identified as a high-risk factor and was focused on in development of the risk assessment protocol, currently being pilot tested with a sample set of organizations. NSF envisions increased on-site review to provide important business and managerial assistance to awardees in this area.

In addition, BFA is currently developing a white paper on cost sharing. It will include an assessment of issues that have surfaced since implementation of Important Notice 124, Implementation of the New Cost Sharing Policy, and provide recommendations for addressing them. Upon completion of the initial draft, NSF anticipates conducting outreach to NSF Program Officers and the community, via the Federal Demonstration Partnership, to assess the agency's proposals.

At the August 2002 meeting of the National Science Board, the Audit and Oversight Committee affirmed the importance of this issue and requested that NSF develop more explicit policies and procedures related to implementation of the "tangible benefit" criterion of the cost sharing policy.

5. DATA SECURITY

NSF OIG COMMENT: "NSF faces the challenging task of facilitating an open research culture while protecting its critical information assets against unauthorized intrusion. Although NSF has enhanced its security program by establishing an Intrusion Detection Service and appointing a Security Officer, continuing efforts are needed to improve system security. Our review of NSF's information security program indicates that there may be weaknesses that increase security risks. NSF has concurred with our recommendations and has initiated corrective action.

We commend the agency for making many improvements to its innovative FastLane program in the past year. FastLane allows NSF's customers to use the Internet to exchange information with NSF in the performance of a variety of tasks, including preparing and submitting proposals, proposal reviews and project reports. Given its vital role as the primary vehicle for transacting NSF business, we listed FastLane as a management challenge last year and emphasized the need for NSF to continue to monitor its progress, paying particular attention to making it as user-friendly and reliable as possible. NSF states that the problem in servicing requests for help from FastLane users was addressed through increased staff, better procedures, and improved on-line documentation.

However, NSF management needs to continue to address some important emerging issues. NSF is participating with other federal agencies in a project to provide grant applicants with a single information exchange portal for all grant-making agencies, called the "Federal Commons." The implementation of the system will begin in FY 2003 and will require significant commitments from NSF before it is operational. While the Federal Commons is under development, the agency is planning to continue to improve FastLane by increasing the number of critical agency functions it supports. In general, the rapid growth of FastLane and other information technology applications at NSF increases the need for an effective information security program."

GAO (01-758) noted that recent audits continue to show that federal computer systems are riddled with weaknesses that make them highly vulnerable to computer-based attacks and place a broad range of critical operations and assets at risk of fraud, misuse, and disruption.

FOCUSED NSF ACTIVITIES IN THIS AREA: The NSF Information Technology Security (ITS) Program remains focused on ensuring that NSF infrastructure and critical assets are appropriately protected while maintaining an open and collaborative environment for science and engineering research and education. An agency-wide ITS program has been implemented encompassing all aspects of information security, including policy and procedures, risk assessments and security plans, managed intrusion detection services, vulnerability assessments, and technical and management security controls. Operational procedures and controls are in place to ensure the security, reliability, and integrity of information technology resources that support NSF operations. Additional resources have been requested to enhance the agency's overall security posture through the use of emerging "smart technology."

NSF has a comprehensive framework for establishing appropriate safeguards and controls and ensuring that they are integrated into existing and new information technology assets and resources. Documentation in accordance with OMB Circular A-130, "Management of Federal Information Resources" of risk assessments and commensurate security plans for major systems is prepared and independently reviewed to ensure that ITS requirements are addressed. In the unlikely event of a major disaster, NSF has comprehensive disaster recovery plans and capabilities, which are tested on an annual basis at a hot-site location.

NSF has implemented policies and processes to ensure it is alert to intrusion attempts and is positioned to take effective action to thwart them. Routine penetration testing is planned to start in FY 2003.

In accordance with Government Information Security Reform Act (GISRA) and the Computer Security Act and due to the increased need for IT security, NSF has implemented a program to provide IT security training to all NSF staff and contractors who use NSF computer systems.

6. GPRA DATA QUALITY

NSF OIG COMMENT: "The President's Management Agenda outlines plans to formally link performance review with budget decisions beginning in FY 2003. This initiative complements the objectives of the Government Performance and Results Act (GPRA) enacted in 1993 to focus federal programs on performance. While NSF is making steady progress in complying with GPRA, the agency needs to evaluate and improve, as appropriate, both its formulation of GPRA measures and its verification of data in order to facilitate the integration of budget and performance information.

In a report issued in June 2001, GAO found that while most strategies for achieving NSF's key outcomes were generally clear and reasonable, some are vague and do not identify specific steps for achieving their goal. GAO also observed that NSF did not provide information on the strategic human capital management strategies necessary to achieve some of the outcomes.

In addition, the validity of NSF's GPRA data and outcome measures has not been firmly established. In order to address these concerns, which were raised by GAO in a report on NSF's FY1999 Performance Report, the agency retained a contractor to verify and validate selected GPRA performance data, including outcome measures. These measures are based on the reports of various external expert panels including the Committees of Visitors (COVs) and Advisory Committees (ACs), which conduct evaluations of program activities. Although the contractor concluded that NSF's processes were adequate, we found that the contractor did not assess the process used by the committees to make their determinations, nor did it evaluate the underlying data used by the committees in making their judgments. NSF states that it understands the importance of data quality and is implementing a COV data project that will substantially improve the information used by NSF committees. Our office is planning to conduct a review of the COV process during the current fiscal year."

FOCUSED NSF ACTIVITIES IN THIS AREA: For FY 2000 and FY 2001 GPRA reporting, NSF engaged an external party, IBM Business Consulting Services, to provide an independent verification and validation (V&V) of selected GPRA goals. The V&V focused on reliability of data, on processes to collect, process, maintain, and report the data, and on program reports prepared by external experts. IBM Business Consulting Services mapped NSF procedures against GAO guidance for polices and procedures that underlie GPRA performance reporting.

IBM Business Consulting Services' FY 2000 assessment concluded that NSF was reporting its GPRA measures with "sufficient accuracy such that any errors, should they exist, would not be significant enough to change the reader's interpretation as to the Foundation's success in meeting the supporting performance goal...." In FY 2001 IBM Business Consulting Services concluded "From our review, we determined that NSF has reported on ten of the quantitative goals and all five qualitative goals in a manner such that any errors, should they exist, would not be significant enough to change the reader's interpretation of the Foundation's success in meeting the supporting performance goal…. For the four goals related to facilities management, we identified significant data limitations, which impaired our ability to verify the processes. However, we believe that NSF's reported outcomes are consistent with the data they collected."

NSF will reassess its GPRA outcome measures during preparation of the updated and revised Strategic Plan, due to OMB on March 1, 2003. The agency has also engaged the services of an external management-consulting firm to conduct an integrated performance, cost, and budget strategy assessment, with the intent of obtaining different scenarios to meet our growing requirements in this arena. Information derived from these activities will allow NSF senior management to address the most appropriate and useful cost and performance information to develop and monitor.

7. COST ACCOUNTING SYSTEMS

NSF OIG COMMENT: "Good cost accounting information can help management make fully informed decisions based on evaluating the cost of an activity or project against its benefits. At present, NSF's information systems do not readily provide the basic cost accounting information needed to effectively manage and report on agency operations, such as the cost of NSF's various grantmaking activities (e.g., proposal processing, peer review, post-award administration) or large infrastructure projects.

The OIG's FY 2000 Management Letter Report recommended that NSF develop performance measures and goals that can be linked to NSF's budget, actual cost of operations, and the management challenges. NSF's ability to measure agency performance, link its costs to its results, and fully implement GPRA, is dependent on an effective financial and cost accounting system. Therefore, NSF should modify its accounting systems so they can capture total costs and readily supply total cost information useful to NSF management, the National Science Board, and Congress."

FROM THE PRESIDENT'S MANAGEMENT AGENDA: NSF is rated "red" on the Budget-Performance Integration initiative of the President's Management Agenda in part because the NSF Budget does not charge the full budgetary cost to individual activities.

FOCUSED NSF ACTIVITIES IN THIS AREA: With regard to the recommendation that the Chief Financial Officer (CFO) "develop and report cost efficiency measures that align with the outputs/outcome goals identified in its Statement of Net Cost," NSF is taking this recommendation into consideration as part of the Foundation's effort to further integrate performance, budgeting and cost. This process recommendation and suggested alignment is being considered as one of many possible means to achieve enhanced integration. The Foundation has recently engaged the services of an external management-consulting firm to conduct an integrated performance, cost, and budget strategy assessment, with the intent of obtaining different scenarios to meet our growing requirements in this arena. This study included a best practices survey of public and private enterprises, and input from NSF senior staff on financial and performance information needed to make better management and budgetary decisions. NSF senior management are evaluating the results of the study to determine the most appropriate and useful cost and performance information to develop and monitor.

8. MANAGEMENT OF U.S. ANTARCTIC PROGRAM

NSF OIG COMMENT: "The U.S. Antarctic Program (USAP) should deliver its services as effectively and efficiently as possible in order to facilitate the impressive scientific discoveries that are taking place in the Antarctic. NSF's Office of Polar Programs (OPP) oversees the USAP and manages all U.S. activities in the Antarctic serving the scientific community as a single program. It also supports most of the polar research funded by the National Science Foundation. OPP accomplishes most of its responsibilities by contracting with private companies and governmental organizations. With responsibilities similar in some respects to those of a local government, OPP provides all the infrastructure, instrumentation, and logistics necessary to enable the research efforts of more than 2,000 scientists from around the world.

The successful operation of the USAP requires unique management and administrative skills that are responsive to the special needs of Antarctic scientific research. OPP staff must not only know the science, but must also manage contractors engaged in delivering a broad range of services to the American scientific community located in a difficult and dangerous environment. Our audit work has focused on reviewing these support activities because of their many inherent risks. From our perspective, NSF's polar programs involve not only a large expenditure of money, but also the safety of scientists and workers, environmental concerns, and the national interests of the U.S. Government. For example, we are currently reviewing USAP's safety and health program, regarded as a high-risk activity because of the difficulties of delivering medical services in such a remote location. Another challenge for the program is the tracking and accounting for items associated with the USAP's large and distant infrastructure, which includes equipment, planes, ships and buildings. Capturing the correct information requires close coordination among OPP, its contractors, and NSF financial staff."

FOCUSED NSF ACTIVITIES IN THIS AREA: NSF agrees with the OIG that the safety of scientists and workers, environmental concerns, and the national interests of the U.S. Government require unique management and administrative skills that are responsive to the special needs of Antarctic scientific research. In order to meet these challenges NSF staff utilize their special expertise to:

- Implement next steps in long range plan for renovating/updating McMurdo Station infrastructure;
- Coordinate Department of Defense, NASA, USGS and DOE activities;
- Oversee environmental, health, safety, and medical activities;
- Oversee construction and maintenance of all infrastructure at three U.S. stations in Antarctica (roads, fire stations, clinics, power stations, heating, communications, ground stations, air traffic control, ground vehicles, food services, sewage treatment, water supplies, etc.);
- Coordinate support of scientists in Antarctica, construction of specialized science instrumentation, etc.;
- Budget for the above activities; and
- Select science projects for deployment on the basis of merit review and ability to meet logistics requirements.

9. MERIT REVIEW AND ITS ROLE IN FOSTERING DIVERSITY

NSF OIG COMMENT: "The effectiveness and integrity of the merit review system may be NSF's most valuable asset. The agency considers this system "the keystone for award selection" and focuses many of its management activities on issues related to merit review. We endorse those efforts and believe that maintaining and improving the quality and integrity of the merit review process will remain a significant challenge for NSF management for years to come.

During the past year the National Academy of Public Administration released a report on the agency's criteria for project selection, focusing in particular on the impact of Criterion 2, which is aimed at evaluating the potential societal impact of a project. While NAPA concluded that it is too soon to judge the impact of Criterion 2, it made several recommendations regarding its use. Specifically, NAPA stated that NSF needed to develop clearer objectives for the new criterion and adopt quantitative measures and performance indicators to track those objectives. Noting that the ultimate issues raised by implementation of Criterion 2 are not those of language but philosophy, NAPA suggested broader-based review panels with participants drawn from a wider range of institutions, disciplines, and underrepresented minorities."

NSF has initiated several changes to the merit review process in the past year to ensure that more attention is paid to Criterion 2, and we understand that further changes are being considered. NSF also states that it is adding new GPRA measures to track progress in encouraging participation in the merit review process by a broader range of institutions and underrepresented minority researchers. Because of its importance to the success of NSF's mission, the merit review system remains on the list of management challenges."

FOCUSED NSF ACTIVITIES IN THIS AREA: NSF considers its merit review process the keystone for award selection. The agency evaluates proposals using two criteria – the intellectual merit of the proposed activity and its broader impacts. NSF staff rely on expert evaluation by selected peers when evaluating proposals and making funding decisions. Each year, more than 250,000 merit reviews are provided to assist NSF with the evaluation of proposals submitted for consideration.

NSF focuses its management activities on a wide variety of issues related to merit review – including use of both merit review criteria by reviewers and program officers, broadening participation, and enhancing customer service.

In FY 2001 NSF established an internal task force to examine strategies to improve both proposer and reviewer attention to the broader impacts criterion. The group assessed the characteristics and quality of reviewer responses to this criterion and found that, based on a sample of FY 2001 reviews, approximately 69 percent of reviews provided evaluative comments in response to the broader impacts criterion. The group also developed examples of broader impacts that may be useful to proposers in developing proposals and reviewers in evaluating proposals.

NSF has also revised its guidance to proposers. The Grant Proposal Guide (GPG) now specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one page Project Summary. The GPG also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative. Effective October 1, 2002, NSF returns without review proposals that do not separately address both merit review criteria within the Project Summary.

10. THE MATH AND SCIENCE PARTNERSHIP PROGRAM

NSF OIG COMMENT: "NSF has been designated the lead agency on a key element of the President's initiative, *No Child Left Behind,* aimed at strengthening and reforming K-12 education. As the performance of American school children on math and science tests continues to disappoint, NSF is preparing to launch the Math and Science Partnership Program. The partnerships will provide $160 million this year for state and local school districts to join with colleges and universities to improve math and science education at the grade school level. A defining feature of the program will be the development of the partnerships between school districts, state and local governments, and institutions of higher learning.

Although we are confident that NSF is striving to achieve success with this initiative, implementation of the program will pose several challenges to NSF. On a practical level, it requires NSF to articulate expectations clearly at the outset and make many awards within a short time frame. Once the selections are made, NSF program officers will need to provide extensive coaching of projects in their formative stage to ensure that awardees do effective project planning. Because the success of the program will depend on a sustained collaboration between institutions that may not be used to working together, NSF staff will also need to assist project partners in building a shared sense of purpose and coordinating efforts.

Also, NSF's experience with projects such as the Urban Systems Initiative indicates that projects involving innovative partnering among awardees with limited experience in handling federal funds will require close monitoring of all aspects of their project, including financial and administrative matters. Therefore, the involvement of NSF on a continuing basis is essential. NSF staff will need to help coordinate the efforts of the various parties, monitor the progress of the projects, and ensure that federal funds are handled properly."

FOCUSED NSF ACTIVITIES IN THIS AREA: NSF has developed a comprehensive award oversight and management plan for all Math and Science Partnership awards.

NSF expects to make approximately 30-40 MSP awards in FY 2002. Larger, more complex awards will be made as cooperative agreements. These cooperative agreements will describe the post-award management and oversight that will support the work of MSP partnerships in realization of their goals; management and oversight activities will draw upon NSF's strong, community-based site visit processes.

The lead partners responsible for both fiscal and project management of MSP-supported projects will, for the most part, be institutions with significant experience handling federal funds. For lead partners with no prior experience working with NSF or other federal funds, NSF staff will work closely with these organizations in the monitoring of all aspects of the project, including financial and administrative matters.

APPENDICES

APPENDIX I. - TABLE OF EXTERNAL EVALUATIONS

The Table below provides information on program assessments and evaluations other than Committee of Visitor and Advisory Committee assessments - with one exception – the CAREER program. The CAREER program is an agency-wide activity, and the assessment was contracted to an external private vendor.

The table lists other types of evaluations, not used in GPRA performance assessment, that were completed in FY 2002. These reports, studies, and evaluations are frequently used in setting new priorities in a field or in documenting progress in a particular area. The reader is encouraged to review the reports for additional information on findings and recommendations that are beyond the scope of this report.

Reports (other than COV reports) produced by NSF are available online at http://www.nsf.gov/pubs/start.htm using the NSF's online document system and the publication number indicated.

Information on obtaining reports produced by the National Research Council or National Academy of Sciences can be found online by searching www.nap.edu or from the National Academy Press, 2101 Constitution Avenue, N.W., Lockbox 285, Washington, D.C. 20055 (1.800.642.6242).

Evaluations Completed in FY 2002

	Directorate for Biological Sciences (BIO)
Fourth Workshop on the Development of a National Ecological Observatory Network (NEON): Standard Measurements and Infrastructure Needs	**Findings:** Planning for NEON requires the development of a plan for standardized equipment needs and measurements for all NEON observatories. As in previous workshops, the group enthusiastically endorsed the proposed development of a national network of ecological observatories. This report provides examples of how NEON will expand research capabilities beyond anything current available, which will greatly advance ecological research and our understanding of the environment. It also provides examples of how such a network can be of service to the Nation's, including the development and training of future generations of the Nation's technological workforce. **Recommendations:** 1. For measuring climate and hydrology: a spatially distributed network of weather-monitoring stations, a subnetwork of sun photometers, a subnetwork of ecohydrologic sensors, a broader-scale ecohydrologic network, 2.Biological monitoring at the broadest phylogenetic level, including microbes, plants and metazoans 3. the inputs, internal dynamics and outputs of carbon, nitrogen, phosphorus and biologically important base cations across the landscape. 4. Monitoring of the dynamics of all major and minor taxa. **Availability:** http://www.nsf.gov/bio/neon/NEON4.pdf

Microbial Ecology and Genomics: A Crossroads of Opportunity	**Findings:** The scientific and technological developments of the last several years have been so rapid as to bring us to a new crossroads of opportunity - analysis of the tremendous complexity of natural microbial systems in more complete terms. Genome sequencing has revealed totally unexpected genetic plasticity within and among named microbial species, and horizontal DNA transfer is now recognized to be a major force in the shaping of their genomes and fostering biochemical innovation. Therefore, before we can understand and predict the patterns in nature, we first need to know what those patterns are. Intensive microbial genomic/biodiversity surveys, covering the full range of environmental conditions and geological/evolutionary histories, will be required to determine the patterns that exist. This is a prerequisite to developing hypotheses to explain these patterns and linking patterns to processes at scales ranging from micrometers to global levels. **Recommendations:** 1. Support research funding opportunities to advance ecogenomics, to sample and sequence microbial genomes representing the breadth of natural microbial biodiversity, and to sample and sequence multiple genomes within well-defined species clusters. 2. Support research funding opportunities for the expansion of culture collections that include a central, well-ordered facility for the maintenance of type strains and their associated data. 3. Develop integrated universal databases that include genomic, phenotypic, habitat and geographical information. 4. Development of new technologies for measuring the activity of microorganisms in the environment, for cultivating currently uncultivable species, and for rapid determination of key physiological traits and activities. 5. Develop Genome Resource Centers to advance microbial genomic science, including a user-oriented approach for sharing microarray technologies, data analysis, and proteomic analysis. 6. Support funding opportunities for the training of students, including such disciplines as ecology, evolution, genomics, bioinformatics and computational sciences, to hone skills in emerging and rapidly changing fields. **Availability:** http://www.asmusa.org/acasrc/aca1.htm

Evolutionary Immunobiology: New Approaches, New Paradigms	**Findings:** The focus of the workshop was to elucidate the current status of the field of comparative (i.e. non-human and non-primate) and evolutionary immunobiology, to delineate the future directions that research should take (i.e. gaps in the relevant knowledge base), and to identify constraints to filling in these knowledge gaps. Reports presented at the workshop highlighted the important functional, evolutionary, and developmental interplay between innate and adaptive immune defense mechanisms throughout biology. Workshop presentations also noted the importance of the knowledge base in the field of comparative immunobiology to our fundamental understanding of evolution, animal interaction with the environment and with other species, in addition to system ecology, agriculture, aquaculture, and human ecology. Not unimportant is also the relevance of fundamental knowledge in this research area to new challenges of combating eco-, bio-, and agro-terrorism. The focus of the workshop was to elucidate the current status of the field of comparative (i.e. non-human and non-primate) and evolutionary immunobiology, to delineate the future directions that research should take (i.e. gaps in the relevant knowledge base), and to identify constraints to filling in these knowledge gaps. Reports presented at the workshop highlighted the important functional, evolutionary, and developmental interplay between innate and adaptive immune defense mechanisms throughout biology. Workshop presentations also noted the importance of the knowledge base in the field of comparative immunobiology to our fundamental understanding of evolution, animal interaction with the environment and with other species, in addition to system ecology, agriculture, aquaculture, and human ecology. Not unimportant is also the relevance of fundamental knowledge in this research area to new challenges of combating eco-, bio-, and agro-terrorism. **Recommendations:** 1. Application of functional genomics to evolutionary immunobiology requires the development of new mathematical modeling approaches. 2. Gaps in our immunobiology knowledge base include the identification of understudied groups. 3. Development and application of powerful genomic tools such as Bacterial Artificial Chromosome (BAC) libraries and Expressed Sequence Tag (EST) databases. 4. Development of novel bioinformatic tools, and the standardization of database annotation. 5. Development of genetically defined stocks of animals and cell lines including monoclonals.

Evolutionary Synthesis Center	**Findings:** Evolution has long served to unify the study of biology. Today, evolution has taken on an even greater role, as it serves to inform and direct data acquisition, analysis and interpretation across the life sciences. This transformation comes in part from an explosion of raw data, from sources as far ranging as whole genome sequences and phylogenetics to long-term behavior studies and functional morphology. Such data and metadata can only be interpreted using advanced mathematical and statistical approaches built on evolutionary concepts. Their implementation depends on highly developed database management and analysis tools. As formerly disparate fields of biological research converge, evolutionary biology is providing the common language. Evolutionary biology is poised to serve as the focal point for the synthesis and interpretation of these massive and growing data sets. Evolutionary biology can, and should, play a similarly central role in addressing a suite of critical national concerns. For example, evolutionary biology has a pivotal role to play in combating the evolution of infectious disease, for controlling the spread of invasive species, in understanding the emergence and spread of antibiotic resistance, for managing biodiversity, and in the application of population genetic tools to trace lineages of bioterrorism agents. To accomplish this mission, however, requires the coordination and communication among a diversity of scientists, government agencies, policy makers, health scientists, epidemiologists and others. **Recommendations:** Create an Evolutionary Synthesis Center to serve the needs of the evolutionary community by providing mechanisms to foster synthetic, collaborative, cross-disciplinary studies. **Availability:** http://frog.biology.yale.edu/esc/

	Directorate for Computer & Information Sciences & Engineering (CISE)
National Science Foundation Information Technology Research, Innovation and E-Government	**Scope:** This workshop was intended to examine broadly issues of E-Government, and to recommend related topics requiring academic research contributions, as well as identifying areas where standard commercial technology would be preferable. **Findings:** Government requirements can differ from those found in the commercial world, with government being a “demand leader”. Targeted research in computer science along with technology transfer can help in domains such as ubiquity, trustworthiness, information heterogeneity and semantic interoperability and building large-scale systems. **Availability:** http://www.cstb.org/web/pub_egovernment

National Science Foundation Research Challenges in Digital Archiving: Towards a National Infrastructure for Long-Term Preservation of Digital Information	**Scope:** This workshop developed a research agenda in this topic area. Digital archiving over periods of decades is of particular importance to government missions, where government agencies are stewards of official material. **Findings:** The National Science Foundation, the Library of Congress, and other government agencies should undertake a massive research effort to improve the state of knowledge and practice for long-term preservation of digital information. Important new research opportunities have arisen in storage and processing capacities, interoperability among heterogeneous systems, automation of intake and preservation management processes, and complex metadata and semantic representation. Related important issues exist in economic and business models, policies to encourage sustainable digital preservation, and economic, social, and legal impediments to digital archiving. All these research needs are propelled by the increasing amount of information that is "born digital". **Availability:** http://www.si.umich.edu/digarch
Developing a Basic Research Program for Digital Government: Information, Organizations and Governance	**Scope:** As information and communications technologies become ubiquitous, it becomes more important to understand just how these technologies impact governance and government agencies broadly speaking. This workshop developed a social science and information science research agenda for this area. **Findings:** High priority research must encompass critical elements of government performance, including effectiveness, efficiency, accountability, access, responsiveness to citizens, federalism, and capacity for learning and innovation. Empirical research on users of digital government is important given wide speculation and predictions regarding digital democracy and citizenship in an information society. The process of change requires research to focus specifically on the transformative processes that lie between inputs and outcomes. Included would be the antecedents and consequences of specific change processes, catalysts and incentives for change, models of emergence and network development from complexity theory, as well as extension and application of current theories of co-evolution, technology adoption, technology transfer, knowledge diffusion, and innovation. **Availability:** http://www.ksg.harvard.edu/digitalcenter; see http://www.ksg.harvard.edu/digitalcenter/reports/Workshop%20Report%2011_4.pdf for report.

National Science Foundation Workshop on Unexpected Events	**Scope:** This workshop developed a broad research agenda in crisis management and emergency response, particularly with respect to low-probability, high-impact events where societal response systems either do not exist or are overwhelmed. **Findings:** R&D drivers at the instant of disaster include: creating ad hoc organizations, quickly assembling sensor and communication networks, immediately putting in place reliable planning and execution processes, creating resource and personnel pools that integrate contributions from different agencies, organizations and communities, across sectors and jurisdictions, and transparently integrating information from multiple sources in a secure manner that allows data to be authenticated and validated. Research is needed in several areas: 1. Infrastructure and Its Protection (Monitoring technologies, transportation infrastructure, infrastructure performance and response outcomes) 2. Risk Analysis (taxonomy, decision-theoretic data analysis, cascading causal mechanisms, decentralized decision-making) 3. Organizational Response, Support and Integration (formation, structure, operation, multi-agent collaboration, distributed resource allocation, pedagogical agents) 4. Information Management (collection, fusion and validation, presentation, access, exploitation, tailoring, metadata representation) 5. Communication Resilience (sensor networks, rule-based systems security, communications infrastructure to support emergency response, grid technologies, heterogeneous and ad hoc wireless infrastructure) **Availability:** http://www.isi.edu/crue
Cybersecurity Today and Tomorrow: Pay Now or Pay Later	**Scope:** The Computer Science and Telecommunications Board (CSTB) of the National Research Council (NRC) has examined various dimensions of computer and network security and vulnerability in several prior reports. This brief report revisited those in the wake of terrorism events of September 11, 2001. The reports examined were: (1) *Computers at Risk*, 1991;[1] (2) *Cryptography's Role in Securing the Information Society*, 1996;[2] (3) *For the Record: Protecting Electronic Health Information*, 1997;[3] and (4) *Trust in Cyberspace*, 1999,[4] (5) *Continued Review of the Tax Systems Modernization of the Internal Revenue Service*, 1996;[5] (6) *Realizing the Potential of C4I*, 1999;[6] and (7) *Embedded, Everywhere*, 2001[7]. **Findings:** The unfortunate reality is that relative to the magnitude of the threat, our ability and willingness to deal with threats have, on balance, changed for the worse, making many of the analyses, findings, and recommendations of these reports all the more relevant, timely, and applicable today. This document presents the enduring findings and recommendations from that body of work. **Recommendations:** The report recommends that government should provide adequate support for research and development on information systems security. Research and development on information systems security should be construed broadly to include R&D on defensive technology (including both underlying technologies and architectural issues), organizational and sociological dimensions of such security, forensic and recovery tools, and best policies and practices. Given the failure of the market to address security challenges adequately, government support for such research is especially important. **Availability:** http://www.nap.edu/catalog/10274.html

Embedded Everywhere: A Research Agenda for Networked Systems of Embedded Computers, Computer Science and Telecommunications Board, National Research Council 236 pages, 2001.	**Scope:** A growing number of physical devices contain embedded computing and communications capabilities – e.g., aircraft, cars, telephones, and health monitoring devices. Networks comprising thousands or millions of such devices are expected to monitor and control complex domains such as battlefields, factories, warehouses, and environmental settings. Technology challenges arising from these developments include, power management, security, autonomous operation, self-organization, and performance requirements. To improve understanding of these issues and help guide future research endeavors, the Defense Advanced Research Projects Agency (DARPA) and the National Institute of Standards and Technology (NIST) asked the Computer Science and Telecommunications Board (CSTB) of the National Research Council (NRC) to conduct a study of networked systems of embedded computers (EmNets) that would examine the kinds of systems that might be developed and deployed in the future and identify areas in need of greater investigation. **Findings:** The Defense Advanced Research Projects Agency (DARPA), the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and other federal agencies all have significant roles to play in the development of robust EmNets and EmNet-related research. **Recommendations:** Recommendations specific to NSF were o to continue to expand mechanisms for encouraging systems-oriented multi-investigator, collaborative, multidisciplinary research on EmNets. NSF can facilitate collaborative multidisciplinary research both through the programs it supports and through the use of a flexible process that encourages the incorporation of perspectives from a broad range of disciplines. o to develop programs that support graduate and undergraduate multi-disciplinary educational programs. NSF could take the lead in tackling institutional barriers to interdisciplinary and broad systems-based work. NSF has a history of encouraging interdisciplinary programs and could provide venues for such work to be explored as well as foster and fund joint graduate programs or joint curriculum endeavors. **Availability:** http://www.nap.edu/catalog/10193.html

New Visions for Software Design and Productivity: Research & Applications; Report on a workshop of the Interagency Working Group for Information Technology Research and Development (ITRD) Software Design and Productivity (SDP) Coordinating Group, Vanderbilt University, Nashville, TN, December 13 - 14, 2001.	**Scope:** The workshop provided a forum for scientists, engineers, and users to identify revolutionary thinking about software development techniques that could dramatically increase software productivity without compromising software quality. Workshop participants included 64 invited researchers from industry and academia and 14 government researchers. The goals of the workshop were to: • Bring together leading-edge researchers and practitioners • Encourage brainstorming and out-of-box thinking • Inform the Federal research agenda • Involve Federal agencies and research community The SDP workshop included panel discussions, breakout sessions, and plenary discussions. The panels and breakout sessions addressed the following four issues central to software design and productivity: 1. The Future of Software and Software Research 2. New Software Development Paradigms 3. Software for the Real World 4. Software for Large-scale Network-Centric Systems **Findings:** The reports major recommendation is: "If we want to maintain and increase the economic advantages of our IT prominence, we must increase our investment in understanding the relationship between emerging new application domains and IT technologies. More importantly, we must, aggressively seek out new methods and tools to explore emerging opportunities and extend our strategic advantage. End-user industry has neither the expertise nor the resources to make these changes themselves, and the dominant software industry may not have the resources or the interest in changing the status quo. Expanded government investment in IT is vital to accelerate this process. We believe that creating and maintaining a vibrant, active IT research community in the US is vital to our long-term economic and national security interests." **Availability:** http://www.isis.vanderbilt.edu/sdp/SDP_Wrkshp2-draft-7-26-02.d.pdf . Workshop Website is: http://www.itrd.gov/iwg/pca/sdp/sdp-workshop/vanderbilt/

IDs – Not That Easy; Computer Science and Telecommunications Board, National Academy of Sciences (NAS)	**Scope:** This report assessed emerging approaches to user authentication in computing and communications systems with specific focus on implications for privacy. Although the study was begun in early 2001, the events of 9/11 prompted several proposals for national identity systems. This study group provided an interim report to raise awareness of the questions being addressed; it focused on a broad set of policy, procedural and technological issues. **Findings:** Policy questions that should be considered when developing identity systems include: identifying the purpose of the system, the scope of the population, and the scope of the data; determining who the users of the system will be (government, corporations, etc.); determining what the allowable uses of the system are, determining whether participation is mandatory or voluntary and whether participants know they are participating, and establishing legal structures to protect the integrity, privacy, and due process and enforce liabilities for misuse of the system. **Availability:** http://www.nap.edu
Broadband: Bringing Home the Bits; Computer Science and Telecommunications Board, NAS	**Scope:** The report examined the technologies, economics, policies and strategies associated with the broadband challenge: providing high-speed connectivity to end users in homes, businesses and other settings; it offered recommendations for fostering broadband deployment and use. **Findings:** There are two issues central to deployment: local access performance to support innovative applications is needed, and services and applications to justify investment. The Telecommunications Act of 1996 is central to current policy; the report concludes that present policy is "unsuited in several respects to the new era of broadband services." **Recommendations**: The report makes several recommendations that are summarized here. o Government should prioritize widespread deployment and defer new regulation in the early stages. Government should enhance monitoring of deployment, investment, use patterns and market outcomes to provide a firmer foundation for future action. o Regulation should be structured to emphasize facilities-based competition and encourage new entrants. Unbundling of services is not the preferred strategy, but when used should be at higher service levels. o Governments, including local levels, should take active steps to promote deployment and facilities based competition. o Research and experimentation should be supported that would foster the emergence of new competitors, increase understanding of economic, social, and regulatory factors, and spur the development of new content and applications. **Availability:** http://www.nap.edu

NSF CISE Grand Challenges in e-Science Workshop Report; January 2002	**Scope:** This report addresses network requirements to support e-science, or large-scale science that studies very complex micro to macro-scale problems over time and space. Support for e-science networks is part of the overall Cyber-infrastructure vision to support IT enabled opportunities in science and engineering. **Findings:** Current production networks (Internet2's Abilene, WorldCom's vBNS+, and the FedNets such as Esnet) do not provide known and knowable characteristics that are needed by e-science. Research networks are not designed to be reliable or persistent. Experimental networks that are robust enough to support application-dictated development of middleware, software toolkits, etc., are needed to bridge the gap between research and production networks. International Experimental networks are needed. **Recommendations:** NSF should develop and experimental networking program to promote cyber-infrastructure; these projects should be at least 5 years in duration and be multi-disciplinary. **Availability:** http://www.evl.uic.edu/activity/NSF/index.html
NSF Advanced Networking Infrastructure and Research (ANIR) Workshop on Experimental Infostructure Networks	**Scope:** This meeting brought together industry, government and academic leaders to seek recommendations for advanced research and education networks; specifically for Experimental Networks as differentiated from Research or Production Networks. **Findings:** The workshop concluded that an application focus for Experimental Networks is of utmost importance to address vertical integration (from network to middleware to application to user interface) over multiple application requirements. Industry looks to NSF for its essential role in supporting high-risk research and providing validation of new concepts. Industry should participate in the research; this research leads to new market opportunities that are too high risk for industry or venture capitalists to undertake. **Recommendations:** NSF should establish an experimental network program to support 5-7 projects at a total annual investment of $10M per year. Multi-institutional and company awards were recommended. The program should fund delivered end-to-end connection of all resources needed **Availability:** http://www.calit2.net/events/2002/nsf/index.html

	Directorate for Education and Human Resources (EHR)
State Systemic Initiatives (SSI) Impact Study	**Scope:** An impact study of systemic reform efforts in three SSIs (Louisiana, Montana and Colorado) and one non-SSI state (Illinois) **Findings:** The theoretical model as conceived by the study team was insufficient for explaining the relationships among school characteristics and student achievement. However, the most important results of the study were that schools with high contact with SSIs were more likely to have conditions supportive of standards based approaches to science and mathematics than matched schools with little SSI contact. Schools with high contact with SSIs were more likely to have conditions supportive of standards based approaches to science and mathematics than matched schools in a comparison state. There appeared to be more differences between high and low SSI contact schools in the use of standards based instructional practices for science classes than mathematics classes. The study also concluded that schools were able to reform parts of the systems but coordinating and affecting all aspects of the reform system is extremely challenging. **Availability:** Available from EHR Directorate, NSF
Raising Standards and Achievement in Urban Schools: Case Stories from CPMSAs in Hamilton County/ Chattanooga and Newport News Public Schools	**Scope:** An evaluative study of 6 Comprehensive Partnerships for Mathematics and Science Achievement (CPMSA) funded between 1993 and 1994. **Findings:** The CPMSAs funded in 1993 and 1994 have demonstrated success in improving the mathematics and science educational infrastructure and student outcomes in medium sized cities. Average high school student enrollment in gate-keeping and higher-level mathematics courses increased over 41%, and average science enrollments increased 33%. By 1997-98, the 8th grade enrollment rates in Algebra I or higher were equal to or higher than the national average. The report also highlighted the achievements of two CPMSA sites: Hamilton County/Chattanooga, TN and Newport News, VA. Hamilton County/Chattanooga CPMSA focused on the implementation of new mathematics and science curricula, partnerships with universities and science-based institutions, and policy changes. Policy changes included the elimination of student tracking and basic-level mathematics and science courses, the adoption of a common core of requirements for high school graduation, and the requirement that all teachers participate in professional development. Newport News Public Schools created its standards-based mathematics and science curricula; instruction and assessment were then aligned to the new curricula. Strengthened professional development programs, convergence of resources, and partnerships were also focus of the program. Participation disparities and achievement gaps between African American and white students received particular emphasis with the creation of several student support programs. **Availability:** Available from EHR Directorate, NSF and the full report can be downloaded at www.systemic.com/CPMSA and www.sistudyforum.org

	Directorate for Engineering (ENG)
The World Technology Evaluation Center (WTEC) Worldwide Study on Tissue Engineering Research	**Scope:** This report is a comparative review of tissue engineering research and development activities in the United States, Japan, and Western Europe conducted by a panel of leading U.S. experts in the field. It covers biomaterials, cells, biomolecules, non-medical applications, engineering design, informatics, and legal and regulatory issues associated with tissue engineering research and applications. **Findings:** The panel's conclusions are based on a literature review, a U.S. review workshop held at NIH in June of 2000, and a series of site visits to leading tissue engineering research centers in Japan and Western Europe. A summary of the June 2000 workshop is included as an appendix, as are site reports from each of the panel's overseas visits. Key recommendation: Establish an interagency tissue engineering (TE) competition, with emphasis on biological aspects of TE. Implementation of this recommendation is under consideration by the Multi-Agency Tissue Engineering Science Working Group. An executive summary is included conveying the panel's overall conclusions. **Availability:** The complete report is available on the web at http://www.wtec.org/loyola/te/final/te_final.pdf
The World Technology Evaluation Center (WTEC) Molecular Modeling Study	**Scope:** This report reviews the development and applications of molecular and materials modeling in Europe and Japan in comparison to those in the United States. Topics covered include computational quantum chemistry, molecular simulations by molecular dynamics and Monte Carlo methods, mesoscale modeling of material domains, molecular-structure/macroscale property correlations like Organism/Chemical Structure/Bioactivity Relationships (QSAR) and Quantitative Structure Activity Relationships (QSPR), and related information technologies like informatics and special-purpose molecular-modeling computers. **Findings:** The United States leads this field in many scientific areas. However, Canada has particular strengths in density functional theory (DFT) methods and homogeneous catalysis; Europe in heterogeneous catalysis, mesoscale, and materials modeling; and Japan in materials modeling and special-purpose computing. Major government-industry initiatives are underway in Europe and Japan, notably in multi-scale materials modeling and in development of chemistry-capable *ab-initio* molecular dynamics codes. In European and U.S. assessments of nanotechnology, it was also concluded that to advance the field most quickly—and competitively—the need is acute for applying new and existing methods of molecularly based modeling. Additional findings are outlined in the panel's executive summary. **Availability:** The complete report is available on the web at http://www.wtech.org/loyola/molmodel/mm_final.pdf

	Directorate for Geosciences (GEO)
Abrupt Climate Change: Inevitable Surprises	**Scope:** Undertake a comprehensive review of the science and potential impacts of abrupt climate change. **Findings:** Abrupt Climate Change: Inevitable Surprises looks at the current scientific evidence and theoretical understanding to describe what is currently known about abrupt climate change, including patterns and magnitudes, mechanisms, and probability of occurrence. It identifies critical knowledge gaps concerning the potential for future abrupt changes, including those aspects of change most important to society and economies, and outlines a research strategy to close those gaps. Based on the best and most current research available, this book surveys the history of climate change and makes a series of specific recommendations for the future. **Availability:** National Academy of Sciences www.nas.edu
An Integrated and Sustained Ocean Observing System for the United States	**Scope:** To examine the scientific significance, technical feasibility, and potential societal benefits of the ISP. **Findings:** This report summarizes (1) the rationale for an Integrated Ocean Observing System (The Problem), (2) the conceptual design of the System (Solving the Problem), (3) economic benefits of an integrated system, (4) first steps for implementation, and (5) the high priority actions and associated funding levels that should be implemented now. Based on established priorities and the cost-effectiveness of a systematic and step-wise approach to implementation, the following actions should be taken: • Accelerate the implementation of the U.S. commitment to the global ocean observing system for global climate change. • Initiate a Data Communications and Management system for the Integrated and Sustained Ocean Observing System (IOOS). • Enhance/expand existing Federal Elements (buoys, water level sites, etc.). • Initiate Regional Observing Systems as Proof of Concept trials. **Availability:** http://www.ocean.us.net/projects/papers/post/FINAL-ImpPlan-NORLC.pdf
The North American Carbon Program Plan (NACP): A Report of the Committee of the U.S. Carbon Cycle Science Steering Group	**Scope:** To develop A plan for carbon cycle research focused on measuring and understanding sources and sinks of carbon dioxide (CO_2), methane (CH_4), and carbon monoxide (CO) in North America and adjacent oceans. **Findings:** The plan outlines how to implement a principal recommendation of the U.S. Carbon Cycle Science Plan (1999). It was developed as a component of the U.S. Interagency Carbon Cycle Science Program and as a contribution to U.S. climate change research planning. **Availability:** University Consortium for Atmospheric Research http://www.esig.ucar.edu/nacp/index.html

	Directorate for Mathematical and Physical Sciences (MPS)
Nanotechnology – Tools and Instrumentation for Research and Manufacturing	**Scope:** The 4th joint NSF-European Community (EC) workshop on nanotechnology was held in Grenoble, France on 12-13 June 2002. The workshop was organized within the framework of cooperation between NSF and the European Commission in materials sciences and nanotechnology. Its aim was to foster international collaboration in research and education by identifying future cooperative activities and joint actions in the area of tools and instrumentation for nanoscale research and manufacturing. **Findings:** The workshop identified challenges and applications for instrumentation with potential for enabling breakthroughs in research and manufacturing related to nanotechnology. The necessary innovation will require increased effort from the private sector to complement the public effort. **Availability:** Office for Official Publications of the European Communities, L-2985 Luxembourg, and NSF Division of Materials Research web page, http://www.nsf.gov/mps/divisions/dmr/ (under Research Highlights).
Nanotechnology – Revolutionary Opportunities and Societal Implications	**Scope:** The 3rd joint NSF-EC workshop on Nanotechnology was held in Lecce, Italy on 31 January-1 February 2002. The workshop was organized within the framework of cooperation between NSF and the European Commission in materials sciences and nanotechnology. Workshop participants from the USA and Europe addressed the technical, educational and ethical implications of nanotechnology for both European and American society. **Findings:** The EC and US nanotechnology communities face common technical, educational and societal challenges that would benefit from increased collaborations. Specific recommendations are summarized in the Report. **Availability:** Office for Official Publications of the European Communities, L-2985 Luxembourg; and Division of Materials Research web page, http://www.nsf.gov/mps/divisions/dmr/ (under Research Highlights).
Proceedings of the Workshop on the Present Status and Future Developments of Solid State Chemistry and Materials	**Scope:** Define research opportunities in the field of solid-state chemistry and materials; identify the most important multidisciplinary areas for involvement by the solid-state chemistry and materials community; determine novel roles for the Solid State Chemistry and Materials community that will advance educational and training opportunities for future scientists, engineers, and technicians; develop new approaches that allow for the more effective and efficient conduct of research and educational activities. **Findings:** Numerous recommendations are listed for various sub-fields in this discipline. **Availability:** NSF web site http://www.nsf.gov/mps/dmr/ssc.pdf

Statistics: Challenges and opportunities for the 21st Century	**Scope:** On May 6-8, 2002 a workshop was held at the NSF to identify the future challenges and opportunities for the statistics profession. The report that will be available in the early part of 2003 identifies major opportunities and challenges for the field of Statistics and formulates recommendations. The organizing committee of the workshop that is responsible in producing this report decided that the entire domain of statistics should be covered, both as a core science and in its scientific application areas, except for the health sciences, which is a very large and thriving specialty deserving of its own report. The report, in addition to discussing scientific opportunities and the challenges associated with those, discusses the role of education and training in statistics. **Findings:** Three high-priority opportunities are identified; analysis of massive data sets, modeling complex systems and understanding uncertainty. An in- depth discussion of each of these areas is provided in the report. Four major challenges were also identified; challenge of recognition, challenge of multidisciplinary activity, challenges in core research areas, and challenges in education and training. Five recommendations are made and discussed in the report: promote recognition of the unique identity of statistics, strengthen the core research areas; strengthen multidisciplinary research activities; develop new models for statistical education and accelerate the recruitment of the next generation of statisticians. **Availability:** At this point the report is 80% complete. The goal of the scientific committee of the report is to deliver the final report in early April of 2003. A preliminary version of the report will be put on http://www.stat.psu.edu for commentary by the Statistics profession early January of 2003.
Algebra, Number Theory, Combinatorics (ANTC) Workshop in Computation	**Scope:** The workshop was planned to bring together members of the ANTC community with extensive computing expertise to discuss future ways in which the community needs computing support. The participants are preparing a report, under the guidance of Brian Conrey, director of the American Institute of Mathematics (AIM). The report, due in November, will identify needs and opportunities of the ANTC community with respect to computing. **Findings:** Numerous recommendations and observations will appear in the report. **Availability:** To appear at the American Institute of Mathematics website http://www.aimath.org

Current and Emerging Research Opportunities in Probability	**Scope:** The report identifies the strengths of the discipline, both internally and in its applications. It describes some of the exciting areas of current research. While it does not quantify the needs of the community, it does demonstrate the need for a larger community trained in probability and probabilistic reasoning. It further points to the responsibilities of the funding agencies, the academic institutions, and the community itself, to meet the growing demands for the discipline. **Findings:** Probability is both a fundamental way of viewing the world, and a core mathematical discipline, alongside geometry, algebra, and analysis. In recent years, the evident power and utility of probabilistic reasoning as a distinctive method of scientific inquiry has led to an explosive growth in the importance of probability theory in scientific research. Central to statistics and commonplace in physics, genetics, and information theory for many decades, the probabilistic approach to science has more recently become indispensable in many other disciplines, including finance, geosciences, neuroscience, artificial intelligence and communication networks. **Availability:** The report is available at http://www.math.cornell.edu/~durrett/probrep/probrep.html
Making Sense of Complexity: Summary of the Workshop on Dynamical Modeling of Complex Biomedical Systems	**Scope:** This report documents the workshop "Dynamical Modeling of Complex Biomedical Systems" sponsored by the Board on Mathematical Sciences and Their Applications and the Board on Life Sciences of the National Research Council, April 26-28, 2001. The topics were chosen to provide a sampling of the rapidly emerging research at the interface of mathematical and biomedical sciences. Mathematicians, biomedical scientists, and statisticians discussed modeling aspects of cellular function, disease states, and neuroscience. **Findings:** When biomedical processes are modeled with mathematical and statistical concepts, the underlying structure of the biological processes can become clearer. Knowledge of that structure, and of the way its mathematical representation respond to change, allows one to formulate hypotheses that might not be apparent from the phenomenological descriptions. **Availability:** http://www7.nationalacademies.org/bms/BMSA_Publications.html

Report of the DOE/NSF High Energy Physics Advisory Panel (HEPAP) Subpanel on Long Range Planning for U.S. High-Energy Physics	**Scope:** The report develops a roadmap for the twenty-year future of U.S. elementary particle (high-energy) physics. The roadmap provides and overview of the field and an outline of the steps to reach the scientific goals. It is built on fully exploiting the investment in the Large Hadron Collider and the ongoing program. It recognizes that the field needs a balanced approach including forefront accelerators at the energy and luminosity frontiers, experiments in space, underground, and away from accelerators, and a strong university program. The roadmap will need to be periodically updated. **Findings:** The five recommendations are: that the U.S. take steps to remain a world leader in particle physics; a twenty-year roadmap for the field and a new mechanism to update the roadmap and set priorities across the program; that the highest priority be a high-energy, high-luminosity, electron-positron linear collider, wherever it is built in the world, and that the U.S. take a leadership position in forming the international collaboration needed to design, build, and operate such a machine; that the U.S. prepare to bid to host the linear collider as an international facility; and a vigorous long-term accelerator R&D effort within the program. **Availability:** http://doe-hep.hep.net/lrp_panel/
Opportunities in Nuclear Science: A Long-Range Plan for the Next Decade	**Scope:** The DOE/NSF Nuclear Science Advisory Committee has developed a long-range plan that provides a framework for the coordinated advancement of the field of nuclear science in the U.S. The plan includes descriptions of recent progress across the field, highlighting the discovery of neutrino oscillations. It makes recommendations that address funding issues facing the present nuclear science program and guide new investments for th future. **Findings:** The four recommendations are: increased funding for research and facility operations to exploit the opportunities for scientific discoveries made possible by recent U.S. investments; the Rare Isotope Accelerator as highest priority for major new construction; immediate construction of the world's deepest underground science laboratory; and an upgrade of the Continuous Electron Beam Accelerator Facility (CEBAF) at the Jefferson Laboratory to 12 GeV as soon as possible. **Availability:** http://www.sc.doe.gov/production/henp/np/nsac/LRP_5547_FINAL.pdf

Connecting Quarks with the Cosmos: Eleven Science Questions for the New Century	**Scope:** This report from the National Research Council's "Committee on the Physics of the Universe" was commissioned jointly by NASA, NSF, and DOE, in recognition of the deep connections that exist between quarks and the cosmos. It identifies eleven science questions that focus on the interface between physics and astrophysics, connecting physics at the most microscopic scales to the properties of the universe and its contents on the largest physical scales. Further, it recommends research and research coordination needed to address the 11 science questions. **Findings:** The report recommends that NASA, NSF, and DOE work together to carry out an extensive program of experiments, including: measure polarization of the cosmic microwave background; determine properties of the dark matter; determine the neutrino masses, the constituents of dark matter, and the lifetime of the proton; use space to probe the basic laws of physics; determine the origin of the highest energy gamma rays, neutrinos, and cosmic rays; discern physical principles of extreme astrophysical environments through laboratory study of high-energy-density physics; and realize the scientific opportunities at the intersection of physics and astronomy. **Availability:** Prepublication copy is available at http://www7.nationalacademies.org/bpa/BPA_Reports.html
Computation as a Tool for Discovery in Physics	**Scope:** This report is the output of a workshop held at NSF to survey opportunities and challenges in computational physics, broadly construed. Presentations covered the state of the art of computation and opportunities and barriers to progress in various research fields with differing maturities in the use of computation. The workshop demonstrated a broad commonality of interests and needs across the spectrum of disciplines represented. **Findings:** The central finding of the committee is that NSF should create a new program in computational physics, which could serve as an exemplar of similar programs in other parts of NSF. They also recognized an urgent need for training the next generation of computational scientists and for integrating computational science into the standard curriculum in physics. The new program should increase attention to software development and pay particular attention to the mid-range hardware needs of university groups. **Availability:** NSF web site http://www.nsf.gov/pubs/2002/nsf02176/nsf02176_1.pdf
Atoms, Molecules, and Light: AMO Science Enabling the Future	**Scope:** This brochure from the National Research Council highlights selected forefront areas of atomic, molecular, and optical (AMO) science and identifies connections between AMO science and other scientific fields, emerging technologies, and national needs. **Findings:** The report is aimed at a broad audience and gives numerous, illustrated examples of AMO science impacting the economy, improving health, protecting the environment, enhancing national defense, and expanding the frontiers of AMO science. **Availability:** http://www.nap.edu/catalog/10516.html

	Directorate for Social, Behavioral and Economic Sciences
Risk Management and Decision Science Workshop	**Scope:** To assess the state of the science and to identify needs and opportunities for integrated research in risk analysis and decision science in a democratic society. **Findings:** This workshop's broad conclusion was that in an age of growing uncertainty and emerging risks, society requires new knowledge and tools to assess and manage risk. Specific findings were: (1) Scientists working in numerous disciplines have significantly advanced our capacity for risk analysis and decision making during recent decades; (2) Unnecessary divisions between risk analysts, decision scientists, and hazards researchers as well as more traditional disciplinary divisions have impeded scientific progress; (3) Advancing the basic science of risk analysis and decision making and increasing its practical utility requires a new focus on interdisciplinary and multidisciplinary research, including engineering, information sciences, natural sciences, and social sciences; and, (4) An NSF initiative can build upon a firm foundation by facilitating interdisciplinary and multidisciplinary research that will make significant advances in risk management-with a special emphasis on the distinctive challenges associated with managing risk in a democratic society. The workshop's unanimous conclusion was that the time is ripe for an initiative that will advance the risk and decision sciences so as to provide the knowledge and tools needed to reduce societal vulnerabilities, save lives, avoid societal disruptions, and reduce psychological and economic losses from extreme events and other threats.

APPENDIX II. – SCHEDULE OF PROGRAM EVALUATIONS

The following table provides information on the scheduling of meetings for Committees of Visitors (COVs) for our programs. The table lists the fiscal year of the most recent COV meeting for the program and the fiscal year for the next COV review of the program. We have highlighted the COV meetings that were held in FY 2002 in bold font.

Committee of Visitors Meetings
By Directorate

(COV meetings held during FY 2002 are highlighted in bold font)

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
BIOLOGICAL SCIENCES		
Biological Infrastructure	2000	2004
Instrument Related Activities	**2002**	2005
Research Resources	2000	2003
Training	2000	2003
Plant Genome	2001	2004
Environmental Biology	1999	2003
Ecological Studies	**2002**	2005
Thematic Review	2001	2005
Systematic and Population Biology	2000	2004
Integrative Biology and Neuroscience	2001	2005
Neuroscience	1999	2003
Developmental Mechanisms	2000	2004
Physiology and Ethnology	**2002**	2005
Molecular and Cellular Biosciences	**2002**	2005
Biomolecular Structure and Function	2000	2004
Biomolecular Processes	2000	2004
Cell Biology	2001	2005
Genetics	1999	2003

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
COMPUTER AND INFORMATION SCIENCE AND ENGINEERING		
Advanced Computational Infrastructure and Research		
Advanced Computational Research	2001	2004
PACI	**2002**	2004
Computer-Communications Research		
Communications	2000	2003
Computer Systems Architecture	2000	2003
Design Automation	2000	2003
Hybrid and Embedded Systems (new in ’02)	N/A	2006
Numeric, Symbolic and Geometric Computation	2000	2003
Operating Systems and Compilers	2000	2003
Signal Processing Systems	2000	2003
Software Engineering and Languages	2000	2003
Theory of Computing	2000	2003
Trusted Computing (new in ’02)	N/A	2006
Information and Intelligent Systems		
Computation and Social Systems	1999	2003
Human Computer Interaction	1999	2003
Knowledge and Cognitive Systems	1999	2003
Robotics and Human Augmentation	1999	2003
Information and Data Management	1999	2003
Advanced Networking Infrastructure and Research		
Networking Research	2000	2003
Special Projects in Networking Research	2000	2003
Advanced Networking Infrastructure	2000	2003
Information Technology Research (ITR) (new in ’00)	N/A	2003
Experimental and Integrative Activities	2001	2004
-Instrumentation Infrastructure Cluster		
Research Infrastructure	2001	2004
Research Resources (new in ‘02)	N/A	2004
-Multidisciplinary Research Cluster		
Biological Information Technology and Systems (new in ’02)	N/A	2004
Quantum and Biologically Inspired Computing (new in ’02)	N/A	2004
Digital Government	2001	2004
Next Generation Software	2001	2004
-Education Workforce Cluster		
Information Technology Workforce (new in ’02)	N/A	2004
Minority Institutions Infrastructure	2001	2004
CISE Educational Innovation	2001	2004
**CISE Postdoctoral Research Associates	2001	

-EIA Special Projects Cluster		
Special Projects (new in '02)	N/A	2004
**NSF-CONACyT Collaborative Research	2001	
**NSF-CNPq Collaborative Research	2001	
**EIA monitored, managed/reviewed by Division in Partnership with Engineering		

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
EDUCATION AND HUMAN RESOURCES		
Educational Systemic Reform		
Statewide Systemic Initiatives	2001	2004
Urban Systemic Initiatives	2001	2004
Rural Systemic Initiatives	2001	2004
Office of Innovation Partnerships		
Innovation Partnership Activities (new in '01)	N/A	2004
EPSCoR	2000	2005
Elementary, Secondary and Informal Education		
Informal Science Education	2001	2005
Teacher Enhancement	2000	2003
Instructional Materials Development	**2002**	2005
Centers for Learning and Teaching (new in '01)	N/A	2004
Undergraduate Education		
Teacher Preparation	2000	2003
Advanced Technological Education	2000	2003
NSF Computer, Science, Engineering and Mathematics Scholarships (new in '01)	N/A	2003
Distinguished Teaching Scholars (new in '02)	N/A	2004
Scholarship for Service (new in '01)	N/A	2005
National SMETE Digital Library (new in '01)	**2002**	2005
Course, Curriculum, and Laboratory Improvement	2000	2003
Undergraduate Assessment (new in '02)	N/A	2004
The STEM Talent Expansion Program (STEP)	N/A	2005
Graduate Education		
Graduate Research Fellowships	1999	2003
NATO Postdoctorate Fellowships	2001	2004
IGERT (new in '97)	**2002**	2005
GK-12 Fellows (new in '99)	**2002**	2005
Human Resource Development		
The Louis Stokes Alliances for Minority Participation	2001	2005
Centers for Research Excellence In Science and Technology (CREST)	2001	2005
Programs for Gender Equity (PGE)	2000	2003
Programs for Persons with Disabilities (PPD)	2000	2003
Alliances for Graduate Education and the Professoriate (AGEP)	2001	2005
Tribal Colleges Program (TCP) (new in '01)	N/A	2005
Historically Black Colleges and Universities (HBCU)	2001	2005

Research, Evaluation & Communications		
REPP/ROLE (new in '96)	**2002**	2005
Evaluation	2000	2003
Interagency Education Research Initiative (IERI) (new in '01)	**2002**	2005
Other		
H-IB VISA K-12	N/A	2004
Math and Science Partnership (MSP) (new in '02)	N/A	2005

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
ENGINEERING		
Bioengineering and Environmental Systems	**2002**	2005
Biochemical Engineering	**2002**	2005
Biotechnology	**2002**	2005
Biomedical Engineering	**2002**	2005
Research to Aid the Disabled	**2002**	2005
Environmental Engineering	**2002**	2005
Environmental Technology	**2002**	2005
Civil and Mechanical Systems	2001	2004
Dynamic System Modeling, Sensing and Control	2001	2004
Geotechnical and GeoHazard Systems	2001	2004
Infrastructure and Information Systems	2001	2004
Solid Mechanics and Materials Engineering	2001	2004
Structural Systems and Engineering	2001	2004
Network for Earthquake Engineering Simulation	2001	2004
Chemical and Transport Systems		2003
Chemical Reaction Processes	2000	2003
Interfacial, Transport and Separation Processes	2000	2003
Fluid and Particle Processes	2000	2003
Thermal Systems	2000	2003
Design, Manufacture and Industrial Innovation		
-Engineering Decision Systems Programs (new in '02)	N/A	2003
Engineering Design	2000	2003
Manufacturing Enterprise Systems (new in '02)	N/A	2003
Service Enterprise Systems (new in '02)	N/A	2003
Operations Research	2000	2003
-Manufacturing Processes and Equipment Systems	2000	2003
Materials Processing and Manufacturing	2000	2003
Manufacturing Machines and Equipment	2000	2003
Nanomanufacturing (new in '02)	N/A	2003

-Industrial Innovation Programs Cluster		
Small Business Innovation Research (SBIR)	2001	2004
Innovation and Organizational Change	2000	
Grant Opportunities for Academic Liaison with Industry	2000	2003
Small Business Technology Transfer	2001	2004
Electrical and Communications Systems		
Electronics, Photonics and Device Technologies	**2002**	2005
Control, Networks, and Computational Intelligence	**2002**	2005
Integrative Systems (new in '02)	**2002**	2005
Engineering, Education and Centers	2001	2004
Engineering Education	2001	2004
Engineering Research Centers	2001	2004
Earthquake Engineering Research Centers	2001	2004
Human Resource Development	2001	2004
State/Industry/University Cooperative Research Centers	2001	2004
Industry/Univ. Cooperative Research Centers	2001	2004

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
GEOSCIENCES		
Atmospheric Sciences		
-Lower Atmosphere Research Section		
Atmospheric Chemistry	2001	2004
Climate Dynamics	2001	2004
Mesoscale Dynamic Meteorology	2001	2004
Large-scale Dynamic Meteorology	2001	2004
Physical Meteorology	2001	2004
Paleoclimate	2001	2004
-Upper Atmosphere Research Section		
Magnetospheric Physics	**2002**	2005
Aeronomy	**2002**	2005
Upper Atmospheric Research Facilities	**2002**	2005
Solar Terrestrial Research	**2002**	2005
-UCAR and Lower Atmospheric Facilities Oversight Section		
Lower Atmospheric Observing Facilities	2000	2003
UNIDATA	2000	2003
NCAR/UCAR	2000	2003
Earth Sciences		
Instrumentation and Facilities	2001	2004
-Research Support		
Tectonics	**2002**	2005
Geology and Paleontology	**2002**	2005
Hydrological Sciences	**2002**	2005
Petrology and Geochemistry	**2002**	2005
Geophysics	**2002**	2005

Continental Dynamics	**2002**	2005
Ocean Sciences		
-Integrative Programs Section		
Oceanographic Technical Services	**2002**	2005
Ship Operations	**2002**	2005
Oceanographic Instrumentation	**2002**	2005
Ship Acquisitions and Upgrades (new in '02)	**2002**	2005
Shipboard Scientific Support Equipment (new in '02)	**2002**	2005
Oceanographic Tech and Interdisciplinary Coordination	1998	2003
-Marine Geosciences Section		
Marine Geology and Geophysics	1998	2003
Ocean Drilling	1994	2003
-Ocean Section		
Chemical Oceanography	1998	2003
Physical Oceanography	1998	2003
Biological Oceanography	1998	2003

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
MATHEMATICAL AND PHYSICAL SCIENCES		
Astronomical Sciences	**2002**	2005
Planetary Astronomy	**2002**	2005
Stellar Astronomy and Astrophysics	**2002**	2005
Galactic Astronomy	**2002**	2005
Education, Human Resources and Special Programs	**2002**	2005
Advanced Technologies and Instrumentation	**2002**	2005
Electromagnetic Spectrum Management	**2002**	2005
Extragalactic Astronomy and Cosmology	**2002**	2005
-Facilities Cluster		
Gemini 8-Meter Telescopes	**2002**	2005
National Radio Astronomy Observatory (NRAO)	**2002**	2005
National Optical Astronomy Observatories (NOAO)	**2002**	2005
National Astronomy and Ionosphere Center (NAIC)	**2002**	2005
Chemistry	2001	2004
Office of Special Projects	2001	2004
Chemistry Research Instrumentation and Facilities (CRIF)	2001	2004
Organic Chemical Dynamics	2001	2004
Organic Synthesis	2001	2004
Chemistry of Materials	2001	2004
Theoretical and Computational Chemistry	2001	2004
Experimental Physical Chemistry	2001	2004
Inorganic, Bioinorganic and Organometallic Chemistry	2001	2004
Analytical and Surface Chemistry	2001	2004

Materials Research	**2002**	2005
-Base Science Cluster		
Condensed Matter Physics	**2002**	2005
Solid-State Chemistry	**2002**	2005
Polymers	**2002**	2005
-Advanced Materials and Processing Cluster		
Metals	**2002**	2005
Ceramics	**2002**	2005
Electronic Materials	**2002**	2005
-Materials Research and Technology Enabling Cluster		
Materials Theory	**2002**	2005
Instrumentation for Materials Research	**2002**	2005
National Facilities	**2002**	2005
Materials Research Science and Engineering Centers	**2002**	2005
Mathematical Sciences	2001	2004
Applied Mathematics	2001	2004
Topology and Foundations	2001	2004
Computational Mathematics	2001	2004
Infrastructure	2001	2004
Geometric Analysis	2001	2004
Analysis	2001	2004
Algebra, Number Theory, and Combinatorics	2001	2004
Statistics and Probability	2001	2004
Physics	2000	
Atomic, Molecular, Optical and Plasma Physics	2000	2003
Elementary Particle Physics	2000	2003
Theoretical Physics	2000	2003
Particle and Nuclear Astrophysics (new in ’00)	N/A	2003
Nuclear Physics	2000	2003
Education and Interdisciplinary Research (new in ’00)	N/A	2003
Gravitational Physics	2000	2003

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
SOCIAL, BEHAVIORAL, AND ECONOMIC SCIENCES		
Office of International Science and Engineering (INT)	**2002**	2005
Science Resource Statistics (SRS) (new in ‘99)		2004
-NSF-wide Programs Cluster		
CAREER	2001	TBD
ADVANCE (new in ‘01)		TBD
Behavioral and Cognitive Sciences (BCS)		2003
Archeology and Archaeometry	1999	2003
Child Learning and Development	1997	2003

Cultural Anthropology	1999	2003
Linguistics	1999	2003
Human Cognition and Perception	1999	2003
Social Psychology	1999	2003
Physical Anthropology	1999	2003
Geography and Regional Sciences	1999	2003
Social and Economic Sciences (SES)		2004
Decision, Risk, and Management Sciences	2000	2004
Political Science	2000	2004
Law and Social Science	2000	2004
Innovation and Organizational Change	2000	2004
Methodology, Measurement and Statistics	2000	2004
Science and Technology Studies	2000	2004
Societal Dimensions of Engineering, Science, and Technology	2000	2004
Economics	2000	2004
Sociology	2000	2004

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
OFFICE OF POLAR PROGRAMS		
Polar Research Support	2001	2004
Antarctic Sciences		2003
Antarctic Aeronomy and Astrophysics	2000	2003
Antarctic Biology and Medicine	2000	2003
Antarctic Geology and Geophysics	2000	2003
Antarctic Glaciology	2000	2003
Antarctic Ocean and Climate Systems	2000	2003
Arctic Sciences		2003
Arctic Research Opportunities	2000	2003
Arctic Research and Policy	2000	2003
Arctic System Sciences	2000	2003
Arctic Natural Sciences	2000	2003
Arctic Social Sciences	2000	2003

DIRECTORATE *Division* Program	Fiscal Year of Most Recent COV	Fiscal Year of Next COV
OFFICE OF INTEGRATIVE ACTIVITIES		
Major Research Instrumentation (MRI)	2000*	
Science and Technology Centers (STC)	1996*	2007
*External evaluations		

APPENDIX III. IBM Business Consulting Services Executive Summary

EXCERPT FROM THE IBM BUSINESS CONSULTING SERVICES REPORT "*Government Performance and Results Act (GPRA) Performance Measurement Validation and Verification*" December, 2002

Executive Summary

"The National Science Foundation (NSF), as a Federal agency, is subject to the performance reporting requirements of the Government Performance and Results Act (GPRA). Accordingly, NSF developed a series of performance goals to help the agency meet its mission, goals, and objectives. The Foundation asked International Business Machines Corporation (IBM) Business Consulting Services (predecessor organization – PricewaterhouseCoopers Consulting) to assess whether the methods that NSF uses to compile and report selected FY 2002 performance results are verifiable and valid. This is the third consecutive year that we have performed this assessment.

We commend NSF for undertaking this third-year effort to confirm the reliability of its data and the processes to collect, process, maintain, and report this data. From our fiscal year (FY) 2002 review, we conclude that NSF has made a concerted effort to ensure that it reports its performance results accurately and has effective systems, policies, and procedures to ensure data quality. Overall, NSF relies on sound business practices, system and application controls, and manual checks of system queries to report performance. Further, our efforts to re-calculate the Foundation's results based on these systems, processes and data were successful.

The United States General Accounting Office (GAO) has directed federal agencies to provide confidence that the policies and procedures that underlie GPRA performance reporting are complete, accurate and consistent. To address GAO's mandate and past concerns, NSF asked us to conduct an independent verification and validation[40] review of selected 2002 quantitative and qualitative results contained in the FY 2002 NSF GPRA Performance and Accountability Report.

The FY 2002 performance goals we reviewed fall under four categories:

- Management goals being reviewed for the first time (7 goals)
- Management goals receiving an update review (8 goals)
- EHR performance goal receiving an update review (1 goal)
- Facilities Goals receiving a limited review, focused on data, results and FY 2002 improvement efforts (4 goals)

As part of our review of the processes and results for these selected performance goals, we:

- Assessed the accuracy of NSF's performance data and reported outcomes of performance goals and indicators
- Described the reliability of the processes NSF uses to collect, process, maintain, and report data
- Reviewed system controls to confirm that quality input results in quality output
- Created detailed process descriptions and process maps for those goals being reviewed for the first time

[40] GAO defines "verification" as a means to check or test performance data in order to reduce the risk of using data that contains significant errors. GAO defines "validation" as a way to test data to ensure that no error creates significant bias.

- Identified changes to processes and data for those goals receiving an update review

We applied GAO's *Guide to Assessing Agency Annual Performance Plans* (GAO/GCD-10.1.20) to guide our review. Based on GAO guidance, we assessed whether NSF's processes to collect, process, maintain and report data meet the following criteria:

- Does the process provide for periodic review of collection, maintenance, and processing procedures to ensure they are consistently applied and continue to be adequate?
- Does the process provide for periodic sampling and review of data to ensure completeness, accuracy, and consistency?
- Does the process rely on independent audits or other established procedures for verifying and validating financial information when performance measures require the use of financial information?
- Does NSF address problems, in verification and validation procedures, known to GAO or the agency?
- Does the agency recognize the potential impacts of data limitations should they exist?

We did not consider the appropriateness of NSF's performance goals or indicators in our assessment of the validity of NSF's reported results. Rather, our validation is based strictly on whether NSF achieved or did not achieve its performance goals based on the indicators established by NSF in the FY 2002 Performance Plan or other appropriate NSF citations.

Results and Recommendations

We determined that NSF has reported on all 19 management goals and one EHR performance goal under review in a manner such that any errors, should they exist, would not be significant enough to change the reader's interpretation of the Foundation's reported outcome in meeting the supporting performance goal. Overall, NSF relies on sound business processes, system and application controls, and manual checks of system queries to report performance. We believe that these processes are valid and verifiable.

We summarize the results of our review for each performance goal in Table 1. We indicate the results of each goal as reported by NSF in the "NSF Result" column. In the "Process Check" column, a check symbol (✔) indicates that we were able to verify the reliability of NSF's processes to collect, process, maintain and report data. In the "Result Check" column, a check symbol indicates that we were able to validate the accuracy of the NSF's reported result for the corresponding performance goal. Where appropriate, we also include comments with respect to "Areas for Improvement" and "Recommendations.[41]" These areas for improvement and recommendations are discussed in greater detail in the balance of this report."

[41] "The areas of improvement" and "Recommendations" are not included in the reproduced table presented on the following pages.

FY 2002 Performance Goal	NSF Result	Process Check	Result Check
Management goals reviewed for the first time in FY 2002			
IV-3: Program Officers will consider elements of both generic review criteria in making decisions to fund or decline proposals.	Achieved	✔ - [42]	✔
IV-6: Establish a baseline for participation of members of underrepresented groups in NSF proposal review activities.	Not Achieved	✔	✔
IV-8: NSF will develop and initiate a risk assessment / risk management plan for awards.	Achieved	✔	✔
IV-12: NSF will implement an agency-wide security program in response to the Government Information Security Reform Act.	Achieved	✔	✔
IV-14: NSF will establish an internal NSF Academy to promote continuous learning for NSF staff.	Achieved	✔	✔
IV-15: NSF will initiate a strategic business analysis to provide a comprehensive perspective on its future workforce requirements.	Achieved	✔	✔
IV-16: NSF will establish various baselines that will enable management to better assess the quality of work life and work environment within the Foundation.	Achieved	NA[43]	✔
Management goals receiving an update review			
IV-1: At least 85% of basic and applied research funds will be allocated to projects that undergo merit review.	Achieved	✔	✔
IV-2: Reviewers will address the elements of both generic review criteria at a level above that of FY 2002.	Achieved	✔	✔
IV-4: Ninety-five percent of NSF program announcements will be available to relevant individuals and organizations at least three months prior to the proposal deadline or target date.	Not Achieved	✔	✔
IV-5: For 70 percent of proposals, be able to inform applicants whether their proposals have been declined or recommended for funding within six months of receipt.	Achieved	✔	✔
IV-7a: NSF will increase the average annualized award	Achieved	✔	✔

[42] We provide a check minus for this goal because of the number of areas for process improvement we have identified.

[43] NSF was not able to implement this goal because the Office of Personnel Management (OPM) did not provide the necessary survey data by the end of FY 2002. Consequently, we are not able to verify NSF's processes, since they were not completed. However, we can validate NSF's reported result that it did not meet this goal for FY 2002.

FY 2002 Performance Goal	NSF Result	Process Check	Result Check
size for research projects to a level of $113,000, compared to a goal of $110,000 in FY 2001.			
IV-7b: NSF will maintain the FY 2002 goal of 3.0 years for the average duration of awards for research projects.	Not Achieved	✔	✔
IV-11: NSF will continue to advance the role of "e-business" in review, award, and management processes.	Achieved	✔	✔
IV-13: NSF will show an increase over FY 2000 in the total number of hires to NSF science and engineering positions from underrepresented groups.	Achieved	✔	✔
III-1b: After three years of NSF support, over 80 percent of schools participating in systemic initiative programs will: Implement a standards-based curriculum in science and mathematics with at least one-third of their teachers; Provide professional development for at least one-third of their teachers; and Improve student achievement on a selected battery of math and science tests at one or more of three educational levels (elementary, middle and high school).	Achieved	✔	✔
IV-9a: For 90% of facilities, keep construction and upgrades within annual expenditure plan, not to exceed 110% of estimates.	Achieved	NA[44]	✔
IV-9b: Ninety percent of facilities will meet all major annual schedule milestones.	Not Achieved	NA	✔
IV-9c: For all construction and upgrade projects initiated after 1996, when current planning processes were put in place, keep total cost within 110% of estimates made at the initiation of construction	Achieved	NA	✔
IV-10: For 90 percent of facilities, keep operating time lost due to unscheduled downtime to less than 10 percent of the total scheduled operating time.	Not Achieved	NA	✔

[44] We reviewed NSF's processes for its management facilities goals in FY 2001. This year's process review focused on the status of select NSF process improvement initiatives, resulting from our FY 2001 recommendations. Because we did not do a full process review this year, we have inserted "NA" in the process check column. We did test the results of the facilities goals for FY 2002 and have noted our results in the result check column. Please see Section 5 for further details.