V. FINDINGS FROM PROGRAM ASSESSMENTS AND EVALUATIONS

Findings for program assessments and evaluations completed in FY 2000 for the Outcome Goals are discussed in Section V.A., followed by agency results for the Management Goals (Section V.B.), and Investment Process Goals (Section V.C.). It is important to note that, with the exception of Investment Process Goal 2, the findings for the Management Goals and Investment Process Goals are prepared by NSF staff with the use of central data systems, and are not judged in the COV assessment process.

The findings for Outcome Goals include summarized judgments reported in the Committee of Visitor (COV) and Advisory Committee (AC) assessment reports. General findings and goal ratings in COV and AC reports are aggregated across NSF, and summarized in a qualitative format for Outcome Goals 1, 2, 3, and 4a, in the following Section V.A.. The COV and AC reports are also the sources of results for Investment Goal 2, presented in Section V.C.

For each Outcome Goal, a brief introduction to the Goal is provided, followed by the annual performance goal and indicators for this fiscal year. Aggregated results of the assessment process follow the Performance Indicators, and a discussion of performance and plans for the next year is presented. Examples of results demonstrating successful performance as identified by COVs and ACs in the assessment process are presented to illustrate the impact of NSF support. Examples of results are organized by goal and area of emphasis, as described in the FY 2000 Performance Plan. Examples of Outcome results may be relevant to more than one goal or more than one area of emphasis.

In addition to the assessments provided by COVs and ACs, studies and evaluations are carried out by independent contractors to address specific issues not specifically linked to the GPRA performance goals. Evaluations completed in FY 2000 are presented in Table 2 in Section V.D., following the Investment Process goal discussion, and for the most part, are not used in the performance assessment process (with the exception of one COV report as noted in Table 2). Information from evaluations is useful to programs to identify issues and opportunities for future investments.

A. OUTCOME GOALS AND RESULTS

The true value of NSF investments can only be measured by the outcomes identified over time. Outcomes might be the results of research or training sponsored by NSF, as long as 10 or 20 years ago. Therefore, NSF's Outcome Goals are very long-term goals, designed to ensure the progress of science and engineering, and to improve the future health, security, and quality of life for U.S. citizens. They focus on the results of NSF awards for research and education in science, mathematics, and engineering and are designed to promote the mission of NSF. The key strategy for success in achieving these goals is the use of rigorous merit review to make awards for activities that will influence research and education, both directly and indirectly, over the long-term.

Outcome Goals are expressed in a qualitative format. To determine the progress NSF makes in achieving these goals, the outputs and outcomes of NSF programs are judged qualitatively against the stated goals by groups of external evaluators known as Committees of Visitors (COVs) and advisory committees (ACs). More information about COVs and ACs is provided in Section III, "*Assessment and Evaluation Process*."

Following the discussion of each Outcome Goal, performance results reported in FY 2000 from awards made in earlier years are presented. These examples include only a few of the many noteworthy achievements reported by programs, Committees of Visitors and Advisory Committees in FY 2000. The examples are selected to cover the full range of activities supported by NSF and illustrate the impact and success of NSF programs and offer only a glimpse of NSF's broad range of supported activities. In each case a grant number issued by NSF can be used to identify the example for purposes of verification.

SUMMARY OF FY 2000 RESULTS FOR OUTCOME GOALS

External evaluators consistently judged NSF's programs to result in high quality outputs and outcomes. This result is a good indication that NSF's programs are achieving NSF's mission to promote the progress of science and engineering. Overall, agency results in this second year of GPRA reporting are similar to those obtained in FY 1999, and trends are beginning to appear. This is an important result, since a different subset of NSF's program portfolio is evaluated each year by different groups of external evaluators. This second year of reporting provides NSF with a good indication of areas needing attention and helps NSF to identify areas to focus on for future improvement.

External evaluators judging programs in FY 2000 indicate that NSF programs have successfully achieved Outcome Goals 1 and 2, and have achieved with limited success Outcome Goals 3 and 4.a – which we report as not achieved, although progress is being made. The two quantitative sub-goals of Outcome Goal 4 were achieved, as were the two sub-goals of Outcome Goal 5. We report six of the eight Outcome Goals as achieved in FY 2000. All Outcome Goals were achieved in FY 1999.

In FY 2000 evaluators identified the same areas in need of improvement as in FY 1999. Although many reports indicate improvement over FY 1999 performance in the area of diversity through increased participation of under-represented groups, some reports indicate that the numbers are acceptable but still lower than expected in order to have a significant impact. Evaluators comment that increasing participation of under-represented groups is an area needing more attention by NSF.

Other areas needing further improvement include (i) balance of portfolio by funding more high-risk[3] proposals; and (ii) use of both of NSF's merit review criteria by applicants and reviewers. Several reports note that there are clear indications that NSF Program Director use of the merit review criteria is evident in making decisions to fund or not fund proposals. Common issues identified in some reports that reduce program performance include increasing workload and delays in processing proposals.

In FY 2000 NSF limited options for grading to either ***successful*** *or* ***not successful****, and required clear justification for successful grades for qualitative measures. An outside accounting firm verified the goal achievement data tables for Outcome Goals 1, 2, 3,and 4.a.*

[3] "High-risk" research refers to proposals or projects that are judged to be at risk at achieving NSF goals or even producing significant breakthrough, and for which there is no scientific consensus or experience to judge the likelihood of success with any precision. Such proposals often provoke a wide range of opinions as to whether they should be funded or even submitted for consideration.

OUTCOME GOAL 1

DISCOVERIES AT AND ACROSS THE FRONTIER OF SCIENCE AND ENGINEERING

NSF supports cutting edge research in science, engineering, and education, that yields new discoveries over time. These discoveries are essential for maintaining the nation's capacity to excel in science and engineering and they lead to new and innovative technologies that benefit society.

New knowledge – new ideas and theories, new tools and approaches – opens doors to understanding and solving problems and new paths for economic growth. The quest for discovery drives the imagination, creativity, and work of scientists and engineers. The innovation that results from discovery is a driving force for continued economic growth and an improved standard of living for all Americans.

NSF's key strategy for achieving this goal is to support the most promising ideas in research and education, as identified through merit review of competitive proposals. Innovation and creativity, cooperative research through partnerships, and education and training are emphasized and encouraged.

PERFORMANCE GOAL 1

NSF's performance toward this Outcome Goal is ***successful*** when NSF awards lead to:

- important discoveries;
- new knowledge and techniques, both expected and unexpected, within and across traditional disciplinary boundaries; and
- identification of high-potential links across these boundaries.

as judged by independent external experts.

PERFORMANCE INDICATORS

- importance and quality of discoveries, new ideas, new tools, and new technologies;
- interplay of disciplinary and interdisciplinary research; and
- balance of the portfolio.

BASELINE:
Pilot projects used FY 1997 and FY 1998 information and expert judgment in performance assessments that indicated NSF was successful in meeting this goal.

FY 1999 RESULT:

THIS GOAL WAS ACHIEVED.

FY 2000 RESULT:

THIS GOAL WAS ACHIEVED.

COMPARISON OF ACTUAL PERFORMANCE WITH PROJECTED PERFORMANCE

Approximately one-third of NSF's portfolio of programs was assessed by Committees of Visitors (COVs) for progress in achieving this Outcome Goal. (Section III, "*Assessment and Evaluation Process*," contains information on the process of evaluating NSF programs). For FY 2000, evaluators were asked to judge whether programs being evaluated were successful or not in meeting the goal.

In aggregating results for the agency, the reports of COVs and Advisory Committees were used, taking into account only those reports with substantive comments and ratings which were clearly justified. We find that all reports that provided a rating for this goal judged NSF successful in meeting this goal in FY 2000. Therefore, we report this goal as achieved.

External evaluators recognize that the highest impacts of discoveries are not identifiable in the short term. It may take 3–10 years for a research discovery to impact the private sector, and normally takes 15–20 years for fundamental ideas to find their way into everyday life.

Each year, NSF asks COVs to examine the portfolio of project support to identify activities they would characterize as high risk, multidisciplinary, or innovative, and to make an assessment of the overall scientific quality and balance with respect to these specific characteristics.

NSF identified "Balance of innovative, risky, interdisciplinary research" as an area of emphasis in FY 2000, and stated it as a goal in FY 1999. In FY 1999, of the COV reports that gave an opinion on balance of projects in the programs under review, most indicated that the balance was appropriate. For FY 2000, of the COV reports that gave an opinion on the balance, more than half indicated good balance, less than half indicated programs could fund more high-risk projects, and a few indicated they would like to see more innovative proposals.

COMPARISON: FY 1999 - FY 2000

This Outcome Goal was continued from FY 1999 with one modification. In FY 1999, the goal was stated using two levels of achievement: *successful* and *minimally effective*, with indicators for each level. Based on comments from COVs and ACs in FY 1999, NSF determined that the definitions for the *minimally effective* level of performance did not provide additional information in evaluating the programs.

In FY 2000, the indicators were refined to improve correspondence between information sought and information that can actually be collected, and the *minimally effective* standard was removed. A single definition for the *successful* standard is stated as the target level of performance for each Outcome Goal. In FY 2000, a stricter definition of allowed success was applied when reviewing reports of external evaluators, which required clear justification of ratings in reports.

The successful result in FY 2000 was also the finding by COVs and ACs in FY 1999. It is important to recognize that the evaluation was carried out on a different subset of NSF's portfolio and by a different group of external evaluators.

FY 2001 AND BEYOND

This goal will be incorporated under a new Outcome Goal heading for FY 2001, which rearranges NSF's five outcome goals into three broad Strategic Outcome areas: People, Ideas, and Tools. A table depicting the structural rearrangement is shown in Section VIII, *"Transition to FY 2001 and Beyond."* This improves the alignment of NSF's Outcome Goals with its mission and allows closer correlation between budget categories and NSF's Strategic Plan. This Outcome Goal will be combined with FY 2000 Outcome Goal 2 to become part of the Ideas Strategic Outcome area as described in the NSF FY 2001 Performance Plan.

EXAMPLES[4] OF FY 2000 ACHIEVEMENTS CITED BY EXTERNAL EVALUATORS

OUTCOME GOAL 1

DISCOVERIES AT AND ACROSS THE FRONTIER OF SCIENCE AND ENGINEERING

External evaluators cited the following examples of results from NSF awards as demonstrating success in support of Outcome Goal 1. These examples illustrate important discoveries, new knowledge and techniques, both expected and unexpected, within and across traditional boundaries, and high-potential links across these boundaries.

The examples also illustrate NSF-supported results reported in the FY 2000 areas of emphasis for this Outcome Goal. These areas include balance of innovative, risky, interdisciplinary research; new types of scientific databases and tools to use them; life in extreme environments; biocomplexity; and nanoscience and engineering. It is interesting to note that many results cross the boundaries between discoveries, new knowledge, interdisciplinary research, biocomplexity, and nanoscience. Where results are forthcoming, the diverse portfolios of awards show potential for significant impact in many of these areas.

- **MAPPING THE ARCTIC OCEAN FLOOR** A most impressive example of using innovative tools and, as a result, developing new databases, is the mapping of the Arctic Ocean floor using the nuclear submarine USS Hawkbill, and the Seafloor Characterization and Mapping Pods. The resulting data sets of high-resolution and narrow-beam bathymetry as well as chirp sub-bottom profiles will revolutionize Arctic Ocean modeling and have driven the development of advanced visualization techniques and multi-dimensional Geographic Information Systems. Sidescan images from the Lomonosov Ridge crest, collected during the Hawkbill mapping, show an ice scoured appearance marked by ploughmarks several kilometers long and several hundred meters wide. The ploughmarks are generally parallel, pointing to either the Barents Sea, or the Arlis Plateau area, as source regions of the ice. The parallel nature and size of the ploughmarks suggests grounding of a floating ice shelf rather than scouring of individual iceberg keels.

- **INTERDISCIPLINARY RESEARCH AT HOME** Most U.S. archaeologists study the Native American past, yet very few are Native Americans themselves. This has often created sharp disagreements between these two groups. To help bridge this gap the Society for American Archaeology has established a fellowship program that allows Native Americans to participate in both field and traditional academic settings. Although most will not become professionals in archaeology, the goal is to develop a cadre of individuals who can act as translators and mediators between two often divergent cultures. NSF funding has helped to increase the size and number of the fellowship awards.

[4] Additional examples may be found in Appendix XIV.

- **BENDING LIGHT AROUND CORNERS – IMPROVING TELECOMMUNICATIONS?** Telecommunication wavelengths are normally considered to be in the wavelength range where optical fiber has the lowest loss. Conventional single mode fibers have two low attenuation ranges, one about 1.3 micrometers, and another about 1.55 micrometers. Between these two ranges there is a high attenuation range, 1.35-1.45 micrometers, due to the presence of the OH radical. What's used in telecommunications also depends on the light sources and amplifiers available. NSF-supported researchers have created "omniguides" – or phototonic bandgaps using alternating concentric layers of polystyrene (plastic) and tellurium (a metal) having specified thickness. These "omniguides" cause complete internal reflection of photons, regardless of the direction of polarization of the light, and allows the guiding of light around sharp corners. Depending upon the tube diameter, the guides can be tuned over a wide range of wavelengths, for use anywhere from CO_2-laser (about 10 micrometers – one inch is 25,400 micrometers) to telecommunications wavelengths (between 1.3 and 1.55 micrometers). *Science* cited this discovery as one of its Top 10 "Breakthroughs of the Year."

- **QUANTUM CONTROL - QUANTUM OPTICS** Precise control and measurement of a variety of quantum systems were demonstrated that could have profound implications for nanoscale technology, chemical physics, and information science. The first completely quantum feedback scheme was developed, which followed the development of a scheme for the complete characterization of the quantum state of the internal degrees of freedom of atoms and molecules. Techniques developed for laser cooling of atoms led to the improvement of optical tweezers that are now capable of holding and moving individual molecules. An important example is the combination of techniques from biology, chemistry, and physics to manipulate single DNA molecules.

- **TOOLS TO BENEFIT MEDICAL APPLICATIONS** NSF-supported researchers have developed a needle-shaped accelerator tube that, when installed on a particle accelerator, can be used to deliver tumor-destroying neutron radiation directly to a tumor with minimum damage to healthy tissue. The prototype is undergoing engineering studies in preparation for studies on prostate tumor irradiation.

- **ADVANCING KNOWLEDGE - SHARED PROTEIN STRUCTURE DATABASE** With the tremendous increase in the amount of DNA sequence information now available, the opportunity exists to characterize the structure and function of all proteins. The support of a world-wide protein database was facilitated by NSF's long-term (~25 years) commitment to support a world-wide protein database developed by universities in cooperation with a national laboratory. The database is serving an international community of researchers (60% US, 30% European, 10% Japanese) interested in protein structure. X-ray coordinates are deposited into this database is then available to the scientific community world-wide. This NSF-sponsored protein database is the only one in the world and includes many features that will serve the advancing genome initiatives at NSF and other agencies in this country and throughout the world.

- **COMPUTATIONAL BIOLOGY** Research in molecular biology confronts many problems of high computational complexity. Large amounts of genomic data have been collected

that require high-speed algorithms for searching, analysis, and prediction of function. Pattern-matching methods developed by the theoretical computer science community were instrumental in expediting the sequencing of the human genome. New algorithms for generating phylogenetic trees are used in inferring evolutionary development of species. NSF-supported research in computational biology has contributed extensively to phylogenetic tree algorithms as well as biological sequence pattern-matching and the specific problem of finding repetitions in genomic data. Using NSF support, researchers developed a much more efficient algorithm for correlating diseases with genetic defects.

Life in Extreme Environments, begun as a focused investment theme in FY 1997, reflects an aspect of Biocomplexity in the Environment. NSF awards produced a wide variety of important discoveries in both the Arctic and Antarctic. Many discoveries concern regional environmental changes that have implications for global climate change.

- NSF interacts with several other federal agencies (Coast Guard, NASA, Army, Air Force, NOAA, USGS, and CIA) and is involved in interagency funding of many projects. Recent conclusions of a jointly-supported NSF and NASA research project have yielded new insights on a controversial subject, the evidence of possible life on early Mars. It was found that the carbonate minerals, one of the key components at the center of the controversy, originated through multiple inorganic processes rather than through biological processes, and that isotopes of iron record evidence of biological fractionation. As a result, iron isotopes can now be used as a new tool for recognizing potential evidence of life.

- In the Arctic, the international Surface Heat Budget of the Arctic (SHEBA) project demonstrated the increased importance of low clouds in warming the lower atmosphere and melting sea-ice The SHEBA Ocean project involved placement of the first-ever, year-long science program in the drifting Arctic ice pack. SHEBA was conducted from an icebreaker frozen in place 300 miles north of Prudhoe Bay, AK, but which drifted over 400 miles to a position 400 miles north of Barrow, AK. Upon arrival, scientists immediately confirmed that a major ice melting event in Summer, 1997, had thinned the ice pack and left thin ice conditions well into 1998. The cross-directorate, interagency (ONR, DOE, NASA, NOAA), and international (Japan, Canada) science project has collected a suite of ice, atmosphere, and ocean measurements to determine the environmental variables responsible for maintenance of the climatically important Arctic ice pack. The measurements address some of the most important unknowns required for improving computer simulations of climate change, weather predictions, and satellite retrievals.

- **EXTRASOLAR PLANETARY DISCOVERY** The first detection of a multiple-planet solar system outside our own has been widely interpreted as evidence that solar systems like ours may be fairly common companions to sun-like stars. A long-standing aim of many astrophysicists has been to detect and characterize sun-like pulsations in distant stars. The technology required to make such studies involves extremely precise measurements of the line-of-sight velocity or brightness of the target stars. It turns out that these measurements are precisely those needed to detect planets circling other stars. Seeking

to identify new extra-solar planets provided an exciting result in April: the discovery that three planets orbit the star Upsilon Andromedae, each with a mass comparable to the mass of Jupiter. The three planets are located at distances from their star that range from .05 to 2.5 astronomical units – one astronomical unit is the distance between the earth and the sun. This discovery was the result of a collaboration involving NSF-supported scientists at the Harvard-Smithsonian Center for Astrophysics and San Francisco State University, using the Anglo-Australian Telescope.

Biocomplexity represented a focused emphasis opportunity for NSF in FY 2000. However, NSF had made related investments in previous years and related investment outcomes underpin this FY 2000 emphasis area.

- **UNEXPECTED DISCOVERY** The structures of proteins that catalyze steps in metabolism and that orchestrate growth and development are specified by the genetic code in DNA. Quality control mechanisms exist at several levels to ensure that all proteins are produced exactly according to genetic instructions. The genetic code is translated into protein structural information through an intermediary called messenger RNA (mRNA), which is a transcript of the information in the gene. A quality control mechanism called RNA surveillance has recently been discovered that ensures that all mRNAs produce full-length functional proteins. RNA surveillance is accomplished by a mechanism that causes the rapid destruction of mRNAs that have mistakes in them that prevent their coding of full-length proteins. NSF-supported research at the University of Wisconsin led to the discovery of a novel and unanticipated pathway for surveillance of aberrant mRNA molecules. Components of this pathway were identified in yeast using a clever genetic selection initially designed to identify factors that affect ribosomal frame shifting. Instead, a novel set of genes was identified that encodes components of a pathway that mediates turnover of mRNAs containing nonsense mutations. This discovery offers an explanation for the long-standing problem of how cells contend with toxic proteins resulting from translation mRNAs containing nonsense or frame shift mutations.

- **EVOLUTIONARY RELATIONSHIPS** A recent series of discoveries grew out of the field recovery and analysis of fossil dinosaurs, birds, and mammals from the Gobi Desert. The expeditions recovered a wealth of fossil material. Analysis of this matrix showed, among other things, that birds had a complex origin from therapod dinosaurs. The large data base gathered, in part, with support from NSF is important not only to the understanding of animal life in the Gobi Desert, but to the understanding of the evolution of vertebrates worldwide.

- **PLANT GROWTH AND DEVELOPMENT** Studies of basic plant developmental mechanisms include studies of the molecular genetics of plant cells and tissues that lead to root and root hair development. The plant root and root hair allows the plant to absorb or restrict nutrients that are present in the soil environment. The success of studies of this sort sheds additional information on root uptake mechanisms to allow for future work on varying nutrient uptake and sequestration by the plant. The development of the shoot and root apical cells and tissues is considered the "holy grail" of plant developmental biology because these two structures give rise to all above and below

ground parts of all plants. Several NSF-supported research groups have lead the field in identifying genes that are necessary to initiate these cells and tissues during embryo development as well as maintain their organization throughout the growth of the plants.

Nanoscience and engineering represented a focused investment emphasis for NSF in FY 2000, an emphasis that builds upon the following discoveries and others like them.

- The development of sophisticated nanoscale optical measurement techniques that are broadly useful for the study of very fast dynamics in excited atoms, chemical reactions, carrier motions in semiconductors, and nanoelectronic devices is resulting from a breakthrough in stable short-wavelength, short time- duration lasers. The innovative work of NSF supported researchers has appeared in *Science* 280, 1412 (1998) and *Nature* 406, 164 (2000). One NSF-supported researcher was recently recognized by the John D. & Catherine T. MacArthur Foundation Award for 2000.

- NSF support has led to new understanding of manufacturing processes and equipment that hold great promise for the future. As the size of all kinds of electromechanical devices becomes smaller and smaller, accurate measuring devices are needed to enable manufacturing and ensure product quality. NSF-supported researchers have:

  - Collaborated to develop the world's highest-resolution and highest-accuracy magnetic suspension positioners. These positioners have been used to demonstrate the principles of ultra-precision positioners for semiconductor processing and advanced imaging systems.

  - Made discoveries leading to two key rapid prototyping technologies - selective laser sintering and 3D printing, respectively. These projects addressed fundamental interdisciplinary research issues in materials science and manufacturing processes. NSF support provided since the late 1980's has played a huge role in the evolution of rapid prototyping from an emerging technology to the mature field with commercial applications that it is today.

  - Studied precision engineering for high-quality products has resulted in major findings in grinding and metrology, both important for traditional manufacturing processes.

- Nanoscale molecular engineering of surfaces has been achieved by NSF-funded investigators in their creation of molecular corrals a few hundred angstroms in diameter and only one molecular layer deep. These molecular corrals have potential to serve as containers wherein a variety of biologically active chemical receptors could be anchored, providing a new basis for future sensor design and application. Other advances in nanoscale design and supramolecular self-assembly are bringing the diverse fields of synthetic and analytical chemistry, physics, materials science, mathematics, and information technology together. For example, families of mechanically interlocked molecules called rotaxanes and catenanes form the architectural foundation of a nanoscale machine that can be switched from one state to another - representing a molecular logic gate. These molecular logic gates are being used in ongoing efforts to design prototype molecular computers.

OUTCOME GOAL 2

CONNECTIONS BETWEEN DISCOVERIES AND THEIR USE IN SERVICE TO SOCIETY

In a world that is increasingly technologically driven, America's national security, economic competitiveness, health, environment, and quality of life depend on taking advantage of discovery. Linking advances in science and engineering with their potential uses generates a productive exchange of knowledge, information, and technologies. These linkages accelerate innovation, often yielding new insights into the underlying research. NSF views public accessibility of NSF-supported results as critical components for the progress of science and technological innovation.

NSF's role in addressing the use of discovery in service to society is in making sure that the channels of communication are open, that results are accessible to potential users, that NSF researchers are alert to how the results of their investigations might be of value to others, and that NSF's investment portfolio appropriately supports national priorities.

An important result of NSF-sponsored research is the generation and dissemination of data and information that can be used by others to explore theories and issues of importance to them. Federal funds are significantly leveraged to produce many times the original investment made in research projects by making NSF-sponsored results available to a wide range of scholars. NSF requires that scholars archive their data and acknowledge NSF support. A cursory review of major journals indicates the large numbers of published articles that acknowledge NSF-sponsored data collections as their source of data.

NSF's key strategy for success in achieving this goal is through the use of the merit review process to make awards for research and education activities that have the potential for future service to society.

PERFORMANCE GOAL 2

NSF's performance toward this outcome goal is ***successful*** when the results of NSF awards are

- rapidly and readily available; and
- feed, as appropriate, into education, policy development, or use by other federal agencies or the private sector

as judged by independent external evaluators.

PERFORMANCE INDICATORS

- outputs and outcomes of NSF awards are made available to and put to use by others; and
- NSF-sponsored activities demonstrate a role in stimulating innovation and policy development.

FY 1999 RESULT:

THIS GOAL WAS ACHIEVED.

BASELINE:
Pilot experiments using FY 1997 and FY 1998 information and expert judgment in performance assessment by external experts indicate NSF was successful in meeting this goal.

FY 2000 RESULT:

THIS GOAL WAS ACHIEVED.

COMPARISON OF ACTUAL PERFORMANCE WITH PROJECTED PERFORMANCE

COVs were asked to judge whether the programs being evaluated were successful or not in meeting the FY 2000 performance goal for this Outcome Goal. Programs evaluated in FY 2000 were judged successful by experts in a significant majority of the reports. Several reports indicated that programs were successful in a limited context, a few reports indicated that programs were not fully successful, and a few reports did not provide judgements. Issues identified in FY 2000 are similar to those reported in FY 1999.

For those programs rated not fully successful, one was found to have awards that limited the scope and duration of the activity. Hence, connections between discoveries and service to society were not described in reports although some proposals had promised such connections. One report found the programs under review to be generally successful, but noted that room for improving the delivery of scientific research results to society, or more specifically to end-user communities, could be made. Another program not fully successful is described as funding primarily "basic" science, and hence it was left to others to make applications to society. Finally, one program was found to be producing results that have benefited a small community of users, including students and educators, and is showing promise for a much wider applicability, but insufficient time has elapsed for the products of this program to have penetrated into the potential broad user community.

We find, from aggregating the results of all reports which rated this goal, and using only reports with substantive comments and ratings which were clearly justified, that the majority of reports from external evaluators indicate that most NSF programs evaluated were successful in meeting this goal in FY 2000. Therefore, this goal was determined to have been achieved in the aggregate. However, as was noted in FY 1999, there is room for improvement in some programs. For those activities that were not judged fully successful, increased award size and duration are recommended by evaluators. NSF is emphasizing award size and duration as explicit management goals in FY 2001.

COMPARISON: FY 1999 - FY 2000

This goal was continued from FY 1999, with some modification of indicators to improve the correlation between information available and the intent of the goal. In FY 1999, the goal was stated using two levels of achievement: *successful* and *minimally effective*, with indicators for each level. Based on comments from COVs and ACs, it was determined that the definitions for the *minimally effective* level of performance did not provide additional information in evaluating the programs.

NSF works toward this outcome goal by using the merit review process to make awards for research and education activities that focus on discovery and that create or have the potential for connections with use in service to society.

In FY 2000, a single definition for the *successful* standard was used as the target level of performance. A stricter definition of allowed success was applied that required clear justification of ratings in reports. The overall result in FY 2000 identified issues similar to those identified in FY 1999, even though the evaluation was carried out on a different subset of NSF's portfolio, and by a different group of external experts.

FY 2001 AND BEYOND

NSF can conduct outreach and awareness efforts, thus encouraging efforts toward connections but, generally, cannot mandate connections for all awards. NSF communicates the importance of its Outcome Goals, investment strategies, and expectations for the set of awards to the science and engineering community. Staff outreach efforts are emphasized for activities with strong potential to serve society. Regular reporting requirements for all awards help program staff understand the outputs and outcomes of their award portfolio and provide the context for decisions on new awards. Many investigators do not think about the possible connections their work might have in serving society. Many potential users are not aware of results from NSF awards that could be useful to them.

This Outcome Goal will be incorporated under a new Strategic Outcome Goal heading for FY 2001 which rearranges NSF's five Outcome Goals into three broad strategic Outcome areas: People, Ideas, and Tools. A table depicting the new organization is shown in Section VIII of this report, "*Transition to FY 2001 and Beyond*." The change to People, Ideas and Tools improves the alignment of NSF's goals with its mission and allows closer correlation between budget categories and NSF's Strategic Plan. This Outcome Goal will be combined with FY 2000 Outcome Goal 1 to become part of the Ideas Strategic Outcome in FY 2001. Results obtained in FY 1999 and FY 2000 have led NSF to refine this goal and to identify ways to improve data/information collection to assess this goal.

FY 2000 EXAMPLES[5] OF ACHIEVEMENTS CITED BY EXTERNAL EVALUATORS

OUTCOME GOAL 2

CONNECTIONS BETWEEN DISCOVERIES AND THEIR USE IN SERVICE TO SOCIETY

External evaluators cited the following examples of results from NSF awards as demonstrating the criteria for success in support of Outcome Goal 2. These examples made the connections between discoveries and their use in society, were rapidly and readily available, and were used as appropriate in education, policy development, or by other federal agencies or the private sector.

The examples below are shown to illustrate the variety of results of NSF awards reported in FY 2000. A few examples also demonstrate results in areas of emphasis, which include elements of Information Technology Research (ITR), Global Change, Research on Learning and Education, Plant Genome Research, Urban Communities, and Science and Technology Centers - Integrative Partnerships. The diverse portfolio of FY 2000 awards promise significant impact in one or more of these areas.

- **UP-TO-DATE LOCAL WEATHER INFORMATION** The Auto-Nowcaster system, jointly sponsored by the Federal Aviation Administration, the Department of the Army, the National Weather Service, and NSF under the U.S. Weather Research Program, provides one-hour Nowcasts of thunderstorms and strong winds. Demonstrations of the Auto-Nowcaster system were held at weather forecast offices of the National Weather Service, the Army Forecast Office, and the Aviation Weather Center. The demonstrations were highly successful the products are extensively used by operational personnel. The Sterling Virginia National Weather Forecast Office's severe storm warnings for 1998 were far more accurate than any previous year, and they give partial credit to the Auto-Nowcaster system for the improvement.

- **ANTICIPATING POWER SHORTAGES** Research sponsored by NSF has catalyzed interaction between government, academe and industry to achieve breakthroughs with immediate and lasting impact on society. In a multi-university center effort, researchers have discovered new methods to anticipate "brownouts" in electric power systems. Software has been developed to quickly assess the transfer capability and operational margins of electric power systems, and software is currently being implemented in electric utilities. Seven of the participating researchers were appointed by the Secretary of Energy to study last summer's blackouts and they were asked to make recommendations about the federal role in reducing future failures.

- **IMPACTING TELECOMMUNICATIONS** A microphone-array technology developed with ten years of NSF support has demonstrated both high-quality sound pick-up and the ability to identify and direct a camera to the speaker in a group of up to five people in a room. The sound quality achievable is comparable with face-to-face sound quality.

[5] Additional examples may be found in Appendix XIV.

Scientific advances underlying these capabilities include the development of new beam-forming algorithms, advanced hardware for real-time processing of multiple microphone inputs, and fast location algorithms. As a result of these breakthroughs, a major teleconferencing company has licensed the technology, and will develop a commercial product based on their prototype.

- **A BETTER LOOK ON LIFE** Biological instrumentation and instrument development as well as training programs at the undergraduate, graduate and postdoctoral levels have led to invention of the confocal microscope and, more recently, the development of both "two photon" and "near-field scanning optical" microscopes. Because of these developments, confocal microscopy has become a standard component of laboratory instrumentation important to the area of cell biology. Advances in cell biology have, in turn, resulted in a better understanding of the basic biological processes in plants and animals. Using the microscopy now available through NSF funding, the private sector has commercialized high-technology products that have been marketed both in the U.S. and abroad. The development of the two-photon microscope allows one to optically section cells, to follow the dynamics of intracellular movements in living cells, and to reconstruct the three dimensional structure of cells at different stages of development or in response to environmental signals. This instrument has revolutionized how scientists in all areas of cell biology view and study cell function. This microscope was commercialized, and is in great demand by the scientific community.

- **IMPACT ON INDUSTRIAL/AGRICULTURAL PRODUCTIVITY** Methodologies that facilitate higher yields and better selectivities for chemical processes, and that systematically optimize the performance and integration of chemical processes, are important for maintaining and enhancing global competitiveness and lead to a large positive balance of payments in the chemical industry. NSF research projects aim at improvement of processes with potentially large economic gains.
  - NSF-supported studies of the fundamentals of "thermal switch membranes" have had important results. The membranes are made from polymers with long side chains that crystallize. Switching membranes have been designed that open or close to particular molecules depending on temperature. This characteristic has been exploited to form coatings on seeds to control germination by blocking moisture permeation at low temperatures. This leads to a savings in seed costs and improvements in crop yields.
  - The reuse of materials in the semiconductor industry is critically important in controlling both cost and environmental impact. NSF supported engineering researchers in collaboration with the Semiconductor Research Corporation (SRC) have developed reactive membrane technology for removing trace impurities from gases and treatment systems for the production and recycle of ultra-pure water using photoactive catalysts. Four patents have resulted from the work, and members were recently recognized for their leadership by the Landmark Innovation Award.

This research area has vast potential implications for smart networks, wireless networking and telecommunications, speech and image processing, access and retrieval of data, and processing of sensor data.

- **CHECKING SYSTEMS SPECIFICATIONS** Nearly twenty years of NSF support has resulted in major contributions in the mathematical foundations for verifying the correctness of hardware and software. An NSF-supported researcher was a co-recipient of the Association for Computing Machinery Kanellakis Award in 1999 for the development of Symbolic Model Checking. Symbolic Model Checking is the most successful method yet devised for formally verifying that hardware and software systems meet their specifications. It has successfully uncovered subtle errors in hardware systems (such as dividers) and software systems (such as networking protocols) that extensive simulation failed to identify, and has been adapted by such companies as Intel, Motorola, IBM, and Siemens.

- **CORRECTING FOR DATA LOST IN TRANSMISSION** One of the basic building blocks of most communications over the Internet is known as transmission control protocol, or TCP. In spite of its ubiquity, TCP has been poorly understood. NSF-supported researchers have developed a simple mathematical model for predicting TCP performance This model shows that transmission behavior is not what was expected. This work is having a significant impact on the continuing evolution of TCP and the design of new transport mechanisms. It also shows substantial benefit in the use of forward error correction (FEC) in the delivery of large data files between a single sender and many receivers. FEC provides a way to correct for data that is lost in transmission. One consequence of this work is that most multicast transport mechanisms now rely on the use of FEC. The researchers have been recognized with a prestigious award from the Institute of Electrical and Electronics Engineers (*IEEE*) for this work.

By any criteria, NSF's support of the sequencing of the first plant genome is an impressive example of how a high-quality research resource can be generated, maintained, and made available worldwide. This sequencing effort, started in 1996, was coordinated through the *Arabidopsis* Genome Initiative (AGI) and an international consortium with two European and one Japanese laboratory.

- ***Arabidopsis* Genome** Completion of the *Arabidopsis* genome sequence at the end of 2000 was a truly remarkable achievement. Work with this model plant, *Arabidopsis*, has led to a detailed understanding of the molecular and genetic control of flower development. Initial conclusions have generated great excitement in the science community since it appears there is significant evolutionary variation in the mechanism of flower patterning, and some of these variations may explain the variation seen in flower morphology in nature. Not only will this information be useful to researchers in public institutions and universities, it will be useful to the private sector as well. The sequence data will be used by biologists to compare and contrast the structure and function of similar protein domains across different kingdoms. To complement this research resource, a separately-funded project maintains an *Arabidopsis* Stock Center at Ohio State University. From here seed stocks are made available to the research community world-wide.

OUTCOME GOAL 3

A DIVERSE, GLOBALLY-ORIENTED WORKFORCE OF SCIENTISTS AND ENGINEERS

The competence and capabilities of the Nation's science and engineering workforce keep America at the forefront of innovation and technological progress. Because science and technology now drive economic growth and shape public policy, professionals trained in science and engineering are being called upon to fulfill an increasingly broad set of responsibilities. A diverse science and engineering workforce that is representative of the American public and able to respond effectively to a global economy is vitally important to America's future.

The nation's universities and colleges educate and train the professionals who make possible America's current competitive position. The characteristics of the workforce of scientists and engineers are highly dependent on the systems through which they are educated and trained. To remain a world leader a strong academic research and educational capability must be maintained.

NSF works to achieve this goal by making awards for research and education activities that are intended to influence the development of the science and engineering workforce and that increase the participation of under-represented groups. While NSF can influence these systems through the types of proposal solicitations generated and the types of awards made, the agency does not control them. NSF programs provide only a relatively small, but important, portion of the overall U.S. investment in the development of the science and engineering workforce of the future.

PERFORMANCE GOAL 3

NSF's performance toward this outcome is ***successful*** when:

- participants in NSF activities experience world-class professional practices in research and education, using modern technologies and incorporating international points of reference;
- academia, government, business, and industry recognize their quality; and
- the science and engineering workforce shows increased participation of under-represented groups.

NSF's success towards meeting this goal is judged by external independent experts.

PERFORMANCE INDICATORS

- demographic data on participants in NSF-funded activities and in the workforce;
- character of experiences in NSF-funded activities aimed at educating the next generation of the workforce; and
- outcome data from longitudinal studies as available.

FY 1999 RESULT:

THIS GOAL WAS ACHIEVED (IN MOST PROGRAMS).

BASELINE

Preliminary efforts in FY 1997 and FY 1998 to pilot the use of expert judgment in performance assessment indicated NSF was successful in meeting this goal.

FY 2000 RESULT:

IN THE AGGREGATE, NSF WAS JUDGED SUCCESSFUL IN A LIMITED CONTEXT: THIS GOAL WAS NOT ACHIEVED BY ALL PROGRAMS ALTHOUGH IMPROVEMENT OVER FY 1999 PERFORMANCE WAS NOTED IN SOME REPORTS. PROGRAMS HAVING SPECIFIC RESPONSIBILITIES FOR THESE AREAS WERE JUDGED TO BE SUCCESSFUL.

COMPARISON OF ACTUAL PERFORMANCE WITH PROJECTED PERFORMANCE

As indicated by NSF's FY 2000 Performance Plan, exceptionally strong performance in this goal is characterized by external recognition of scientists or engineers who received NSF support during their training; and when the production of degree recipients in science, mathematics, and engineering increases markedly for under-represented groups.

NSF's performance toward this goal was judged successful in the aggregate by external experts in committee reports with respect to achieving a globally oriented workforce**,** but not fully successful with respect to achieving diversity or increasing participation of under-represented groups**.** Using only reports with substantive comments and ratings that were clearly justified for *both* areas, we find that overall, the majority of reports from external experts indicate that NSF was not successful in meeting *both* areas of this goal in FY 2000. However, programs specifically designed to increase diversity and those designed to achieve a globally-oriented workforce were judged to be successful.

In FY 2000, about 19 percent of competitively reviewed proposals were from female applicants. They received about 20 percent of the awards.

Some COV reports noted that improvements have been made in the past year. However, numbers of under-represented groups are still low and should be increased. One report notes that the programs reviewed in FY 1999 did not achieve this goal, but that programs assessed this year did achieve it.

The number of proposals from female applicants has increased by 18% since 1993, and the number of awards has increased by 32%.

From a sampling of reports which rated programs successful in a limited context, one report notes that despite excellent efforts to fund activities that increase diversity, there does not yet appear to have been an increased participation of under-represented groups in the scientific workforce. Reasons for this remain elusive and may include time lags between intervention and effect.

One report notes that while the funding rate for women is not statistically different from that for males, the number of female proposers is significantly less than the number of male proposers. Reports note that factors affecting improved performance in achieving this goal are not always evident.

In FY 2000, the number of awards to minority PIs increased by 14% over FY 1999, ... but this is still only about five percent of the total number of NSF awards.

One report states that although NSF program officers work to involve under-represented individuals in the range of NSF activities, increased effort is needed, possibly through involvement of individuals from undergraduate institutions. One report notes that recruitment efforts for minority students have had only limited success. Other report recommendations include recruiting young scientists into the field, and in order to reduce attrition rates, nurturing them once they have started. Another report indicates the participation of under-represented groups in the workforce is low and slowly increasing, but that it is not possible to make an unequivocal assessment of the impact of NSF programs. One report states that a full evaluation of progress toward this goal cannot be determined in a three year period, although it rates the programs being evaluated as successful.

Experts agree that the current workforce does not meet national needs. They also agree that NSF programs on the whole are successful, but may not be sufficient to meet the national challenge. Changes in American society may be necessary to bring about the desired change.

COMPARISON FY 1999 – FY 2000

This goal was continued from FY 1999, with some modification of indicators made in FY 2000 to improve the correlation between information available and the intent of the goal.

In FY 1999, the goal was stated using two levels of achievement: *successful* and *minimally effective*, with definitions for each level of performance. In FY 1999, programs judged by external evaluators were rated successful in achieving all or most aspects of this goal in most reports. Several reports qualified their ratings by indicating that NSF should do more in the area of showing increased participation of under-represented groups. Based on comments from COVs and ACs in FY 1999, it was determined that the definitions for the *minimally effective* level of performance did not provide additional information in evaluating the programs.

For FY 2000, the indicators were refined to improve correspondence between information sought and information that can actually be collected. A single definition for the *successful* standard was used as the target level of performance. A stricter definition of success was applied when aggregating results, which required clear justification of ratings in reports. As a result of using stricter definitions of success, we have reported this goal as "not achieved" in the aggregate for FY 2000 as opposed to "achieved" in FY 1999. However, we note that many reviewers comment that NSF is making serious efforts to increase participation of individuals from under-represented groups, even though the numbers remain small.

STEPS TO MEET THIS GOAL IN THE FUTURE

Evaluating the impact of NSF support in achieving diversity or increasing the participation of under-represented groups is a long-term ongoing challenge for NSF. Part of the challenge lies in a fundamental inability to collect adequate quantitative information that describes the diversity of NSF stakeholders, in order to enable tracking of results. NSF cannot mandate full reporting from participants in order to evaluate this goal, and must rely on voluntary reporting. Such reporting is often incomplete and inaccurate. NSF also relies upon the involvement of the institutions it supports to create opportunities for under-represented groups.

NSF works toward this outcome goal by using the merit review process to make awards for research and education activities that influence the development of the science and engineering workforce, both directly and indirectly.

In spite of these challenges, NSF remains fully committed to increasing diversity through the increased participation of under-represented groups in science and engineering. Thus this goal remains a primary long-term objective of the agency. Significant progress toward meeting this goal is not expected in the short term, and will only be realized with continued efforts and investments over many years.

FY 2001 AND BEYOND

This Outcome Goal will be incorporated under a new Strategic Outcome Goal heading for FY 2001 that rearranges NSF's five Outcome Goals into three broad Strategic Outcome areas: People, Ideas, and Tools. A table depicting the structural rearrangement is shown in Section VIII of this report, "*Transition to FY 2001 and Beyond*". This change improves the alignment of NSF's goal with it's mission and allows closer agreement between budget categories and NSF's Strategic Plan. This Outcome Goal will be restated to avoid mixing goal objectives and indicators, and is more fully developed under the People Strategic Outcome area in FY 2001. In addition, it will also be placed under a new category in FY 2001, described as "Broadening Participation". This is included under NSF's Investment Process Goals in the FY 2001 Performance Plan.

In FY 2001, NSF will focus on increasing the participation of individuals from under-represented groups in the merit review process and on increasing the diversity of the NSF staff. Some NSF organizational units have taken steps to develop a broader effort to increase diversity within their programs by developing new programs to increase diversity.

NSF encourages participation of students on international projects to enhance the global awareness of the science and engineering workforce.

In FY 2000, NSF organized a working group to review its increased diversity goals. This working group produced a plan to improve diversity within the agency and in the reviewer pool. NSF will maintain this goal, and will focus on achieving a diverse science and engineering workforce within its own ranks in order to establish a more diverse leadership. NSF will continue to review approaches for improved evaluation of the impact programs have in achieving increased participation of under-represented groups outside the agency. Current program announcements ask proposers to address how the activity they propose will impact diversity in the science and engineering workforce.

NSF provides a relatively small investment in the overall federal investment to develop the national science and engineering workforce. Achieving this Outcome Goal in the long-term implies a gradual change in process and philosophy of educating the scientific, engineering, and technological community. A commitment on the part of institutions and their faculties to enhance the diversity of the science and engineering workforce and to provide a broader range of educational opportunities is needed to meet this goal.

FY 2000 EXAMPLES[6] OF ACHIEVEMENTS CITED BY EXTERNAL EVALUATORS

OUTCOME GOAL 3

A DIVERSE, GLOBALLY-ORIENTED WORKFORCE OF SCIENTISTS AND ENGINEERS

External evaluators cited the following examples of results from NSF as demonstrating the criteria for success in support of Outcome Goal 3. Noteworthy examples taken from committee reports have also been selected to demonstrate results in FY 2000 areas of emphasis that include integrative research and education opportunities, and participation of under-represented groups in integrative research and education.

These examples have also been selected to show that participants in NSF activities experience world-class professional practices in research and education, using modern technologies and incorporating international points of reference; that academia, government, business, and industry recognize their quality; and that the science and engineering workforce has shown increased participation of under-represented groups. In some examples, the diverse portfolios of awards show potential for significant impact in many of these areas.

- **PROJECT LEARN** The Laboratory Experience in Atmospheric Research (LEARN) is a four-year teacher enhancement project targeted at 5th through 8th grade science teachers from rural schools in Colorado. LEARN is comprised of two major components: a summer workshop and 3 days of in-district training. Between October and April, LEARN staff, NSF-supported scientists and science educators from the Science Discovery Program at the University of Colorado traveled to rural regions and conducted three, full-day, hands-on training programs for up to 21 teachers in each region. The training days drew 299 teachers from eight rural regions. For the first day, Science Explorers, 142 teachers participated as a team with five of their students in a full day of hands-on activities. Additionally, 41 teachers from an urban district also participated in Science Explorers in conjunction with LEARN. This brought the total number of students in attendance to 915. The teachers returned to their classrooms with written curriculum, material kits, and very excited students to help them teach the content and activities to the rest of the class.

- **COMPUTATIONAL GEOMETRY** Two NSF-supported research groups at Smith College, an undergraduate women's college, conducted research with undergraduates in computational geometry. One group discovered a combinatorial structure that underlies all planar linkages (bar-and-joint frameworks), a wide class of mechanisms that play an important role in robotics. The other group released the first public program for finding the shortest paths on a polyhedral surface from one source point to all vertices that may be useful in medical applications (to flatten brain maps), robotics (for navigation over rough terrain), and manufacturing (to unfold 3D shapes for planar cutouts).

[6] Additional examples may be found in Appendix XIV.

- **MENTORING FOR SUCCESS** NSF supports activities designed to expand opportunities for women, minorities, and persons with disabilities in all areas including computer and information science and engineering. Among its most successful projects is the Distributed Mentor Project. A longitudinal evaluation by the Center of the University of Wisconsin shows the Distributed Mentor Project (DMP) to be successful at meeting its primary goal of increasing the number of women entering graduate school in computer science and engineering (CS&E). Using a Baccalaureate & Beyond study conducted in 1994 as a comparison, the best male CS&E graduates were 10 times more likely to enter graduate or professional school within one year of graduation than the best female CS&E graduates. The figure for men being 29.19% of graduates, for women being 2.53% of graduates. Of the DMP participants, over 50% were enrolled in graduate or professional school the year following their graduation. In both cases the surveys considered only graduates with GPA's greater than or equal to 3.5. In each of these past years, approximately twenty-five undergraduate women have participated in the research and mentoring activities of the DMP with resounding success.

- **TOOLS THAT ENABLE** A variety of new tools have been developed which enable the learning of science and mathematics by persons with disabilities. Included are:
  - A three-dimensional, tactile model of the periodic table with Braille labels;
  - Documented instructions for accessible chemistry laboratory assignments placed on the World-Wide-Web;
  - CD-ROM-based accessible interactive math instructional games; and
  - A prototype graphical calculator for blind students using a force-feedback mouse.

- **ENGAGING DIVERSITY** An example of an approach to engage diverse students with differing scientific and technological ideas and techniques is used by a center in microelectronics that with collaborators from industry and in cooperation with the Semiconductor Industry Association. The center prepared 100 teaching models in 19 clusters using virtual reality and CD-ROM interactive teaching. It has seen a 50% increase in Hispanic population participation.

- **ENABLING THE DISADVANTAGED** An international project has enabled U.S. students from economically disadvantaged backgrounds and from under-represented groups to participate in an Organization of Tropical Studies (OTS) ecology course in Costa Rica. The students were exposed to hands-on, field-oriented research, and the international experience was a first for many of them. While some of the students had no prior familiarity with scientific research outside of a laboratory, and some were initially tentative about exploring the tropical forest and engaging in hands-on research, by the end of the course they had not only learned from their experience but also felt that the course was academically enriching and had provided an opportunity for personal growth.

OUTCOME GOAL 4

IMPROVED ACHIEVEMENT IN MATHEMATICS AND SCIENCE SKILLS NEEDED BY ALL AMERICANS

Proficiency in essential skills such as reading, and the understanding of basic concepts in mathematics and science, will be critical to the earning power of individuals and to the nation's economic competitiveness and quality of life in the 21st century. NSF is the only agency that directly aims at developing such proficiencies at all levels of education. Our activities set the stage for improved education in science and mathematics, both formal and informal, and lead to improved achievement in essential skills on the part of all Americans over time.

Achievement in mathematics and science skills is most directly dependent on the educational systems, both formal and informal, that impart such skills to those who need them. NSF exerts influence on these systems through support of new models for education, teacher preparation and enhancement, development of instructional materials and learning technologies, and support for standards-based education at all levels. But it is the educational systems – the schools, academic institutions, museums, and other organizations that comprise them – that are the implementers. The political constraints and budget stringency's they face will have an impact on their implementation that NSF can neither predict nor control. NSF programs influence educational systems and the public that supports them, but are only one influence among many.

The FY 2000 government-wide performance plan contains a performance goal that is related to NSF's systemic activities in K-12 education. At the start of the decade, NSF initiated major programs for the systemic reform of science, mathematics, engineering, and technology education. Based on the belief that all students can learn and achieve in science and mathematics at much higher levels than then obtained, systemic projects treat whole systems and build much-needed educational capacity at state, urban, rural, school district, and school levels. These projects are unique in their reliance on broad partnerships and development of comprehensive goals, solutions, and actions.

Two quantitative subgoals (4.b and 4.c) are included as areas of emphasis for this Outcome Goal. Both subgoals are continued from FY 1999 and will be maintained in FY 2001.

PERFORMANCE GOAL 4.a

NSF's performance toward this outcome goal is ***successful*** if NSF awards lead to:

- the development, adoption, adaptation, and implementation of effective models, products, and practices that address the needs of all students;
- well-trained teachers who implement standards-based approaches in their classrooms; and
- improved student performance in participating schools and districts.

NSF's success towards meeting this goal is judged by external independent experts.

PERFORMANCE INDICATORS

Models and practices to improve achievement, teacher training, teacher classroom work, and student achievement.

FY 1999 RESULT:

THIS GOAL WAS ACHIEVED.

BASELINE

Preliminary efforts in FY 1997 and FY 1998 to pilot the use of expert judgement in performance assessment either did not address this performance goal or did so in the context of a small base of program activity.

FY 2000 RESULT:

IN THE AGGREGATE, NSF WAS JUDGED SUCCESSFUL IN A LIMITED CONTEXT: THIS GOAL WAS NOT FULLY ACHIEVED OVERALL BUT NSF WAS SUCCESSFUL WHERE PROGRAMS HAD CLEAR OBJECTIVES DIRECTED TOWARD THIS GOAL.

PERFORMANCE GOAL 4.b

Over 80 percent of schools participating in a systemic initiative program will:

(1) implement a standards-based curriculum in science and mathematics;
(2) further professional development of the instructional workforce; and
(3) and improve student achievement on a selected battery of tests, after three years of NSF support.

In 1999, 40 NSF-sponsored projects implemented mathematics and science standards-based curricula in over 81 percent 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 on a battery of system-selected assessment instruments.

FY 1999 RESULT:

THIS GOAL WAS ACHIEVED.

In FY 2000:

- Three major systemic initiatives implemented mathematics and science standards-based curricula in over 80% of the 7,630 participating schools.
- The systemic initiatives furthered professional mathematics and science development in over 90% of 7,630 participating schools.
- The systemic initiatives reported improved student achievement in mathematics 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 three years.

FY 2000 RESULT:

THIS GOAL WAS ACHIEVED.

PERFORMANCE GOAL 4.C

Through systemic initiatives and related teacher enhancement programs, NSF will provide intensive professional development experiences annually for at least 65,000 precollege teachers.

FY 1999 RESULT:

THIS GOAL WAS ACHIEVED.

In FY 1999, systemic initiatives and related teacher enhancement programs provided intensive professional development to a total of 82,400 teachers, exceeding the goal of 65,000.

FY 2000 RESULT:

THIS GOAL WAS ACHIEVED.

In FY 2000, NSF awards provided intensive professional development (60 hours or more) to a total of 89,723 teachers, exceeding the goal of 65,000 for the second year.

COMPARISON OF ACTUAL PERFORMANCE WITH PROJECTED PERFORMANCE

Activities important to achieving success toward this goal include systemic approaches, attention to teacher preparation and development, partnership with other agencies, digital libraries, graduate teaching fellows as content resources in K-12 schools, and developing a strong research base for use by practitioners.

NSF works toward this Outcome Goal by using the merit review process to make awards for research and education activities that influence math and science achievement, both directly and indirectly, and by funding proposals that show potential to improve achievement in mathematics and science skills.

In the aggregate, when this goal was a clear objective of the programs being evaluated and when there was sufficient information available to carry out the evaluation, most reports indicated NSF programs were successful in achieving this goal. However, external evaluators were uncertain how to assess performance where programs did not have funds directed to these objectives, resulting in an assessment of less than successful or no assessment in many reports.

In aggregating results and using reports with substantive comments and ratings which were clearly justified for each area, we find NSF's performance toward this goal was judged as successful or successful in a limited context by a majority of external evaluators, and therefore, we describe this result as *successful in a limited context*, and report it to be not fully achieved in the aggregate in FY 2000.

For FY 2000, evaluators were asked to judge whether programs being evaluated were successful or not in meeting the FY 2000 performance goal and indicators. In arriving at an aggregated assessment, it is very likely that programs with objectives focused primarily in the areas of this goal are more successful in meeting this goal for these indicators than is indicated by the FY 2000 result statement of "not achieved". However, there remains disagreement among external evaluators as to the overall success of meeting the broad Outcome Goal as it pertains to "***all*** Americans".

Many external evaluators view this goal as primarily relevant to NSF's educational activities, and therefore tended to rate it only when evaluating educational programs. A significant fraction of COV reports indicate that the goal was not met because this goal was not a priority objective for many programs. Many reports do not rate this goal because the experts stated that the goal did not apply to the programs and there was no information provided on which to evaluate performance. Several reports give no comment at all.

For those reports which gave ratings of "not successful" the comments of experts indicate the reasons for lack of success are lack of relevance of this goal and that few of the awards are intended to focus on educational development; hence they do not contribute to the achievement of this goal. Those ratings are not automatically used in tabulating results overall. In one report covering several programs, the experts indicate that the programs were *minimally effective* in achieving the goal, and yet are able to cite examples of success relevant to achieving the goal. One report indicates that although they were aware of activities aimed to address this goal which could be evaluated, they could not locate data, and recommended that the staff summarize such efforts in the future.

In effect, many of the programs evaluated did not provide clear evidence of support for the objectives of this goal, external evaluators had difficulty in providing a qualitative assessment, and success across the agency is not apparent based on COV and AC reports. This goal is difficult to evaluate as it is written, in part because the specific activities referenced by the indicators are not widespread across all programs. NSF is reviewing the components of this goal for FY 2001 and FY 2002, to develop appropriate indicators more directly within the agency's control.

COMPARISON FY 1999 – FY 2000

This goal was continued from FY 1999, and includes two quantitative subgoals achieved this year and also in FY 1999. In FY 1999, this Outcome Goal was stated using two levels of achievement: *successful* and *minimally effective*, with indicators for each level. Based on comments from COVs and ACs in FY 1999, it was determined that the definitions for the *minimally effective* level of performance did not provide additional information in evaluating the programs.

In FY 2000, a single definition for the *successful* standard was used as the target level of performance, and a stricter definition of allowed success was applied, which required clear

justification of ratings in reports. The overall result in FY 2000 is similar to that obtained in FY 1999, even though the evaluation was carried out on a different subset of NSF's portfolio by a different group of external experts. In following stricter guidelines for definitions of success in FY 2000, we are reporting this goal as "not achieved", as opposed to "achieved" as we did in FY 1999.

STEPS TO MEET THIS GOAL IN THE FUTURE

Although NSF has a significant focused effort in mathematics and science education, NSF provides very little of the overall investment in K-12 education. Meeting the performance goal implies a commitment on the part of school districts, schools, and their faculty to modifying their approaches to education in order to enhance achievement; it is also very dependent upon the availability of resources to do so.

Results obtained in FY 1999 and FY 2000 have led NSF to refine this goal and to identify ways to improve data/information collection to assess progress by tracking contributions in achieving this goal more effectively.

The goal and indicators will be modified to clarify applicability of this goal to programs being evaluated in FY 2001. The reporting template used by external evaluators to assess programs will be improved to gather better information on achievement of programs for which this goal is relevant in order to gain a better understanding of performance. COVs have recommended that some NSF programs develop plans to address this goal more fully in future years and some action has been taken.

FY 2001 AND BEYOND

This goal will be incorporated under a new Strategic Outcome Goal heading for FY 2001 which rearranges NSF's five Outcome Goals into three broad Strategic Outcome areas: People, Ideas, and Tools. A table depicting the structural rearrangement is shown in Section VIII of this report, "*Transition to FY 2001 and Beyond*." The quantitative subgoals will be maintained in FY 2001 as subgoals of the People Strategic Outcome Goal.

The change to People, Ideas and Tools improves alignment of NSF's goals with its mission and allows closer agreement between budget categories and NSF's Strategic Plan. This Outcome Goal will be restated to avoid mixing goal objectives, under the People Strategic Outcome area in FY 2001. It will also be contained under a new category in FY 2001, described as "Broadening Participation". This is included in the description of NSF's Investment Process Goals contained in the FY 2001 Performance Plan.

FY 2000 EXAMPLES[7] OF ACHIEVEMENTS CITED BY EXTERNAL EVALUATORS

OUTCOME GOAL 4

IMPROVED ACHIEVEMENT IN MATHEMATICS AND SCIENCE SKILLS NEEDED BY ALL AMERICANS

External evaluators cited the following examples of results from NSF awards as demonstrating the criteria for success for Outcome Goal 4. Noteworthy examples taken from committee reports have also been selected to demonstrate results in FY 2000 areas of emphasis, which include K-12 systemic activities; research on learning and education; graduate teaching fellows in K-12 education; and K-16 digital libraries.

These examples are also shown to illustrate how NSF awards have led to the development, adoption, adaptation, and implementation of effective models, products, and practices that address the needs of all students; well-trained teachers who implement standards-based approaches in their classrooms; and improved student performance in participating schools and districts. The diverse portfolios of awards show potential for significant impact in many of these areas. NSF considers many of the K-12/16 activities listed to be of interest to students to engage them at an early state in their education in science, mathematics and computer science. Early involvement is extremely important for retaining students in science and engineering.

- High Quality Instructional Materials for both teachers and students are benefiting from discoveries related to teacher and student learning. Professional development for teachers is now viewed as a continuing process that is tailored to the needs of the adult learner. The work of NSF-supported projects have shown that site administrators and parents must also be part of the professional development process.
  - The *Hands-on Universe* project empowers teachers to use research-quality astronomical tools (remote telescopes, and software) in their classrooms with students. Last year, students in Massachusetts discovered a new asteroid in the Kuiper Belt. The announcement of their discovery and its confirmation made news worldwide. Two years ago, a different group of students using these tools discovered a supernova.
  - *Pattern Exploration* seeks to integrate mathematics and science using the new ideas of fractal geometry. Materials used in this teacher enhancement project were derived from two previous NSF-funded projects and help teachers deepen their understanding as well as their ability to use hands-on materials and software with their students to make patterns in nature visible.

[7] Additional examples may be found in Appendix XIV.

- Results may come from large-scale national centers or close-to-home, small-scale experiments that enable teaching and learning of scientific and technological ideas. A few examples of results derived from advanced technological education projects include:
  - The use of computer animation to visualize magnetic and other fields of force, to assist student understanding of complex physical concepts;
  - Centers that create and serve as depositories and disseminating agents for best techniques in technician education and industry practice, and have engaged in ground-breaking biological, telecommunications, semiconductor and marine discoveries; and
  - The adaptation, by an undergraduate program, of a sophisticated university field-based course on watershed management for teacher certification in environmental studies.

Systemic reform projects have leveraged the products and expertise developed by NSF awardees.

- Over the first six years of the Chicago Urban Systemic Initiative (USI) the percentage of fourth grade students meeting Illinois State Standards in science increased from 46 to 66.

- For the San Antonio USI, the average scores of African-Americans in grade 4 on the Texas Assessment of Academic Skills increased by 32 percentage points over four years, and those of Hispanic students by 39 percentage points, compared to a 16 percentage point increase for Texas fourth-graders overall.

- In the New York City USI, students in grades 3-8 scoring at or above grade level in mathematics on the California Achievement Test improved from 49% to 63% over a five-year period.

- Noticeable gains on the Texas Assessment of Academic Skills (TAAS) were evidenced for students in classrooms of K-8 teachers who received one or more years of professional development through the Austin Collaborative for Mathematics Education. The most dramatic gains were made by African American, Hispanic and economically disadvantaged students, reducing the performance gap with majority students.

- Recent findings from research studies indicate that NSF-supported efforts are decreasing disparities in student achievement across socioeconomic levels and identifiable populations. An evaluation conducted by the Wisconsin Center for Educational Research, showed evidence in a preliminary analysis of National Assessment of Educational Progress (NAEP) data that grade 8 mathematics achievement by African American students in Statewide Systemic Initiatives (SSI) states improved and exceeded the achievement in non-SSI states from 1990 to 1996.

Research on Learning and Education was given high priority in the report of the President's Committee of Advisors in Science and Technology on the Use of Technology to Strengthen K- 12 Education in the United States (March 1997). NSF, in partnership with the Department of Education, has built on past investments in this area in FY 1999 and continued joint activities in FY 2000. The NSF portfolio of awards has led to the development of an extensive array of tools, models, products and practices that address the needs of all students.

- NSF awards have created tools and resources to increase the assessment of science and mathematics learning, provide evidence on the quality of professional development, and enhance the capacity of professional developers. For example, *TECH-STAT*: Teaching Statistics Grades 1-6, a statewide implementation project in North Carolina, has developed both professional development manuals for teachers and statistics modules for students. Professional development materials are designed around the use of performance assessments to inform and strengthen classroom instruction.

- Informal science education programs–through variety of media–reach over 150 million viewers yearly. For example, *The World We Create*, an exhibit at the Louisville Science Center, features 40 hands-on science activities and over 400 graphic panels highlighting science careers, inventors, and problem solving strategies. From 1997-2000, the exhibit and associated programs reached almost 1.5 million visitors, nearly one-third the population of the rural state of Kentucky.

- Projects for developing professional materials produce printed materials as a major item but now include materials that require use of video as well as regular and on-line computer technologies (e.g., CD-ROMs, listserve, other software). Some examples are:
  - *Telemonitoring*–An Online Model to Sustain Professional Development in Science, Math, and Technology for Grades K-12.
  - *Developing Mathematical Ideas, and Problem Solving in the Sciences*–An Innovative Software Approach (IMMEX), is introducing secondary teachers to techniques and analyses using software developed for medical schools to teach problem-solving and monitor student and class mastery of concepts.
  - *Science K-6–Investigating Classrooms* has developed a library of videotapes and supporting print materials to illustrate the effective application of the National Science Education Standards in K-6 classrooms.
  - Teaching modules distributed by the American Chemical Society to secondary schools. They range from teaching the chemistry used in the carbonated beverage industry to treating waste-water. The modules have been field tested in 21 states by 58 teachers with 2200 students.

OUTCOME GOAL 5

TIMELY AND RELEVANT INFORMATION ON THE NATIONAL AND INTERNATIONAL SCIENCE AND ENGINEERING ENTERPRISE

NSF's provision of information on the national and international science and engineering enterprise is a customer-oriented activity. The performance goals for this activity aim for improved quality through enhanced *timeliness* and enhanced attention to *data quality* measures.

NSF's role in providing information on the science and engineering enterprise is important to assessing the health of the science and engineering enterprise and to the development of appropriate national policies. One such assessment is the report of the National Science Board to Congress of indicators on the state of science and engineering in the United States. Also, a number of long-running series of data provide a detailed picture over time of trends in areas such as federal and private sector funding of research and development and the science and engineering workforce. Such information on the national science and engineering enterprise is complemented by parallel studies of patterns in other nations. The types of information required by policy makers change over time, and NSF must ensure that studies addressing new types of data are incorporated as needed.

In order to ensure that it efficiently provides meaningful information on the science and engineering enterprise, NSF consults with users of the information to determine their needs for effective policy development, modifying existing studies, or adding new ones where feasible. NSF maintains long-standing time series of information that permit users to discern trends. NSF enhances connections with organizations gathering information on science and technology in other countries. NSF expands the analysis of the impact of science and technology on America's economic progress and quality of life. NSF increases the efficiency and timeliness of the data gathering and reporting processes, and increases the accessibility of data to users.

This Outcome Goal is quantitative. The alternative form is not used for this goal and it is not assessed by COVs.

TIMELINESS

In a recent survey, a sample of the science and engineering policy community indicated that improving timeliness of data was a high priority for them. Data collected either refer to a specific date, such as salary as of April 15 or fall enrollment as of October 15, or to a period of time, such as a calendar or fiscal year. The reference date in the latter case is calculated as the last day in the period. The time between the reference date and the first public release of data

from each of eleven major surveys is calculated, and then an average is taken across all surveys over a two-year period. Data are maintained by the Science Resource Studies (SRS) Division.

Means for achieving success: Taking advantage of advances in information and communications technologies; and regular reporting of status to give ample time to take action to improve performance.

PERFORMANCE GOAL 5.a

Maintain FY 1999 gains in timeliness for an average of 486 days as the time interval between reference period and reporting of data.

PERFORMANCE INDICATORS

Average time interval between the reference period and reporting data from SRS surveys.

RESULT:

THIS GOAL WAS ACHIEVED.

	FY 1995-96	FY 1999-2000
Baseline	540 days	
Goal		486 days
Actual		461 days

DATA QUALITY

The value of information on the science and engineering enterprise is highly dependent on its ability to address issues of importance to those who seek to use it in making policy decisions. Measures of data quality help users determine the reliability of the information and the extent of likely variance introduced by sampling processes. This goal replaced a related FY 1999 performance goal which dealt with customer measures of relevance. Data quality is one factor in addressing relevance.

Means for achieving success: NSF staff developed a standard set of data quality measures that are now in place. Procedures were established to ensure that appropriate information is provided electronically for all surveys.

PERFORMANCE GOAL 5.b

Establish a standard set of data quality measures for reporting of Science Resources Studies (SRS) products. Prepare reports on these measures for all SRS surveys and publish them in electronic formats to inform users of SRS data quality.

PERFORMANCE INDICATORS

Data quality measures and their use in SRS products.

RESULT:

THIS GOAL WAS ACHIEVED.

BASELINE

This is a new effort to provide standard measures. Their absence has placed limits on the usefulness of surveys.

Data quality measures were developed by SRS after conducting a thorough review of the written data quality standards for surveys conducted by other statistical agencies such as the National Center for Education Statistics, the Energy Information Administration, and the National Center for Health Statistics. A general literature review was also conducted, especially of material developed by the Office of Management and Budget's Federal Committee on Statistical Methodology (OMB/FCSM). Based on this research and analysis, a relevant set of measures was chosen as the standard set of quality measures for SRS surveys.

DATA QUALITY MEASURES

a. SAMPLING VARIABILITY
b. COVERAGE
c. NON-RESPONSE
   (1) UNIT NON-RESPONSE
   (2) ITEM NON-RESPONSE
d. MEASUREMENT

A standard format for reporting the data quality measures was developed. For each on-going SRS survey, the information on data quality measures, critical for the user to know for proper use of the survey data, was organized into the standard reporting format. These data quality reports were placed on the SRS web site and linked to the other information available for each SRS survey (http://www.nsf.gov/sbe/srs/ssdr/start.htm).

FY 2001 AND BEYOND

This goal will not be continued in this form in FY 2000. The goal has been redefined for FY 2001 to reflect the requirements established under the NSF Act of 1950. For FY 2001, NSF's five Outcome Goals are rearranged into three broad Strategic Outcome areas: People, Ideas, and Tools. A table indicating the change is shown in Section VIII, "*Transition to FY 2001 and Beyond.*" The rearrangement into the three areas improves alignment of NSF's Outcome Goals with its mission and allows closer agreement between budget categories and NSF's Strategic Plan. This topic will be addressed by a new area described as the Tools Strategic Outcome area in FY 2001.

B. MANAGEMENT GOALS AND RESULTS

FOCUS ON MANAGEMENT

NSF's Management Goals address the Foundation's administrative, operational and policy objectives. Excellence in managing the agency's activities is the key to achieving successful performance for all of NSF's goals. NSF's six Management Goals for FY 2000 address three issues of high priority in the Foundation – staff training, staff diversity, and how well advanced technology is being incorporated into NSF business operations. Five are continuations of goals previously established, with more stringent performance indicators. The new Management Goal included this year is reflective of our desire to more fully integrate technology into the core activities of the Foundation. Four factors are especially critical to successful management at NSF:

CRITICAL FACTORS

- **OPERATING A VIABLE, CREDIBLE, EFFICIENT MERIT REVIEW SYSTEM;**
- **EXEMPLARY USE OF AND BROAD ACCESS TO NEW AND EMERGING TECHNOLOGIES;**
- **A DIVERSE, CAPABLE, MOTIVATED STAFF THAT OPERATES WITH INTEGRITY; AND**
- **IMPLEMENTATION OF MANDATED PERFORMANCE ASSESSMENT AND MANAGEMENT REFORMS IN LINE WITH AGENCY NEEDS.**

These critical factors are used in developing annual performance goals in the following performance areas: electronic proposal submission and processing; staff diversity; technological capability of staff through training; Y2K compliance; and use of electronic systems for project reporting. Results for the Management Goals, most of which have quantitative measures, are prepared and reviewed by NSF staff. They are presented below by area of performance.

SUMMARY OF RESULTS FOR MANAGEMENT GOALS

Five of NSF's six Management Goals were achieved in FY 2000. Areas identified as showing improvement include orientation and training of NSF staff using FastLane – NSF's electronic system for proposal submission, proposal review, and project reporting; and increasing the use of the electronic Project Reporting System for project reporting by awardees. The one Management Goal which was not achieved involves the technological capability to submit, review, and process proposals electronically. Complex issues in establishing protocols for electronic signature prevented this goal from being achieved. NSF piloted two models for electronic certification of proposals and is currently assessing which model will best serve the agency and its customers. NSF engaged an outside accounting firm to verify the data systems for most Management Goals.

PERFORMANCE AREA: ELECTRONIC PROPOSAL SUBMISSION

The research and education communities have worked with NSF staff to build FastLane, our Web-based interface with grantee institutions. Each FastLane module has gone through a phase of expanding use. The most complex use of FastLane is for the submission of full technical proposals. NSF is the only federal research agency currently receiving proposals electronically on a production basis. In fact, effective FY 2001, electronic proposal submission is required by NSF, except in special cases.

MANAGEMENT GOAL 1

In FY 2000, NSF will receive and process at least 60% of full proposal submissions electronically through FastLane.

PERFORMANCE INDICATOR

Percent of full proposal submissions received electronically through FastLane.

	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Baseline	4.4%	17%			
Goal			25%	60%	95%
Actual			44%	81%	

RESULT:

THIS GOAL WAS ACHIEVED.

FastLane is a collection of electronic system modules that allows all transactions and communications between NSF and its grantees to be facilitated via the Internet. Under development since 1994, FastLane plays a major role in NSF's goal of achieving a paperless environment by the end of FY 2001. This ambitious goal was continued from FY 1999, and based on real-time results was revised in FY 1999 and FY 2000. The goal will be continued in FY 2001, with the target level of performance increased based on expectations and actual performance in FY 1999 and FY 2000.

In FY 2000, a total of 25,160 proposals were received and processed through FastLane. This is 81% of the full proposal submissions, which totaled 30,932. The success of this goal can be attributed to an aggressive outreach strategy combined with the efforts of a *Helpdesk*, a staffing resource designed to provide external customers with assistance. More than 35,000 requests for assistance were received by the *Helpdesk*, of which approximately 90% were related to proposal preparation and submission.

In September 2000, the NSF Director issued Important Notice 126 to the presidents of universities and colleges and the heads of other NSF grantee institutions to reaffirm that effective October 1, 2000, specified transactions with NSF must be accomplished electronically

via use of the FastLane system. The Important Notice is posted on http://www.nsf.gov/pubs/2000/iin126/iin126.htm.

IMPLICATIONS FOR FY 2001

FastLane continues to be rapidly accepted among our external customers for proposal submission. A significant number of program initiatives required the submission of proposals in FastLane in FY 2000. Virtually all programs will require FastLane submissions in FY 2001.

For FY 2001, the goal is being raised to 95% of full proposal submission. This equates to full implementation, and is consistent with the requirement specified in Important Notice 126 (see above). This percentage recognizes that some universities, colleges, or persons with disabilities, may experience difficulties in transmission, and others may not have the technical capability to submit electronically to NSF.

PERFORMANCE AREA: ELECTRONIC PROPOSAL PROCESSING

Current NSF practice is to use paper processing to review and process proposals. NSF's goal is to move to full electronic processing eventually eliminating internal paper processes currently in use.

MANAGEMENT GOAL 2

By the end of FY 2000, NSF will have the technological capability of taking competitive proposals submitted electronically through the entire proposal and award/declination process without generating paper within NSF. This was a new goal in FY 2000.

PERFORMANCE INDICATOR

Technological capability for a paperless process.

RESULT:

THIS GOAL WAS NOT ACHIEVED.

In order to enhance operational efficiency, NSF instituted requirements for electronic submission of grant proposals. Upon receipt, proposals are distributed to the appropriate office for administrative processing and peer review. Recommendations are prepared by NSF staff, funding decisions are made and award/declination letters are prepared for the approximately 30,000 proposals submitted annually. Historically, NSF required paper submission once grant proposals were submitted electronically. Efforts to modernize this process have been underway for several years. The goal is to move to electronic processing for the entire internal review and award/decline process.

At the start of the year, only four functions within the peer review process were still paper-based, namely: communications between NSF and the peer reviewer; electronic panel review system; letters to principal investigators (PIs) with declined proposals; and release of review results to PIs. By the end of the year, the technological barriers to a completely paperless process were removed within NSF, except for one remaining issue, i.e., the electronic equivalent of a signature for funding approval by NSF.

IMPLICATIONS FOR FY 2001

Two electronic signature pilot projects were initiated during the FY 2000. The results are being evaluated in FY 2001 to determine which approach will best serve the agency and its customers. Technological, financial, and legal issues still need to be resolved before electronic signatures can be fully adopted. NSF will continue to address these issues in FY 2001. In addition, we will make use of the technological capabilities established in FY 2000 to initiate pilot projects that demonstrate the paperless review capability. The FY 2001 goal for NSF is to conduct 10 pilot paperless projects that manage the review process in an electronic environment.

PERFORMANCE AREA: STAFF DIVERSITY

In order to increase the diversity of the U.S. science and engineering workforce, it is particularly important that program officers at NSF exemplify that diversity. As might be expected from national workforce trends, the science and engineering staff at NSF show the highest levels of under-representation of women, minority groups under-represented in the science and engineering careers, and persons with disabilities. During FY 2000, NSF concentrated on increasing the number of applicants from under-represented groups in its science and engineering (S&E) job applicant pool. In the coming year, NSF will continue these efforts, but has changed the indicator and goal to be more measurable.

MANAGEMENT GOAL 3

In FY 2000, NSF will show an increase over 1997 in the total number of hires to Science and Engineering positions from under-represented groups. This was a new goal in FY 2000, based on a revised FY 1999 goal.

PERFORMANCE INDICATOR

Efforts to sufficiently attract applications from members of under-represented groups in order to increase the numbers hired.

BASELINE:

Of S&E hires in 1997, 16 were female and 15 were from under-represented minority groups.

RESULT:

THIS GOAL WAS ACHIEVED. OF THE 113 S&E EMPLOYEES HIRED IN FY 2000, 39 WERE FEMALE AND 19 WERE MINORITY.

In order to ensure that the United States maintains its world leadership role in science and technology, the Nation must maintain a first-class cadre of scientists, mathematicians, and engineers from all segments of society. NSF is committed to diversifying its staff of scientists and engineers both in permanent positions and in the important rotating scientist positions.

During FY 2000, NSF engaged in a number of activities to increase the numbers of minorities in the S&E staff. These activities included:

- Requiring a diversity recruitment plan from each directorate and requesting a year-end report on their activities;
- Advertising specific vacancies in minority-serving magazines, institutions and professional associations;

- Attending job fairs that attract minority and female participants; and
- Requiring written justifications from selecting officials regarding their outreach activities and selection process.

Additionally, hiring information is displayed on the NSF GPRA homepage to assist managers in addressing under-representation. This information includes demographics of the current S&E workforce, statistics on the availability of minorities and women in the S&E labor pool, and the numbers of hires from under-represented groups.

IMPLICATIONS FOR FY 2001

NSF will maintain this goal in FY 2001. In addition to increasing emphasis by the Director's office, NSF will increase its recruitment presence at major program workshops and seminars, target recruitment material towards under-represented groups, and create a registry for minorities interested in serving on NSF advisory committees and panels. These committees and panels serve as a major resource for recruiting visiting scientists and engineers for the Foundation. NSF management will continue to emphasize diversity hiring practices, diversity pool statistics will be stressed at management sessions, and merit promotions will be reviewed at the senior executive levels.

PERFORMANCE AREA: CAPABILITY IN USE OF ELECTRONIC PROPOSAL/AWARD JACKETS - FASTLANE TRAINING

Electronic communication is changing the character of work for support, administrative, and science and engineering staff. Everyone at NSF must have good computer skills and be able to master new ones on a continuing basis. Since so much of the Foundation's business will be done through FastLane in the future, our training goal for FY 1999 focused on that system and was revised for FY 2000. Once the technological capability is in place for managing the entire proposal and award/declination process electronically, we will need trained staff to implement these paperless processes. In order for NSF to successfully implement the FastLane system it is essential that staff be oriented and properly trained.

MANAGEMENT GOAL 4

By the end of FY 2000, all staff will receive an orientation to FastLane, and at least 80% of program and program support staff will receive practice in using its key modules.

PERFORMANCE INDICATOR

Proportion of relevant staff trained (Orientation or Training)

Orientation	FY 1999	FY 2000
Goal	100%	100%
Actual	80%	100%

Training	FY 1999	FY 2000
Goal	95%	80%
Actual	43%	90%

RESULT:

THIS GOAL WAS ACHIEVED.

By the end of FY 2000, 100% of NSF staff had received an orientation to FastLane and 90% of program and program support staff had received practice in using its key modules**.**

As the use of FastLane continues to grow, it is critical that all staff are oriented to FastLane and other electronic systems. Through a series of ongoing formal classes, extensive individual and group training, distribution of informational materials, and the persistent efforts of NSF staff, NSF achieved this goal this year.

By the end of FY 2000, all 1,239 staff members (100%) on-board as of July 1, 2000 received an orientation to FastLane. For program and program support staff, 698 of 777 (90%) received practice in using its key modules.

The formal FastLane training program, initiated in FY 1998, continued through FY 2000. Approximately 40 FastLane classes were conducted during the year, with announcements posted on the training bulletin board and on the internal electronic Announce channel. Based on user feedback, we are moving towards new electronic business classes. These are scheduled to begin in January 2001.

Training on request was also provided to organizational units. Users were allowed to take training at their workstations through on-line training services, and informational material on FastLane was developed and distributed to employees.

Throughout the year, training statistics were posted on the GPRA web page to help managers monitor their progress. In addition, the NSF Training System was modified to allow for the entry of short, no-cost training as a way of capturing some of the required training data. Data was provided to the directorates to ensure that the information in the system was accurate and to encourage divisions to schedule employees for training.

IMPLICATIONS FOR FY 2001

Because NSF relies on visiting scientist and engineer positions to maintain it's portfolio, staff turnover will remain high. Hence, FastLane orientation will continue to be an on-going process. Moreover, as existing modules are enhanced or new modules added, the curricula will be modified to ensure that staff stay current in the use of FastLane and other electronic systems. Additionally, we will continue our outreach efforts to increase the proficiency of PI's and grant administrators in using FastLane. Since existing staff have been fully trained and procedures have been put in place to ensure that new staff receive orientation and training, FastLane training will no longer be reported as a goal.

PERFORMANCE AREA: YEAR 2000 COMPLIANCE

In order to fully support its mission, NSF's information systems must be able to withstand the problems predicted for many systems at the turn of the century. Based on guidance from OMB, NSF developed and submitted a plan (May, 1997) for evaluating, correcting, and testing its systems. Quarterly updates showed that NSF was accomplishing its objectives.

MANAGEMENT GOAL 5

NSF will complete all activities needed to address the Year 2000 problem for its information systems according to plan, on schedule and within budget.

PERFORMANCE INDICATOR

Operation of systems.

All activities needed to address the Year 2000 problem were completed according to plan, on schedule and within budget. Due to inspection and modification of pre-existing information systems, NSF entered the year 2000 trouble free in regard to the operation of computer and other critical systems. This activity will no longer be reported as a goal.

RESULT:

THIS GOAL WAS ACHIEVED.

PERFORMANCE AREA: PROJECT REPORTING

Assessing results for NSF's Outcome Goals requires a more accessible database of project results than NSF has previously maintained. A new project reporting system was fully implemented at the start of FY 1999. During FY 2000, NSF continued to monitor the use of the system and the quality of the information gathered, and took appropriate steps to address problems, as they were identified.

MANAGEMENT GOAL 6

In FY 2000, at least 85% of all eligible project reports will be submitted through the new Project Reporting System.

PERFORMANCE INDICATOR

Percent of eligible project reports submitted through the new Project Reporting System.

Training	FY 1999	FY 2000
Baseline	59%	
Goal	70%	85%
Actual	59%	92%

RESULT:

THIS GOAL WAS ACHIEVED.

The Project Reporting System (PRS) is part of NSF's effort to use advanced technology to create a more efficient, paperless work environment, in which information is exchanged between the Foundation and its research and education customer community via the Internet. In its first two years of use, the PRS has provided a wealth of information that was previously not available electronically. This has lead to significant changes in how NSF responds to internal as well as external requests for information on the technical aspects of NSF awards.

An internal search utility allows NSF staff to search the reports based on a variety of criteria and isolate the award and/or report of interest. This is leading to profound changes in how NSF can respond to requests from Committee of Visitors, internal management, and the public on technical aspects of NSF awards.

During FY 2000, 8,949 final project reports were received, of which 8,269 (92.4%), were submitted through the PRS. The remaining 680 final project reports were submitted via paper or email.

In addition to final project reports, annual reports are submitted for those grants that are active. During FY 2000, 9,987 annual reports were submitted via FastLane. Information on annual project reports submitted via paper is not maintained in NSF's electronic systems, so data on annual reports is not included in this Management Goal. However, since annual and final project reports usually contain the same information and are submitted by the same Principal Investigators (PIs), we expect that the percentage of annual reports submitted through the PRS is comparable to the percentage of final reports.

Two NSF documents that provide guidance to applicants and institutions were revised to reference the new PRS: the NSF Grant Proposal Guide and the NSF Grant General Conditions. Both documents now reference the fact that PIs are required to submit reports electronically via the PRS in FastLane. Based on feedback received throughout the year, modifications to the PRS have been made. NSF will continue to enhance the system based on user feedback and policy changes, as resources allow.

In September 2000, the NSF Director issued Important Notice 126 to the presidents of universities and colleges and the heads of other NSF grantee institutions describing NSF's requirements for a paperless proposal and reporting system. The important notice is posted on http://www.nsf.gov/pubs/2000/iin126/iin126.htm.

IMPLICATIONS FOR FY 2001

During FY 2000, NSF received 92% of final project reports through the PRS. Recognizing that minor exceptions are allowed for older awards, this represents nearly full implementation. Since the PRS has been successfully implemented and is now fully utilized, project reporting will not be continued as a goal in the future. However, NSF will continue to emphasize the importance of using the PRS with our external community.

C. INVESTMENT PROCESS GOALS AND RESULTS

FOCUS ON INVESTMENT PROCESS

NSF's key strategy for success is the use of external merit review to make awards for activities that will impact research and education in mathematics, science, and engineering, both directly and indirectly. The heart of the investment process is competitive merit review by external peers, using two criteria established by the National Science Board. The scientists and engineers comprising NSF's program staff take NSF priorities and the advice of external reviewers into account in developing their portfolio of awards. Critical to the success of the investment process are the means and strategies for high quality proposal and award processes that support achievement of the Outcome Goals and meet customer expectations.

MEANS & STRATEGIES – CRITICAL FACTORS FOR SUCCESS

- Provide staff resources needed to manage proposal and award processes.
- Provide electronic information systems that support the processes.
- Provide administrative guidance/requirements that reflect the imperatives of high quality processes.
- Provide needed oversight of management to ensure that guidance and requirements are met.
- Provide needed operating expenses to ensure credible processes.
- Work with the science and engineering community to provide high quality external review of NSF proposals.

SUMMARY OF RESULTS FOR INVESTMENT PROCESS GOALS

Seven of NSF's 15 Investment Process Goals were achieved in FY 2000, seven goals were not achieved, and one goal did not apply to projects during FY 2000. Areas needing improvement include the implementation of both Merit Review Criteria by reviewers and program officers; making new program announcements and solicitations available at least three months prior to the deadline or target date; decreasing the time to decision to six months or less for 70% of proposals; and maintaining openness in the system to increase the percentage of awards for new investigators to 30%. NSF engaged an outside accounting firm to verify the data systems for most Investment Process goals.

INVESTMENT PROCESS GOALS

The Investment Process Goals address various aspects of NSF's awards process, such as the use of merit review and the need to keep the awards system open to new people and new ideas. These goals help to establish customer service standards for the agency. Examples include use of merit review and improved practices such as the time it takes to process a proposal. In addition, the facilities oversight performance goals relevant to the federal science, space and technology agencies, are included in NSF's set of Investment Process Goals. Results for the Investment Process Goals, most of which have quantitative measures, are prepared and reviewed by NSF staff. Investment Process Goal 2 is a qualitative goal expressed in the alternative form and evaluated by external experts (COVs and ACs). Results are presented and discussed according to performance areas: Proposal and Award Processes, Customer Service, Maintaining Openness in the System, Integration of Research and Education, Diversity, and Facilities Oversight.

PERFORMANCE AREA: PROPOSAL AND AWARD PROCESSES - USE OF MERIT REVIEW

NSF policy states that each recommendation for funding or non-funding of a proposal must be accompanied by at least three external merit reviews and a balanced discussion of those reviews. The average total number of reviews per proposal ranges between 5 and 9. Merit review of proposals that takes into account the quality of the proposed project and the potential for broader impact, is a critical component of NSF's decision-making process for the funding of research and education projects. The Foundation strongly believes that award selection based on a competitive merit review process with peer evaluation ensures that ideas from the strongest researchers and educators are identified. For the more than 29,400 competitive proposal decisions made in FY 2000, more than 46,000 external reviewers reviewed one or more proposals by mail, and more than 8,700 reviewers served as panelists. NSF annually prepares a report on the NSF Merit Review System, which is reviewed by the National Science Board.

INVESTMENT PROCESS GOAL 1

At least 90% of NSF funds will be allocated to projects reviewed by appropriate peers external to NSF and selected through a merit-based competitive process.

PERFORMANCE INDICATOR

Percent of NSF funds allocated to projects reviewed by appropriate peers external to NSF and selected through a merit-based competitive process.

Based on NSF's original goal, which included merit reviewed projects as a percentage of all NSF funding, the Foundation exceeded its goal of 90% for FY 2000. As in FY 1999, NSF allocated 95% of its funds to merit-reviewed projects. This goal was achieved in FY 1999 and maintained in FY 2000. It will be revised based on OMB revised definitions for FY 2001.

RESULT:

THIS GOAL WAS ACHIEVED.

Percent of project funding subject to merit review	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Baseline	89%	90%			
Goal*			90%	90%	85%**
Actual*			95%	95%	

***N.B.** Based on old OMB definitions. During FY 2000, the Office of Management and Budget revised the federal goal, stating that 70-90% of research and development funds should be awarded to merit reviewed projects. Under the new definition, federally-funded research and development centers (FFRDCs) and merit-reviewed scientific research with competitive selection and internal (program) evaluation will not be considered merit-reviewed. Taking into account the new definition, NSF has revised its goal for FY 2001 to 85%.

*****Based on the most recent definitions from OMB, the revised percent of project funding subject to merit review is:***

FY 2000 Goal	**80% (est.)**
FY 2000 Result	**87%**

PERFORMANCE AREA: PROPOSAL AND AWARD PROCESSES - IMPLEMENTATION OF MERIT REVIEW CRITERIA

Implementation of the merit review criteria is an important goal in the proposal selection process and is critical for ensuring that the best projects are supported. In FY 1998 the National Science Board reviewed the NSF merit review criteria and established two revised criteria in accordance with the NSF Strategic Plan. The two merit review criteria, which took effect in early FY 1998, are designed to weigh a proposal's quality and broader impact relevant to NSF's goals through expert evaluation of the proposal's technical merit, creativity, educational impact, and potential benefits to society. The use of *both* criteria (quality and impact) by both expert reviewers and program staff is an important step in the NSF investment process to ensure realization of NSF's broader goals.

To evaluate NSF's progress in meeting this goal, external committees are asked to assess the use of the two merit review criteria by reviewers and program officers. The results of the assessment are described below using the alternative form (non-quantitative form) allowed by the Act. Results in FY 1999 identified issues which NSF began to address in FY 2000. Results in FY 2000 indicate that more attention is being given to use of both criteria. However, improvements are still needed.

INVESTMENT PROCESS GOAL 2

NSF's performance in implementation of the new merit review criteria is ***successful*** when:

- reviewers address the elements of both generic review criteria appropriate to the proposal at hand; and
- when program officers take the information provided into account in their decisions on awards,

as judged by external independent experts.

PERFORMANCE INDICATOR

Use of merit review criteria by reviewers and program staff.

BASELINE:

New criteria went into effect in early FY 1999. External expert judgment is used to assess performance. The assessment process was used for the first time during FY 1999.

FY 1999 RESULT:

LARGELY SUCCESSFUL, NEEDS SOME IMPROVEMENT.

FY 2000 RESULT:

THIS GOAL WAS NOT ACHIEVED.

Full performance in achieving this goal requires that both merit review criteria be addressed by both reviewers and program staff. The results indicate that NSF was not fully successful as judged by external evaluators.

For FY 2000 COVs reviewed 78 NSF programs and were asked to judge whether the programs were successful or not in meeting this performance goal. A total of 58 out of 64 reports rated programs on their use of both merit review criteria. NSF was judged successful in achieving this goal in 20 of the 58 reports.

In most cases where NSF was not successful, reviewers did not fully address the second merit review criterion regarding the broader impacts of the proposed activity in their reviews or applicants did not address broader impacts in their proposals. Most COV assessments noted that NSF staff addressed both criteria in their decisions.

It is important to note that the two merit review criteria were not implemented until FY 1998, and the time period covered by COVs conducting program assessments in FY 2000 included proposals that had been reviewed before the two criteria were implemented (i.e., proposals from FY 1997). Since both criteria were not fully implemented during this time period, full use by reviewers and staff should not be expected for this assessment. The FY 2001 assessment will include proposals reviewed in FY 1998 and beyond, which will be the first assessment to review the full implementation of the two criteria. Full usage should become more apparent in the FY 2001 and FY 2002 assessments.

COMPARISON: FY 1999 – FY 2000

In FY 1999, this goal was stated using two levels of achievement: *successful* and *minimally effective*, with indicators for each level. In FY 1999, a majority of reports rated programs as successful on their use of the merit review criteria. In most cases where programs were not fully successful it was indicated that reviewers and proposers were not fully addressing both review criteria. Based on comments from evaluators in FY 1999, it was determined that the descriptors for the *minimally effective* level of performance did not provide additional information in evaluating the programs.

For FY 2000 a single descriptor for the *successful* standard was used as the target level of performance. In FY 2000 a stricter definition of allowed success was used in aggregating these results. This required clear justification of ratings in COV and AC reports. If reports gave successful ratings but did not mention use of both criteria by both reviewers and program managers, the goal was judged to be less than fully successful. It is possible that programs are more successful in achieving this goal than these results indicate. However, most reports indicate NSF programs can still improve on use of both criteria.

The issued identified by COVs in FY 2000 are similar to those observed in FY 1999, even though the evaluation was carried out on a different subset of NSF's portfolio by a different group of external experts. Comments from reports indicate that progress is being made. Nevertheless, improvement is still needed.

STEPS TO IMPROVE PERFORMANCE RESULTS FOR THIS GOAL FOR FY 2001 AND BEYOND

NSF took steps in FY 2000 to educate reviewers and proposers on the use of the merit review criteria. NSF clarified the meaning of the criteria and stressed the importance of using them. Improving results for this goal depends upon improving information in proposals submitted by proposers and on motivating reviewers to provide substantive comments on both criteria. It also depends on the use of both criteria by NSF staff when making decisions. NSF can encourage proposers and reviewers to address both criteria, but has limited control over their response. Many proposals do not contain sufficient information necessary for reviewers to evaluate the broader impact criterion. To improve this situation, NSF has modified program announcements to encourage proposers to provide information on all relevant aspects of the merit review criteria in their proposals. NSF has recently re-issued guidance to the proposers and reviewers, stressing the importance of using both criteria in the preparation and evaluation of proposals submitted to NSF.

To assist reviewers and staff in FY 2001, separate on-screen pages are available in FastLane - NSF's electronic data system. These provide the capability for reviewers to address each merit-review criterion separately. In FY 2001, performance data will be collected from the FastLane database.

Full implementation of this goal is a priority for NSF in FY 2001 and beyond. To do so requires information to be included in proposals, addressed by reviewers, and taken into account by program staff. NSF has taken steps to ensure that incoming proposals contain adequate information for reviewers to evaluate. NSF is taking steps to further implement this goal by developing a system to determine the extent of program officer use of both criteria in decision making. This process will be made quantitative upon determination of an appropriate mechanism and baseline.

In response to a directive by the Senate Appropriations Committee that NSF review the procedure and criteria for merit review once the new criteria had been in place for a year, in FY 2000, NSF issued a contract to the National Academy of Public Administration (NAPA). This contract was designed to conduct a study of the impact of the new merit review criteria on the nature of the projects NSF supports. In conducting the study, NAPA interviewed key personnel and stakeholders from the S&E community and analyzed a sample of COV reports and proposal documents. The key finding was that it is too soon to make valid judgements about the impact and effectiveness of the new criteria. The NAPA report also highlighted the need to (1) improve the conceptual clarity of the criteria, (2) better communicate with proposers, reviewers and NSF staff about how the criteria are to be used, and (3) improve quantitative measures and performance indicators to track the objectives and implementation of the new criteria. NSF will act upon these suggestions beginning in FY 2001.

This goal will be maintained and emphasized in FY 2001. It will appear as two goals, one addressing use of the criteria by reviewers, and a second addressing use of the criteria by NSF staff. Improvements to the COV and AC process and guidelines for evaluating this goal are being implemented in FY 2001.

PERFORMANCE AREA: CUSTOMER SERVICE - GENERAL

For the past two years NSF has participated along with about 30 other federal agencies in a national assessment of customer satisfaction. The mechanism used to assess customer satisfaction is the American Customer Satisfaction Index (ACSI), a cross-industry index of customer satisfaction. This survey is conducted by the University of Michigan. In FY 1999 the ACSI survey team interviewed a random sample (n=260) of NSF grant applicants which included both awardees and declinees. Approximately 68% of the applicants interviewed submitted proposals that were declined. This percentage is consistent with NSF's overall proposal funding rate.

The Foundation's ACSI results for the FY 1999 survey indicated that NSF grant applicants generally hold NSF in high regard and give it high marks for accessibility and usefulness of information. However, NSF received only mid-level scores for its merit review process and for its handling of customer complaints. NSF believes there is room for improvement in this area and identified several factors to be addressed in FY 2000. These include training staff and developing models of best practices.

Based on the FY 1999 survey, NSF elected to establish three new related goals in FY 2000. Two were achieved, one was not. These goals were intended to help identify areas where NSF could improve service to customers. The results obtained by setting these goals have helped NSF to identify areas of customer service that need improving, and NSF is making use of this information to set goals for FY 2001 and beyond. NSF will not continue Investment Process Goals 3, 4 or 5 beyond this year.

INVESTMENT PROCESS GOAL 3

Identify possible reasons for customer dissatisfaction with NSF's merit review system and with NSF's complaint system.

PERFORMANCE INDICATOR

Results of NSF applicant surveys.

RESULT:

THIS GOAL WAS ACHIEVED.

In FY 2000, NSF commissioned additional surveys including the ACSI survey of awardees and informal surveys and focus groups at NSF regional grants seminars. These were designed to identify the reasons for Principal Investigator dissatisfaction with the timeliness and efficiency of the proposal process, the quality and fairness of the merit review process, and the handling of customer complaints.

The 2000 ACSI survey indicated that NSF improved slightly in two key areas:

1. timeliness and efficiency of the proposal process; and
2. quality and fairness of merit review.

These were the two areas of greatest concern identified in the FY 1999 survey. NSF will continue to address customer service as noted in Investment Process Goals 3, 6, and 7.

INVESTMENT PROCESS GOAL 4

Identify best practices and training necessary for NSF staff to conduct merit review and answer questions about the review criteria and process. Identify best practices and training necessary for NSF staff to answer questions from the community and to deal with complaints in a forthright manner.

PERFORMANCE INDICATOR

Development of models of best practices and NSF staff training, where appropriate.

RESULT:

THIS GOAL WAS NOT ACHIEVED.

NSF conducted customer service surveys and solicited other forms of feedback in an effort to pinpoint specific customer issues and to identify effective practices for handling customer complaints within NSF. Further, other federal agencies were examined to locate a model with similar customer interactions, but no appropriate model was identified. Models of best practices and NSF staff training are still being developed in FY 2001. NSF continues to place great importance on these issues and will complete this effort in FY 2001. In addition, NSF will pilot the best of the models in NSF divisions and provide specific customer service training to NSF staff.

INVESTMENT PROCESS GOAL 5

Improve NSF's overall ACSI index compared to the FY 1999 index of 57 (on a scale of 0-100).

PERFORMANCE INDICATOR

Results of the American Customer Satisfaction Index (ACSI).

BASELINE:

57 on a scale of 0-100 in FY 1999

RESULT:

THIS GOAL WAS ACHIEVED. NSF ACHIEVED AN ACSI INDEX OF 58 IN FY 2000. THIS FEEDBACK IS HELPING NSF TO FOCUS ITS EFFORTS TO IMPROVE CUSTOMER SERVICE.

In addition, NSF coordinated a Customer Service Focus Group meeting in March 2000 as part of an NSF regional grants conference held at Louisiana State University. This Focus Group was a follow-up activity to an informal email survey of seminar participants conducted prior to the seminar. The participants were 32 Principal Investigators and research administrators. The primary topics addressed by the survey were NSF's handling of complaints and the timeliness and efficiency of the NSF proposal process. These informal surveys were continued at the Purdue University seminar in October 2000 to compare previous data and to gather additional information concerning customer service.

NSF arranged for another ACSI survey in FY 2000, involving only grantees, to ascertain possible reasons for customer dissatisfaction with the merit review system and with NSF's complaint system. This awardee survey was performed to confirm the results of the ACSI survey (see Investment Process Goal 5) and to get more detailed information on specific issues related to merit review and customer interaction. The University of Michigan conducted the supplementary survey of NSF awardees in November 2000 using a set of questions developed by the Foundation.

The results from the FY 2000 awardee survey indicate that NSF customers' primary concern regarding the timeliness and efficiency of the proposal process is the time it takes NSF to reach a funding decision.

NSF is striving to improve the time to decision (see Investment Process Goal 7). Applicants who stated that they had a specific problem or concern with the quality or fairness of merit review identified two primary concerns: reviews were inappropriate (i.e., reviews did not seem to adequately address the proposed project, in the opinion of the proposer) and reviews were uneven (i.e., the range of review scores included both high and low scores).

Finally, survey participants in FY 2000 who stated that they had complained to NSF described the nature of their complaints primarily in three ways: 1) concern about overall quality or fairness of proposal merit review process; 2) problem submitting a proposal, review, or project via FastLane; and 3) problem making timely contact with appropriate person at NSF.

PERFORMANCE AREA - CUSTOMER SERVICE: TIME TO PREPARE PROPOSALS

This customer service standard was established in response to a survey where NSF applicants revealed that having a minimum of three months (90 days) between program announcements and proposal deadlines was highly valued. NSF staff work toward this goal by limiting the number of special competitions requiring individual program announcements and solicitations, planning for such competitions as far in advance as possible, and initiating clearance processes at least six months prior to the anticipated proposal deadlines. Significant improvement has been made toward achieving this goal since last year. NSF will maintain the target level in FY 2001.

Customer service standard: To make program announcements and solicitations available to relevant individuals and organizations at least three months prior to the proposal deadline or target date.

INVESTMENT PROCESS GOAL 6

Ninety-five percent of program announcements and solicitations will be available at least three months prior to proposal deadlines or target dates.

PERFORMANCE INDICATOR

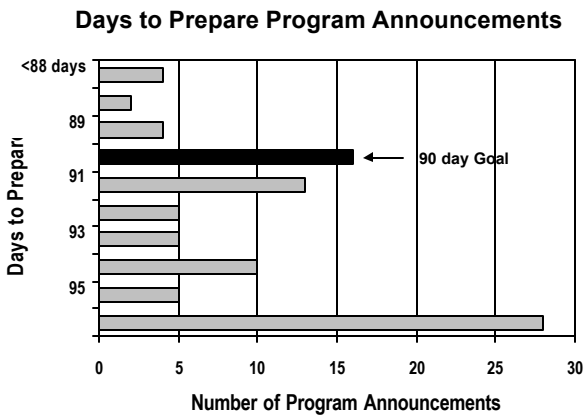
Percent of program announcements and solicitations available at least three months prior to proposal deadlines or target dates.

	FY 1998	FY 1999	FY 2000	FY 2001
Baseline	66%			
Goal		95%	95%	95%
Actual		75%	89%	

RESULT:

THIS GOAL WAS NOT ACHIEVED.

In FY 2000 89% of program announcements and solicitations were made available at least three months prior to their deadline/target date. Approximately 97% of program announcements and solicitations were available within 5 days of the three-month goal. This is a significant improvement over FY 1999, when 75% of announcements met the 3-month standard. The following bar-chart visually demonstrates the number of program announcements that gave applicants 90 days or more to prepare proposals (goal achieved) compared with those that missed the goal by a few days. Ninty-five percent of announcements were posted within 5 days of the three month goal.



The most common reason cited for not achieving this goal was delay in posting announcements on the NSF web site. In FY 2000 a web-based system for creating program announcements was established. This system has decreased the time required for an announcement to be posted on the NSF web site. This should aid the agency in achieving this goal. However, this was the first year of implementation, and not all announcements were prepared using the new system. The Foundation intends to review and revise the timing of clearance procedures, in order to ensure that web posting of announcements will occur in a timely manner. NSF is also working to enhance the tracking system that measures the time available to applicants to prepare proposals in an effort to improve the accuracy of the data.

The Foundation staff work toward this goal by limiting the number of special competitions requiring individual program announcements and solicitations, planning for such competitions as far in advance as possible, and initiating clearance processes at least six months prior to the anticipated proposal deadline. NSF expects increased use of the new systems in FY 2001, and expects to see additional progress toward meeting this goal next year.

PERFORMANCE AREA: CUSTOMER SERVICE - TIME TO DECISION

This customer service standard was established in response to a survey of NSF applicants who indicated that processing proposals within six months of receipt was highly valued. NSF recognizes the validity of the community's interest in this customer service standard and is striving to expedite the time between proposal submission and agency decision without jeopardizing the quality and integrity of the review process. This goal will be maintained in FY 2001.

Customer Service Standard: NSF's long-term goal continues to be processing 95% of proposals within six months of receipt. In other words, NSF should be able to tell applicants whether their proposals have been declined or recommended for funding within six months of receiving them.

INVESTMENT PROCESS GOAL 7

Maintain the FY 1999 goal to process 70% of proposals within six months of receipt, improving upon the FY 1998 baseline of 59%.

PERFORMANCE INDICATOR

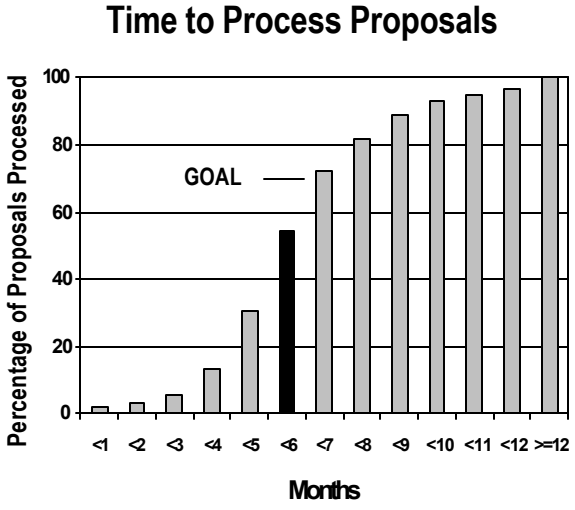
Percent of proposals processed within six months of receipt.

	FY 1998	FY 1999	FY 2000	FY 2001
Baseline	59%			
Goal		70%	70%	70%
Actual		58%	54%	

RESULT:

THIS GOAL WAS NOT ACHIEVED.

In FY 2000 more than half (54%) of all proposals were processed within six months of receipt, while an additional 35% of proposals were processed between six and nine months of receipt. In FY 1999, 58% of proposals were processed within six months of receipt, somewhat better than the 52% average rate over the last five years, but nevertheless short of the 70% goal. Data show that about 71% of proposals were fully processed in less than seven months, and about 82% of proposals were processed in less than 8 months, as shown.



One of the most significant issues raised by applicants (see results of the ACSI customer survey, described under Investment Process Goal 3) is the amount of time it takes for NSF to process proposals. NSF is reviewing the steps needed to decrease the processing time of proposals to find ways to process them more quickly.

One factor leading to delay in processing is that some programs at NSF prefer to conduct merit review by mail rather than by panel. Mail reviews often take longer to complete. Another factor is that some programs tend to hold a few highly rated proposals until the end of the fiscal year, or even into the next fiscal year, in anticipation that more funds might become available. In FY 2000 a few programs reported temporary staffing shortages. This slowed down their review process. This situation has been corrected.

In addition, the processing of international awards often takes more time than standard awards. This is because the process of making international awards necessarily involves additional major steps with more program units involved, increasing the amount of time required for processing. For example, in many cases, foreign country approval of a matching proposal must be obtained, which often results in unpredictable delays.

In FY 2001 NSF staff will work towards shortening the award processing time by making more effective use of electronic mechanisms in conducting the review, working cooperatively to reduce overloads and bottlenecks, and by carefully tracking the stage of processing and received date of all proposals. In addition, some internal organizations are reconsidering the practice of holding over proposals for potential funding until the next fiscal year. Some have added "performance on prompt handling of proposals" to the performance evaluation criteria of their staff.

PERFORMANCE AREA: MAINTAINING OPENNESS IN THE SYSTEM

NSF believes it is important that the proposal and award process be open to new people and new ideas in order to help ensure that NSF is supporting research at the frontier of science, engineering, and education. NSF is committed to maintaining openness in the system and will strive to increase the percentage of awards to new investigators. This goal will be maintained in FY 2001.

INVESTMENT PROCESS GOAL 8

The percentage of competitive research grants going to new investigators will be at least 30%, 3% over the FY 1998 baseline of 27%.

PERFORMANCE INDICATOR

Percent of competitive research grants going to new investigators.

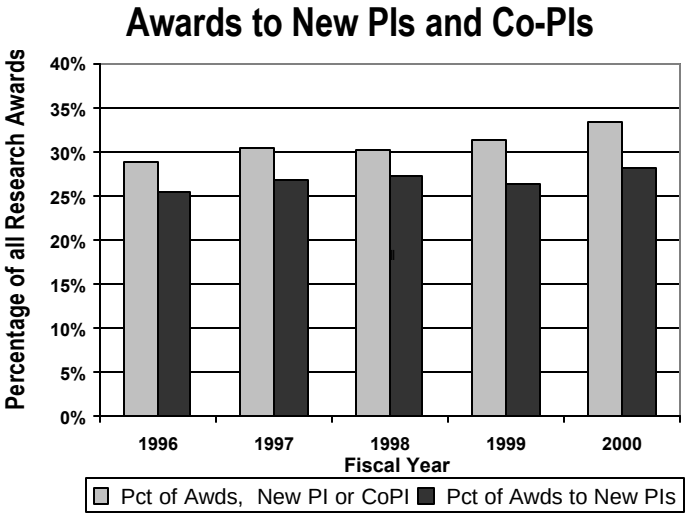
	FY 1998	FY 1999	FY 2000	FY 2001
Baseline	27%			
Goal		30%	30%	30%
Actual		27%	28%	

RESULT:

THIS GOAL WAS NOT ACHIEVED.

The percentage of competitive research grants issued to new investigators was 28% in FY 2000, one percent higher than in FY 1999. This is a challenging goal for NSF. There continues to be a wide disparity in the funding rates of "new" Principal Investigators (PIs) and "prior" PIs – 24 percent and 40 percent, respectively in FY 2000.

It is important to note that this goal counts "grants" to new investigators. It does not count *all* new investigators who may be collaborating on a project – it counts only new *PIs* - not new *co-PIs* – which would be the case if two or more new applicants collaborating together received an award. Also, the goal does not count new co-PIs on awards where the PI has had prior NSF support, as is often the case. If we count both PIs and co-PIs who are new, we find that more than 32% received support in FY 1999 and more than 33% received support in FY 2000. The following bar-chart compares the percentage of all research awards where both new PI and co-PI's are counted (first column) to the percentage of all research awards where only new PI's are counted (second column), for fiscal years 1996, 1997, 1999, and 2000. This result indicates that many new investigators are receiving their first support as co-PIs on NSF awards.



NSF will continue to seek creative and innovative proposals from new investigators. Program staff will attend scientific meetings, conferences, and conventions and will conduct site visits to promote awareness of the research and education opportunities at NSF and to encourage new investigators to submit proposals. NSF will examine trends, such as whether the pool of new investigators is smaller than in previous years or whether they are submitting fewer proposals, and if needed, use this information to modify targets in the future.

PERFORMANCE AREA: ATTENTION TO INTEGRATION OF RESEARCH AND EDUCATION – IN PROPOSALS

Integrating research and education appears as part of the investment strategies supporting all of NSF's Outcome Goals for education and research as described in the NSF Strategic Plan. NSF expects to see continuous improvement in the extent to which its research and education functions are accomplished jointly. The long-term objective is two-fold: (1) to renew the strong interaction between federally-funded academic research and the development of the science and technology workforce that has characterized the U.S. science and engineering enterprise; and (2) to draw academic scientists and engineers into the challenge of improving K-12 education. NSF wants all awardees to give deliberate attention to their effectiveness as both researchers and educators. This goal will also help to achieve full use of both merit review criteria, Investment Process Goal 2. This goal was introduced in FY 2000 and will not be continued in FY 2001.

INVESTMENT PROCESS GOAL 9

NSF will develop a plan and system to request that Principal Investigators (PIs) address the integration of research and education in their proposals, and develop and implement a system to verify that PIs have done so.

PERFORMANCE INDICATOR

Outreach to community; implementation of system to verify that PIs address the integration of research and education in proposals.

RESULT:

THIS GOAL WAS ACHIEVED.

In FY 2000 NSF implemented an electronic Program Announcement Template (PAT) clearance process that is used by NSF staff to generate announcements and solicitations. Use of the PAT ensures that PIs are asked to address the integration of research and education in all announcements and solicitations. In addition, the Foundation has included language in the Proposal and Award Manual, the Grant Proposal Guide, and the FY 2000 Guide to Programs regarding the importance of the integration of research and education.

In order to verify that PIs are addressing the integration of research and education, NSF asks Committees of Visitors (COVs) to assess whether the broader impacts of the proposed activity are being addressed in proposals and by reviewers and NSF staff as part of the merit review process. The COV reporting template has been modified in FY 2001 to explicitly address the use of both merit review criteria by reviewers and program staff.

PERFORMANCE AREA: ATTENTION TO INTEGRATION OF RESEARCH AND EDUCATION – IN REVIEWS

This goal will help to achieve full use of both merit review criteria, as stated in Investment Process Goal 2, which requires attention being given to *both* merit review criteria by reviewers. To achieve full use of both merit review criteria requires that attention be given to them both in proposals and by reviewers and staff. Once proposals include information on plans for integrating research and education (Investment goal 9), then reviewers will be able to address those plans in their reviews. This will also aid NSF staff in using the information in making funding decisions. This goal was introduced in FY 2000 and will not be continued in FY 2001.

INVESTMENT PROCESS GOAL 10

NSF will develop and implement a system/mechanism to request and track reviewer comments tied to the merit review criterion "What are the broader impacts of the proposed activity?"

PERFORMANCE INDICATOR

Outreach to community; implementation of system to track reviewer comments.

RESULT:

THIS GOAL WAS ACHIEVED.

During FY 2000 screens were redesigned in FastLane (NSF's electronic proposal and review system) so reviewers will be able to address each merit-review criterion separately in FY 2001. This information is used to aid in the determination of whether NSF has achieved this goal.

NSF modified program announcements to encourage applicants and reviewers to address these criteria in proposals and reviews. NSF has recently re-issued guidance to the proposing institutions and reviewers that stresses the importance of addressing both merit review criteria in the preparation and evaluation of proposals submitted to NSF. NSF staff continue to stress the importance of reviewers addressing the "*broader impacts*" criterion whenever they attend NSF-sponsored seminars, science meetings, site visits, conferences, and conventions.

PERFORMANCE AREA: DIVERSITY - NSF APPLICANTS

In 1980 legislation gave NSF explicit responsibility for addressing issues of equal opportunity in science and engineering. This reflected the serious under-representation of women, minorities, and persons with disabilities in the science and engineering workforce. Recognizing that progress toward all Outcome Goals for research and education requires diversity of intellectual thought, NSF is emphasizing attention in all its programs to enhancing the participation of groups currently under-represented in science and engineering, including women, under-represented minorities, and persons with disabilities. The long-term objective is to have a science and engineering workforce that mirrors the U.S. population. This was a new goal in FY 2000, based on a revised FY 1999 goal. It will be revised as a new goal in FY 2001 to broaden the participation of under-represented groups in the reviewer pool.

INVESTMENT PROCESS GOAL 11

NSF will identify mechanisms to increase the number of women and under-represented minorities in the proposal applicant pool, and will identify mechanisms to retain that pool.

PERFORMANCE INDICATOR

Mechanisms to attract proposals from members of under-represented groups in order to increase the total applicant pool; mechanisms to retain the applicant pool.

RESULT:

THIS GOAL WAS ACHIEVED.

NSF is strongly committed to increasing the participation in all NSF activities of science and engineering researchers, educators, and students from groups currently under-represented in the science and engineering enterprise. Congress 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, underrepresentation that persists to this day, although some progress has been made.

NSF is committed to the principle of diversity and deems it central to the programs, projects, and activities it considers and supports. NSF continues to work toward increasing diversity in its proposal applicant pool through the following means:

- To place the issue on equal footing with the quality of research being supported, NSF issued Important Notice No. 125 to presidents of universities and colleges encouraging PIs to address the merit review criterion – what are the broader impacts of the proposed activity - which embraces integrating diversity into all NSF supported activities;

- Developing and increasing funding for specialized programs designed to promote diversity;

- Recruiting members of under-represented groups for merit review panels, COVs, and NSF workshops and conferences; and

- Strongly encouraging women, minorities, and persons with disabilities to compete fully in NSF programs.

NSF is revising this long-term goal to extend its efforts as it continues to pursue diversity in the applicant pool. A new goal designed to broaden participation of under-represented groups in FY 2001 will build on the results of this goal by targeting the reviewer pool.

PERFORMANCE AREA: FACILITIES OVERSIGHT

The goals which follow are for federal science, space and technology agencies which support construction projects and have responsibility for managing facilities (NSF, NASA, DOE). NSF reports in two categories for this performance area: *Construction and Upgrade of Facilities, and Operations and Management of Facilities*.

NSF provides support for large multi-user facilities. These facilities meet the needs of the academic community for access to state-of-the-art research platforms that are vital to the progress of research. This funding is essential to the development of world-class research capabilities. NSF provides funding for the construction and acquisition of major research facilities that provide unique capabilities at the cutting edge of science and engineering.

NSF has major responsibility for funding the operation of several multiple-user facilities. This support provides high-cost equipment with unique capabilities to many individuals. NSF has provided construction funds for only a few facilities. Such facilities typically cannot be duplicated at more than one site. In addition, NSF puts 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. Such facilities test the limits of technological capability.

Every year, in the President's Budget Request to Congress, NSF sets out a cost plan and schedule for major construction and upgrade projects currently underway or planned for initiation in the Major Research Equipment account. NSF has established performance goals and measurements with respect to these plans and expects each construction and upgrade activity to meet these performance goals. NSF consults with other agencies to avoid duplication and to optimize capabilities available to American researchers and educators, and cooperates with other agencies in construction of facilities for use across broad communities of researchers and educators. NSF manages facilities in the Antarctic that are used by all federal agencies for selected projects. Many major facilities involve international cooperation.

Facilities must operate efficiently and reliably and must offer appropriate opportunities if they are to be valuable to those they serve. NSF program officers work closely with facility directors to ensure that the facilities have appropriate resources to conduct operations and to provide maintenance that ensures reliable operations.

In order to report on the government-wide performance goals related to Facility Operations, and Construction and Upgrade, NSF developed in FY 1999 a new Performance Reporting System (as a module of the existing FastLane system), to collect information on facility 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 in subsequent years as managers gain experience with gathering and reporting the required data. In FY 1999 NSF developed a general facilities reporting template for use in collecting information on the construction, upgrade, and operations goals. This reporting system was linked to the new Project Reporting System (as a module of the existing FastLane system). The manager of each facility reports the data to NSF. FY 1999 was the first year that NSF collected data on these goals.

FACILITIES OVERSIGHT - CONSTRUCTION AND UPGRADE OF FACILITIES

INVESTMENT PROCESS GOAL 12

Maintain the FY 1999 goal to keep construction and upgrades within annual expenditure plan, not to exceed 110 percent of estimates.

PERFORMANCE INDICATOR

Comparison with planned annual cost.

Of the eleven construction and upgrade projects supported by NSF, all were within annual expenditure plans; six met the planned annual cost and five were less than the estimated cost. This goal was achieved in FY 1999. The majority of facilities were within annual spending estimates of 110%. This goal will be revised in FY 2001 to require that 90% of NSF-supported facilities keep construction and upgrades within their annual expenditure plan.

RESULT:

THIS GOAL WAS ACHIEVED.

INVESTMENT PROCESS GOAL 13

Maintain the FY 1999 goal to keep construction and upgrades within annual schedule, total time required for major components of the project not to exceed 110 percent of estimates.

PERFORMANCE INDICATOR

Comparison with planned annual schedule.

Of the eleven construction and upgrade projects supported by NSF, seven reported that all of their scheduled milestones were completed within 110 percent of the estimated time for completion. For four projects, missed milestones were due to circumstances beyond the project manager's control. For example, one construction project was dependent upon the research and development of new instrumentation, the results of which were delayed. In other projects, the missed milestone was due to difficulty acquiring necessary parts; non-performance of a sub-contractor; and underestimation of the complexity of the work. One project did not report. In FY 2001 NSF program managers are working more closely with project managers to ensure all NSF-supported construction/upgrade projects achieve this goal. This goal will be revised in FY 2001 to require that 90% of NSF-supported facilities keep their planned construction and upgrades within annual schedule.

RESULT:

THIS GOAL WAS NOT ACHIEVED.

INVESTMENT PROCESS GOAL 14

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.

PERFORMANCE INDICATOR
Comparison with planned total cost.

This goal will be maintained in FY 2001.

RESULT:

THIS GOAL DID NOT APPLY IN FY 2000 OR FY 1999; THERE WERE NO CONSTRUCTION PROJECTS COMPLETED IN FY 2000 OR FY 1999.

FACILITIES OVERSIGHT - OPERATIONS AND FACILITIES

Facilities must operate efficiently and reliably and must be available on schedule if they are to be useful to those they serve. NSF program officers work closely with facility directors to ensure that facilities have appropriate resources to operate reliably and schedule necessary maintenance.

INVESTMENT PROCESS GOAL 15

Maintain the FY 1999 goal to keep operating time lost due to unscheduled downtime to less than 10 percent of the total scheduled possible operating time.

PERFORMANCE INDICATOR
Comparison to scheduled operating time.

Of the 26 reporting facilities, 22 met the goal of keeping unscheduled downtime to below 10% of the total scheduled operating time. Four reported unscheduled downtime greater than 10%.

RESULT:

THIS GOAL WAS NOT ACHIEVED.

In FY 2000 NSF reviewed the FY 1999 data collection and reporting effort and made modifications to the FY 2000 and FY 2001 systems in order to improve the efficiency, clarity and accuracy of the process. This included allowing for reporting on construction/upgrade activities at facilities funded through the Research and Related Activities Account, refining the clarity of the on-screen language, addressing the facilities goals more accurately, automating most of the output, and instituting a stage for collecting estimates. NSF program staff will work more closely with project managers to ensure that all achieve this goal in FY 2001.

The *on time* and *on schedule* goals for FY 2001 will be revised slightly so that when at least 90 percent of facilities meet the federal standard, the goal is considered achieved. These changes are being made because NSF places great importance on accurate planning for construction and upgrade of facilities, but we recognize that the unique, state-of-art projects being supported stretch the limits of technological capability. As a result there may be unexpected construction delays and/or unforeseen expenditures. NSF expects that the vast majority of its projects will be within budget and on schedule. However, we do not believe the agency should be considered unsuccessful overall in these areas if a small percentage of facilities are unable to meet the goals. Therefore, to provide the flexibility necessary for NSF to report realistic and achievable goals, we are reestablishing the target level of success at 90% of the facilities for FY 2001. This change will be evaluated over time to determine if 90% is the appropriate level for this goal.

The *operating time* goal will also be revised from 100% to 90% for FY 2001. NSF recognizes that some facilities may have a failure rates greater than 10%, but that this is balanced overall by facilities that operate more reliably. NSF expects that the vast majority of facilities will keep operating time lost due to unscheduled downtime to less than 10% of the operating time. We do not believe the agency should be considered unsuccessful if a small percentage of the facilities are unable to meet this goal. Therefore, to provide the flexibility necessary for NSF to report realistic and achievable goals, we are reestablishing the target level of achievement at 90% of the facilities for FY 2001. This change will be evaluated over time to determine if 90% is the appropriate level for these goals

D. TABLE OF EVALUATIONS

Table 2 below provides information on the program assessments and evaluations other than Committee of Visitor and Advisory Committee assessments - with one exception – the Major Research Instrumentation (MRI) program. The MRI program is an agency-wide activity, and is the first Committee of Visitor (COV) review NSF has contracted to an external private vendor.

The table lists other types of evaluations, not used in GPRA performance assessment, that were completed in FY 2000 and for which information was available at the time this report was prepared. 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 which are beyond the scope of this report. A table showing the schedule for COV assessments appears in Section XV. A discussion of results obtained for Outcome Goals based on the COV and advisory committee assessments is presented in Section V. A.

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. COV reports will become electronically available in December, 2001.

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).

TABLE 2

EVALUATIONS COMPLETED IN FY 2000	SCOPE	FINDINGS	AVAILABILITY
Report of the Committee of Visitors: Major Research Instrumentation Program	Initial review of MRI program for period FY 1995-FY 1999; program processes and management; program results and goals specific to MRI program.	Program effectively uses merit review process to generate appropriate portfolio of awards based on quality of proposed instrument; not as effective in use of "broader impact" criterion; evaluation of progress in meeting most outcome goals difficult because few results have yet been achieved and some are beyond the scope of the program.	Will be electronically available through NSF web site December 2001

EVALUATIONS COMPLETED IN FY 2000	SCOPE	FINDINGS	AVAILABILITY
Progress of the Engineering Education Coalitions	Review of effectiveness and progress in educational reform through engineering coalitions program.	Coalitions made important contributions and facilitated the implementation of performance-based accreditation standards (ABET 2000).	NSF 00-116 May 2000
Measuring the Science and Engineering Enterprise: Priorities for the Division of Science Resource Studies in 2000	Review of the SRS portfolio of data collection, acquisition, and analysis activities.	Recommends expansion and modification of SRS data activities such as: increased interaction with users and customers; increase timeliness of release data; expand data collections for some areas; revise collection surveys.	National Research Council
Challenges in Collecting and Reporting Federal Research and Development Data	Comparison of numbers reported by the federal agencies as outlays for federal R&D on National Science Foundation surveys with those reported by federal R&D performers as expenditures or reimbursements from federal agencies.	Source of discrepancy is almost exclusively with reporting by performers; CRS suggests further study and increased support to improve R&D data collection and reporting.	Congressional Research Service, Library of Congress Order Code RL30413
Nanotechnology Research Directions: IWGN Workshop Report	Identifies challenges and opportunities in nanotechnology field; outlines how advances in field can impact national economy, health care and national security.	Recommends long term fundamental nanoscience and engineering research, synthesis and processing 'by design' of material building blocks, and education and training of future workforce.	See reference 1
Condensed-Matter and Materials Physics – Basic Research for Tomorrow's Technology	Scholarly assessment of field as part of a new survey of physics, *Physics in a New Era*, that is in progress.	Provides advice for support of the field and what areas should receive increased investment.	National Academy Press

Reference 1: http://www.nsf.gov/home/crssprgm/nano/start.htm.

EVALUATIONS COMPLETED IN FY 2000	SCOPE	FINDINGS	AVAILABILITY
Astronomy and Astrophysics in the New Millennium	Assessment of field, identifies fundamental scientific challenges, assesses infrastructure and impact on society, international activity, and balance of national objectives, coordination of federal agencies.	Report identifies key areas of astronomy and astrophysics for advances to increase understanding of the universe.	National Research Council
Materials Science and Engineering – Forging Stronger Links to Users	Addresses the relationships among academia, government, government laboratories and industry in the materials science and engineering field, including the relationships among the producers and users of materials and the processes of innovation.	In depth study covers three sectors: automotive industry, jet-engine industry, and computer-chip and information-storage industries. Provides advice for mechanisms to support pre-competitive research, multidisciplinary research, and the facilitation of university-industry interactions.	National Academy Press
Cooperative Stewardship – Managing the Nation's Multidisciplinary User Facilities for Research with Synchrotron Radiation, Neutrons, and High Magnetic Fields	To explore possible strategies to address changing usage of research facilities (synchrotron radiation, neutron beam, and high-magnetic field facilities) and changing roles of the supporting agencies.	U.S. funding agencies should adopt a cooperative stewardship model for managing facilities.	National Academy Press
NSF Geosciences Beyond 2000, Understanding and Predicting Earth's Environment and Habitability	A decadal outlook for the geosciences evaluating opportunities and requirements for research, education and infrastructure.	The report outlines the scientific programs needed to continue the expansion of the basic knowledge of Earth systems.	NSF 00-27

EVALUATIONS COMPLETED IN FY 2000	SCOPE	FINDINGS	AVAILABILITY
National Research Council/National Academy of Sciences: Illuminating the Hidden Planet: The Future of Seafloor Observatory Science	Review of merit of seafloor observatories.	Planning and implementation of a seafloor observatory program should move forward.	National Research Council/ National Academy of Sciences July 2000
National Research Council/National Academy of Sciences: Basic Research Opportunities in Earth Science	Review of program balance and research opportunities.	Recommendations address new mechanisms to exploit research opportunities.	National Research Council/ National Academy Press 2000
The Graduate Research Traineeships (GRT) Program	GRT projects evaluated on the number of students reached and on processes carried out to meet goals.	As of 1998, almost half of the nearly 200 students receiving a Ph.D. with partial support through the GRT program had obtained postdoctoral positions and half were working in education, government, or private employment.	Available from NSF in FY 2001
Collaboratives for Excellence in Teacher Preparation Program (CETP)	Review of changes in learning infrastructure, faculty involvement, and student outcomes.	Too early for information on students; program is meeting objectives in areas of learning infrastructure and faculty involvement.	Available from NSF in FY 2001
Mathematical Sciences and Their Applications Throughout the Curriculum: Final Report	To determine whether curricula for undergraduates was developed and new partnerships among higher education institutions were created by initiatives.	Most initiatives successful in developing and disseminating materials; less success in developing and maintaining institutional partnerships.	NSF 00-73
Best Practices Study of Federal Minority Undergraduate SMET Programs	To determine best practices in programs for undergraduate minority programs across NSF, NASA, and HHS.	All programs had recognized strengths; NSF program focused on less well-prepared students.	Available from NSF in FY 2001

EVALUATIONS COMPLETED IN FY 2000	SCOPE	FINDINGS	AVAILABILITY
Program for Gender Equity (PGE)	Review of collaborations developed among educational organizations, number of individuals impacted by projects, findings on gender equity.	Program successful in all areas: most projects replicated or institutionalized; nearly 85,000 participants served.	Available from NSF in FY 2001
Faculty Early Career Development (CAREER) Program	Study of first three years of award impact and value to awardees, to determine if CAREER awardees demonstrated greater career advancement than non-CAREER awardees.	CAREER awardees reported more rapid advancement in professional careers than non-CAREER awardees.	Available from NSF in FY 2001