

Report to the National Science Board
on the
National Science Foundation's
Merit Review Process
Fiscal Year 2002



May 2003

FY 2002 Report on the NSF Merit Review System

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HIGHLIGHTS

1. During FY 2002 NSF took action on 35,165 competitively reviewed proposals, and provided funding to 10,406 of them. This resulted in an overall funding rate of 30 percent. The number of proposals reviewed increased by 10.1 percent, the largest annual percentage increase in over a decade.
2. In FY 2002, the number of awards to minority PIs increased to 548, a 7 percent increase over FY 2001, and a 25 percent increase since 1995. The funding rate for minority PIs is 29 percent, slightly less than the overall rate of 30 percent. Proposals received from minority PIs increased by 9 percent in FY 2002.
3. During FY 2002, female PIs received 2,012 awards, a 6 percent increase over 2001, or 19 percent of total NSF awards. The funding rate was 30 percent, equivalent to the funding rate for males. The number of proposals received from female PIs increased by thirteen percent in FY 2002 and has increased by 27 percent since 1995.
4. The average annualized award amount for *research grants* in FY 2002 was \$115,666, an increase of 2 percent above the previous year and 22 percent above FY 1998. Adequate award size is important for attracting high quality proposals and for ensuring that proposed work can be accomplished as planned.
5. Since 1995 the percentage of NSF proposals reviewed by panel-only has increased from 39 to 50 percent of all proposals. During the same period, there has been a steady decline in the use of mail-only review from 28 to 14 percent. The use of mail-plus-panel review increased from 28 to 32 percent.
6. In FY 2002, 74 percent of all proposals were processed within six months, compared to 62 percent in FY 2001. The agency exceeded its GPRA target goal of 70 percent. The success of this goal is particularly significant in light of the fact there was a 10 percent increase in the number of proposals submitted in FY 2002.
7. For proposal decisions in FY 2002, 48,000 external reviewers were sent one or more proposals for mail review and 10,000 reviewers served as panelists. About 9,000 of these reviewers had never reviewed an NSF proposal before. In FY 2002, 58 percent of requests for mail reviews produced positive responses, down from 60 percent response rate in FY 2001 and 62 percent in FY 2000.
8. A large number of potentially fundable proposals are declined each year. In FY 2002, about \$1.25 billion of declined proposals were rated as high as the average rating for an NSF award. These declined proposals represent a rich portfolio of unfunded research and education opportunities.
9. Effective October 1, 2002, NSF returned without review proposals that failed to separately address both merit review criteria within the Project Summary. For the first half of FY 2003, 193 proposals were returned without review due to the failure of addressing both merit review criteria in the Project Summary.
10. About 59 percent of NSF Program Officers are non-permanent employees (i.e., VSEE, IPA and temporary employees), compared to 44 percent in FY 2000. These employees provide NSF with new ideas and fresh science and engineering perspectives.

FY 2002 Report on the NSF Merit Review System

1. Introduction

The National Science Foundation (NSF) is responsible for advancing the progress of science and engineering in the United States across a broad and expanding frontier. It carries out its mission primarily by making merit-based grants to researchers, educators, and students at more than 1,800 U.S. colleges, universities and other institutions.

NSF plays a critical role in supporting fundamental research, education and infrastructure at colleges, universities, and other institutions throughout the country. Its broad support for research and education, particularly at U.S. academic institutions, provides not only a key source of funds for discovery in many fields, but also unique stewardship in developing the next generation of scientists and engineers.

NSF leads Federal agencies in funding research and education activities based upon merit review. For example, NSF makes about 10,000 new awards each year from more than 35,000 competitive proposals submitted. Over 96 percent of NSF's awards are selected through its competitive merit review process. All proposals for research and education projects are evaluated using two criteria: the *intellectual merit* of the proposed activity and its *broader impacts*, such as impacts on teaching, training and learning. Reviewers also consider how well the proposed activity fosters the integration of research and education and broadens opportunities to include a diversity of participants, particularly from underrepresented groups. The merit review system is at the very heart of NSF's selection of the projects through which its mission is achieved. Ensuring a credible, efficient system requires constant attention and openness to change.

Excellence in managing NSF underpins all of the agency's activities. Enabled by a diverse, agile, results-oriented workforce, NSF focuses on leadership in business processes, such as e-government and financial management. While funding for the agency has grown significantly in the past decade, its staffing level has remained relatively flat. NSF has accommodated the workload increase through the exemplary use of information technology and reliance on the outstanding support the science and engineering community provides to its merit review process. NSF is the only agency to receive the highest status rating (green) in two of the government-wide President's Management Agenda initiatives. In the initial assessment period, NSF was the lone agency to receive the top rating for financial management. During 2002, NSF became the first federal agency to receive the top rating for the e-government initiative.

This *FY 2002 Report on the NSF Merit Review System* responds to a National Science Board (NSB) policy endorsed in 1977 and amended in 1984, requesting that the NSF Director submit an annual report on the NSF proposal review system. The report provides summary information about levels of proposal and award activity and the process by which proposals are reviewed and awarded. While the report indicates several areas in which improvements are being made, the health and vitality of NSF's merit review process, and the S&E community's confidence in it, remains very strong.

2. Proposals and Awards

Competitively Reviewed Proposals, Awards and Funding Rates

During FY 2002, NSF took action on 35,165 competitive, merit reviewed research and education proposals, as shown in **Text Figure 1**. This represents an increase of 10.1 percent from the previous year. This is the largest annual percentage increase for NSF in over a decade. Since 1998, the number of proposals processed by NSF has increased by 19 percent.

During FY 2002, NSF funding was awarded to 10,406 of the reviewed proposals, resulting in an overall funding rate of 30 percent. This rate has ranged from 30-33 percent over the past decade. As shown in **Appendix Table 1**, there are significant differences in the funding rates of the various NSF directorates¹, ranging from 24 percent for Computer and Information Science and Engineering (CISE) to 35 percent for Geosciences (GEO) and Mathematical and Physical Sciences (MPS). There are many reasons for these differences, such as the relative size, diversity and nature of the S&E disciplines and communities being served by the various directorates.

Text Figure 1
NSF Proposal, Award and Funding Rate Trends

	Fiscal Year				
	1998	1999	2000	2001	2002
Proposals	28,422	28,579	29,508	31,942	35,165
Awards	9,381	9,190	9,850	9,925	10,406
Funding Rate	33%	32%	33%	31%	30%

Types of Proposals and Awards

In general, NSF makes two kinds of competitive grants for the support of research and education:

Standard grants provide funding in a single fiscal year award to cover all of the proposed activities for the full duration (generally 1-5 years) of a project.

Continuing grants provide funds for an initial period (usually one year) of a multiple year project with a statement of intent to continue funding in yearly increments until completion of the project.

Of the 10,406 competitive awards made in FY 2002, 6259, or 60 percent were standard grants. Since 1993 the number of standard grants has increased by 17 percent, while the number of continuing grants has only increased by 4 percent. In addition to these awards, NSF awarded 7,002 continuing grant increments (CGIs) based on proposals which had been competitively reviewed in earlier years.² As shown in Text Figure 2, in recent years NSF has devoted an increasingly larger percentage of its annual budget to making new standard grants.

¹ The term "directorates" as used in this report, refers to NSF's seven programmatic directorates and the Office of Polar Programs. See NSF Organization Chart in Appendix Table 15.

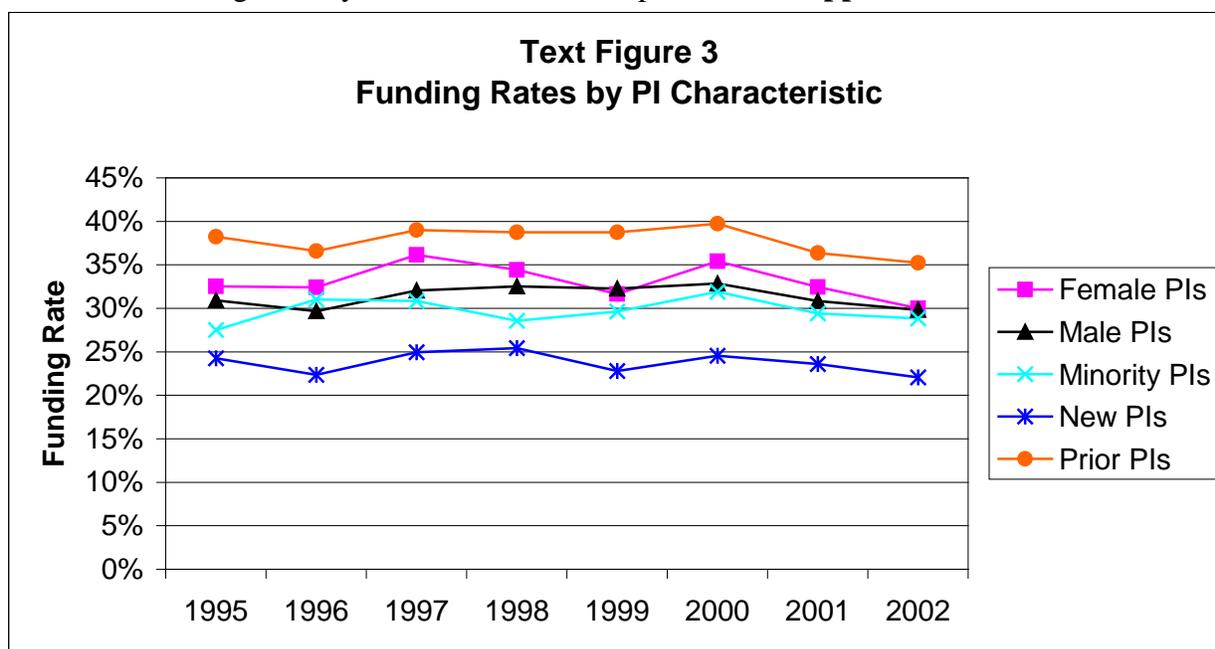
² While the original award is a competitive action, the CGI is a non-competitive renewal grant.

Text Figure 2
Percentage of NSF Budget by Type of Award

	1999	2000	2001	2002
New Standard Grants	23%	23%	25%	26%
New Continuing Grants	18%	21%	19%	21%
Continuing Grant Increments	43%	38%	38%	35%
Facilities/ Other Awards	16%	18%	18%	18%
100% = \$Billion	\$3.69	\$3.92	\$4.46	\$4.77

Broadening Participation

A key NSF strategy, stated in its GPRA Strategic Plan, is “to broaden participation and enhance diversity in NSF programs.” NSF is strongly committed to increasing the participation in all NSF activities of researchers, educators and students from groups currently underrepresented in the science and engineering enterprise. Trends in funding rate for all Principal Investigators (PIs), female and minority PIs³, and prior and new PIs⁴ are shown in **Text Figure 3** below. Proposals, awards and funding rates by PI characteristics are presented in **Appendix Table 2**.



During FY 2002, female PIs received 2,012 awards, or 19 percent of total NSF awards. This compares to 1,894 awards, or 19 percent of the total, in the previous year. The funding rate fell from 32 to 30 percent, compared to the funding rate of 30 percent for males, which fell from 31 percent. The number of proposals received from female PIs increased by thirteen percent in FY 2002 and has increased by 27 percent since 1995.

³ Minority includes American Indian or Alaskan Native, Black, Hispanic, and Pacific Islander and excludes Asian and White, not of Hispanic Origin.

⁴ A proposal is counted in the New PI category if the PI did not have an NSF award in the current or prior years.

In FY 2002, the number of awards to minority PIs increased to 548, a 7 percent increase over FY 2001, and a 25 percent increase since 1995. Still, this is only about five percent of the total number of NSF awards. The funding rate for minority PIs is 29 percent, slightly less than the overall rate of 30 percent. In FY 2002, minority PIs submitted 1906 proposals, up 9 percent from last year and up 25 percent from FY 1995. **Appendix Table 3** provides a breakdown of funding rates by the race/ethnicity of the minority Principal Investigators. Note that the funding rate for Asian PIs has been consistently lower than for other minority groups.

There continues to be a wide disparity in the funding rates of *new PIs* and *prior PIs* (22 percent and 35 percent, respectively, in FY 2002). There are a number of likely reasons for this; for example, prior PIs are more experienced at writing proposals and are more likely to cite the results of previously funded projects in their subsequent proposals. As indicated in Appendix Table 2, in FY 2002 new PIs submitted 15,085 proposals, up 12 percent from last year.

In FY 2002 and beyond, NSF will make strong efforts to increase the number of proposals submitted by and awards made to scientists and engineers from underrepresented groups. A key element of NSF's strategy includes the use of information technology and connectivity to inform and engage under-served individuals, groups, and communities in science and engineering.

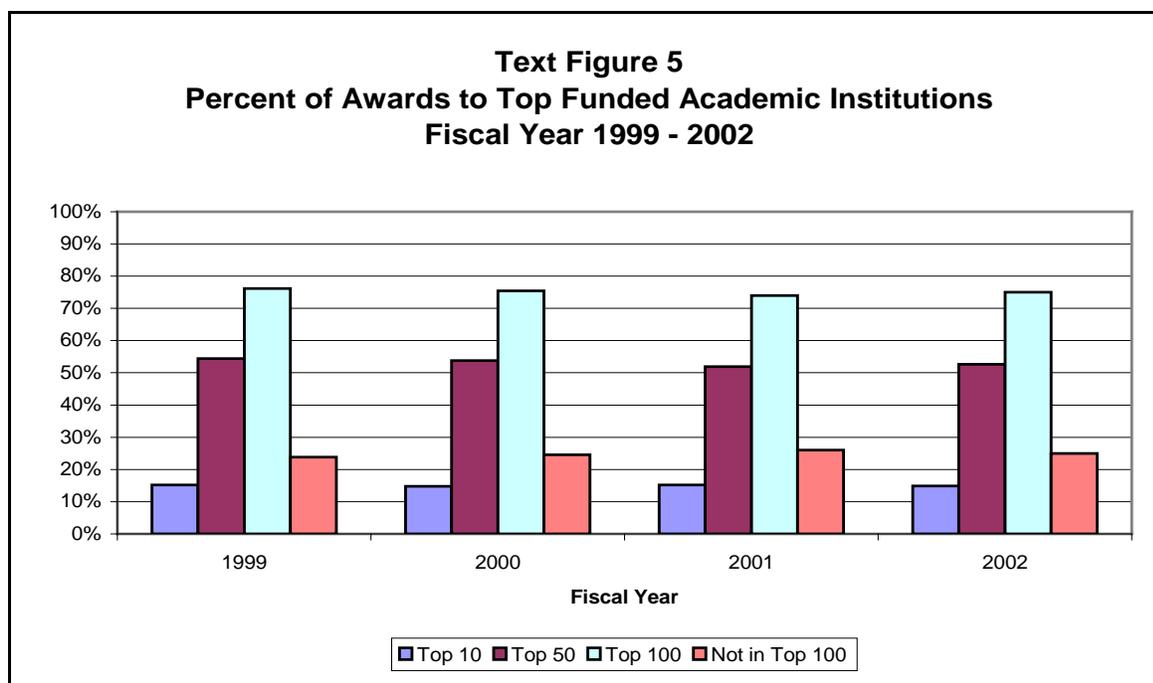
Distribution of Awards by Sector/Institution

According to **Text Figure 4**, in FY 2002 NSF awarded 76 percent of its budget to academic institutions, 15 percent to non-profit and other institutions, 7 percent to for-profit businesses, and 2 percent to Federal agencies and laboratories. The overall distribution of funds by performer has remained fairly constant over the past three years.

Text Figure 4
Distribution of NSF Awards by Performer

	Fiscal year					
	2000		2001		2002	
Type of Performer	\$M	%	\$M	%	\$M	%
Federal	93	2%	80	2%	89	2%
Industry	268	7%	284	7%	323	7%
Academe	2,711	72%	3,292	76%	3,489	76%
Non-Profit & Other	685	18%	665	15%	697	15%
TOTAL	3,758	100%	4,321	100%	4,599	100%

According to **Text Figure 5**, the percent of NSF awards made to the top funded 10, top funded 50 and top funded 100 academic institutions has also remained within a narrow range over the past three years. In FY 2002, the top 10 funded institutions receive about 15 percent of NSF awards while 25 percent of NSF awards are made to institutions that are not in the top 100 funded schools.



Award Amounts and Duration

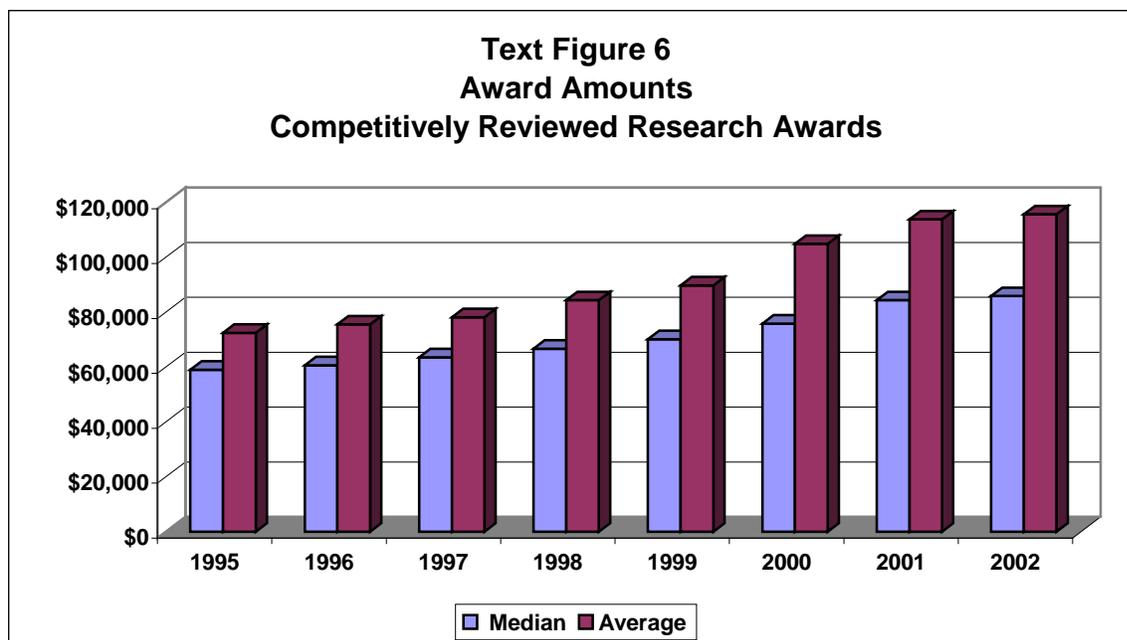
Text Figure 6 indicates average and median NSF award amounts from FY 1995 to FY 2002. Detailed data from FY 1998-2002 are also presented in **Appendix Table 4**. The average annualized award amount for *research grants*⁵ in FY 2002 was \$115,666, an increase of 2 percent from the previous year and 37 percent from FY 1998. The median award⁶ was \$85,839, an increase of 2 percent over last year, and 29 percent over FY 1998. NSF met its FY 2002 GPRA goal to increase the average annualized award size for research projects to \$113,000. The FY 2003 goal is \$125,000 (see Appendix Table 13).

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

Longer award terms are important in increasing the effectiveness of principal investigators and graduate students. Less time is spent preparing proposals, and graduate students are able to have more time to do their thesis work. NSF's FY 2002 GPRA goal was to achieve an average award duration of 3.0 years for research grants. The actual result was 2.9 years. In the future, given adequate funding, NSF would like to increase the duration of research grants to at least four years.

⁵ *Research Grants* is a subset of total NSF awards associated primarily with individual investigator and small group research projects.

⁶ The difference between the median and average award amounts reflects the effect of numerous small awards on the median, and a few large awards on the average award amount.

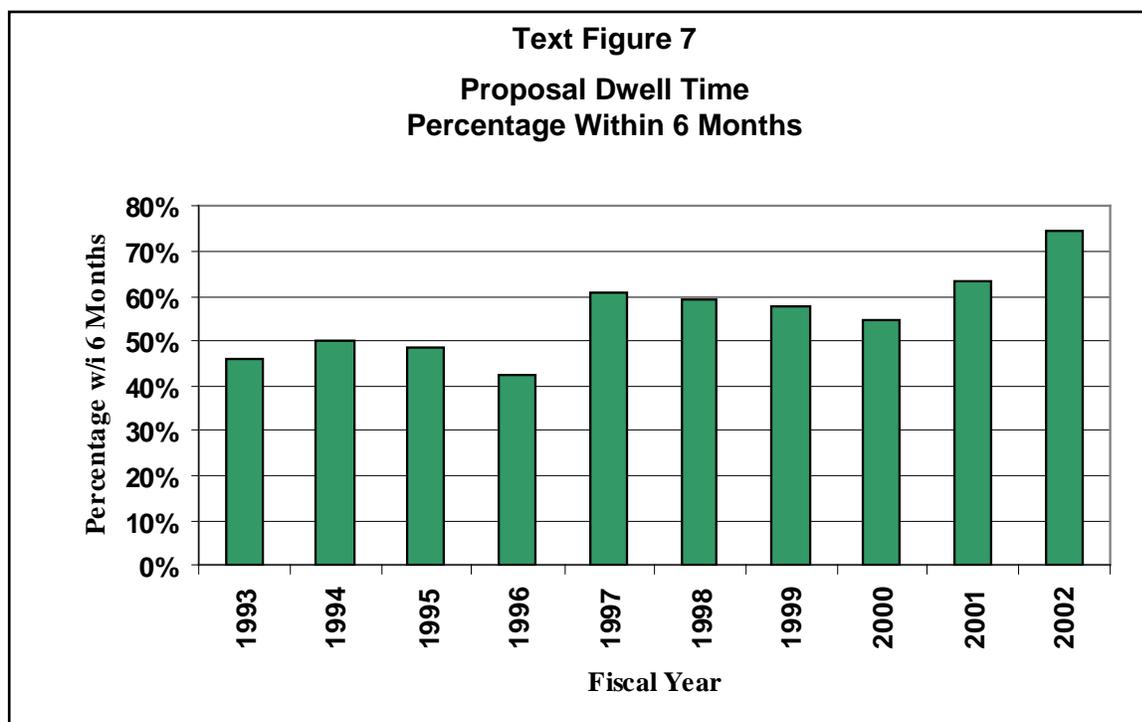


In FY 2001, NSF contracted with Mathematica Policy Research (MPR), Inc. to conduct the Principal Investigator Grant Award Survey (n=6160 PIs) and a companion survey of institutions. The goals of these surveys were to determine the appropriate size and duration of an NSF grant and to identify specific areas within a principal investigator's body of research that would benefit from an increased grant size and/or duration.⁷ The MPR report reveals a general consensus among principal investigators that both award size and duration should be increased. Principal investigators generally agreed that increasing award duration to an average of five years would be desirable. Principal investigators also reported that, on average, an award size of close to \$250,000 would be needed in order to achieve all of their research and educational goals. Student support was the top area slated by principal investigators to receive this additional funding, with about 80 percent of principal investigators reporting that they would increase the number and/or months of graduate support. Increased support for undergraduates and postdoctoral associates was also among the top areas of which additional funding would be directed.

Proposal Processing Efficiency – Dwell Time

It is very important for applicants to receive a timely funding decision (i.e., proposal dwell time). NSF's FY 2002 GPRA performance goal was, for at least 70 percent of proposals, to inform applicants whether their proposals have been declined or recommended for funding within six months of receipt. As indicated in **Text Figure 7**, NSF not only met this goal but surpassed it. In FY 2002, 74 percent of all proposals were processed within six months, compared to 62 percent in FY 2001 and 54 percent in FY 2000. The success of this goal is particularly significant because there was a 10 percent increase in the number of proposals submitted in FY 2002. This is the first year that NSF has achieved this goal since its establishment in FY 1999.

⁷Mathematica Policy Research, Inc. 2002. *NSF Report on Efficiency of Grant Size and Duration*.



3. The Proposal Review Process

The NSF proposal process starts with electronic receipt of the proposal, which is then forwarded electronically to the appropriate NSF program for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF program officer, and usually by three to ten experts from outside NSF in the particular fields represented in the proposal. Care is exercised to assure that the external reviewers have no conflicts of interest.

Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal, along with persons who they believe should not review the proposal. These suggestions may serve as an additional source in the reviewer selection process, at the program officer's discretion. Program officers may obtain comments from assembled review panels or from site visits before recommending final action on proposals.

Senior NSF staff further review recommendations for awards and declines. When a decision has been made, verbatim copies of reviews, excluding the names of the reviewers, and summaries of review panel deliberations, if any, are provided to the proposer.

Review Processes Used at NSF

The involvement of knowledgeable peers from outside the Foundation in the review of proposals is the keystone of NSF's proposal review system. Their judgments of the extent to which proposals address the NSB-established merit review criteria are vital for informing NSF staff and influencing funding recommendations. NSF programs obtain external peer review by three principal methods: (1) "mail-only," (2) "panel-only," and (3) "mail-plus-panel" review. In addition, site visits by NSF staff and external peers are often used to review proposals for

facilities and centers. NSF program officers are given discretion in the specific use of review methods, subject to higher-level review.

In “mail-only” reviews, peers are sent proposals and asked to submit written comments to NSF through FastLane, NSF’s Web-based system for electronic proposal submission and review. These mail reviews are then used by the NSF program officer to support a recommendation for award or decline.

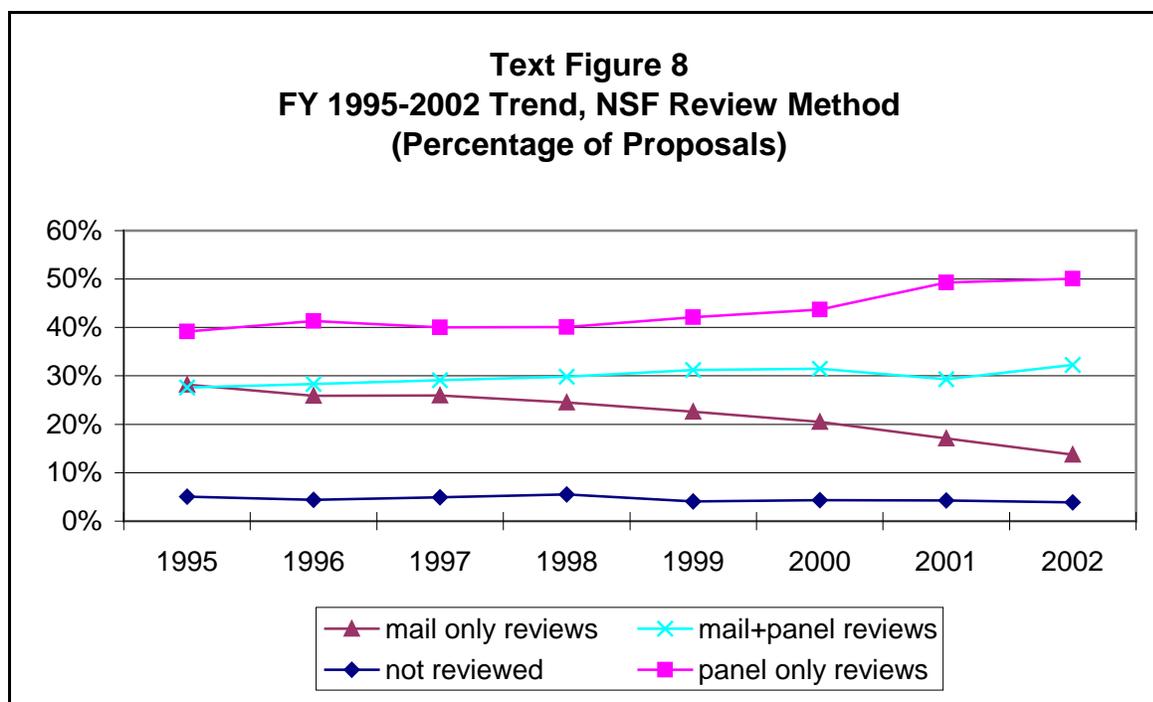
“Panel-only” review refers to the process of soliciting reviews only from those peers who meet in a panel review setting to discuss their reviews and provide advice directly to the program officer. Most programs that use this process provide proposals to panelists and receive their reviews before the panel meeting.

Many proposals submitted to NSF are reviewed using some combination of these two processes (“mail-plus-panel” review). Those programs that employ the mail-plus-panel review process have developed several different configurations, such as:

- A peer is asked to submit a written mail review and also serve as a panelist; and
- A peer is asked to participate only as a panelist, with responsibility only for reviewing and discussing mail reviews written by others and providing verbal and/or written advice to the program officer.

The use of various review methods has changed markedly over time, as shown in **Text Figure 8**, and the corresponding data in **Appendix Table 5**. Since 1995 the percentage of NSF proposals reviewed by panel-only has increased from 39 to 50 percent of all proposals. During the same period, there has been a steady decline in the use of mail-only review from 28 to 14 percent. The use of mail-plus-panel review increased from 28 to 32 percent.

There are a number of reasons for the trend toward panel review. For example, the panel review process permits proposals to be discussed and compared to one another. For this reason, panel review is the norm in evaluating proposals in response to program solicitations and announcements with proposal submission deadlines. The panel review process also has advantages in the evaluation of multidisciplinary proposals, because, unlike mail-only review, viewpoints representing several disciplines can be openly discussed and integrated.



Evaluation of the broader impacts of the proposal is also facilitated by the panel review process. Finally, the panel review process usually requires fewer individual reviewers per proposal than the mail-only process. For example a panel of 25 reviewers could possibly review 200 proposals, while it may require several hundred mail reviewers to review the same proposals. Also, using panels in the review process tends to reduce proposal processing time (time-to-decision), compared to mail-only reviews. For example, in FY 2002, 79 percent of all proposals reviewed by panel-only were processed within six months, compared to 71 percent for mail-plus-panel and 63 percent for mail-only.

Mail review often takes more time because additional reviews must be requested when some of the reviewers in the first set decline to review the proposal. The chief advantages of mail review are: (1) the expertise of the reviewers can be more precisely matched to the proposal, and (2) it is less expensive (for example, there are no travel costs). The mail-plus-panel review process is used frequently because it combines the in-depth expertise of mail review with the more comparative analysis of panel review.

Directorate-level data on the use of different review processes during FY 2002 are presented in **Appendix Table 6**. NSF Directorates vary widely in their use of proposal review methods. Mail-plus-panel review was the predominant review process used in the BIO, GEO, and SBE Directorates while panel-only review was the predominant method in CISE, EHR, ENG and MPS. Mail-only review was the most common mode of review in the Office of Polar Programs (OPP).

Reviews and Reviewers

NSF policy states that each recommendation for final action on a proposal must be accompanied by at least three external reviews, unless the requirement has been waived under special

circumstances. The total numbers of reviews and the average numbers of reviews per proposal obtained by the three different review methods are presented in **Text Figure 9**. As expected, the mail-plus-panel method had the highest number of reviews per proposal. Directorate-level data for FY 2002 are presented in **Appendix Table 7**. The variation among directorates in the number of reviews per proposal reflects both their preferences for the different review methods, and differences in the way directorates count reviewers in the panel review process.

Text Figure 9
Reviews per Proposal, FY 2002

	All Methods	Mail-plus-Panel	Mail-Only	Panel-Only
# of Reviews	213,016	89,111	21,695	102,210
# of Proposals	33,797	11,369	4,838	17,590
Reviews per Proposal	6.3	7.8	4.5	5.8

Diversity of the reviewer pool is an important feature of the merit review system. Reviewers from diverse backgrounds help ensure that a wide range of perspectives is taken into consideration in the review process. NSF emphasizes reviewer diversity through a variety of processes, including use of a large and expanding Foundation-wide reviewer database, explicit policy guidance, mandatory training for all program officers, and directorate-level initiatives.

NSF maintains a central electronic database of about 270,000 reviewers. Potential reviewers are identified from a variety of sources including applicant suggestions, references attached to proposals and published papers, scientific citation indexes and other similar databases, and input from mail reviewers, panelists, and visiting scientists. During FY 2002, 48,000 reviewers were sent one or more proposals for mail review and 10,000 reviewers served as panelists. In all, 54,000 individuals served on a panel, were sent a proposal for mail review, or served in both functions. About 9,000 of these reviewers had never reviewed an NSF proposal before.

In FY 2001, NSF developed systems and policies to enable it to request voluntary demographic data electronically from all reviewers to determine participation levels of members of underrepresented groups in the NSF reviewer pool. The goal was to establish a baseline for participation of members of underrepresented groups in NSF proposal review activities. In FY 2002, a total of 37,943 distinct reviewers returned their reviews on proposals decided upon in FY 2002. Demographic information was volunteered for only 3,507 of these reviewers and 1,168 (33 percent) of these 3,507 reviewers indicated they are members of an underrepresented group. The low response-rate can be attributed to the inability of NSF to legally require reviewers to provide demographic information. Provision of such data is voluntary. NSF requested and collected demographic data from reviewers but given the low response rate, there is not enough information to establish a baseline. In FY 2003, NSF will continue to request demographic information from reviewers.

Meanwhile, NSF will continue efforts to identify additional reviewers from underrepresented groups through: expansion and enhancement of existing NSF Library resources; collection and sharing of potential reviewer data from associations and institutions serving groups that are underrepresented in science and engineering; and encouraging participation of members of

underrepresented groups in activities such as NSF workshops or conferences (so NSF is made aware of the review expertise of each).

Participation in the peer review process is voluntary. Panelists are reimbursed for expenses; mail reviewers receive no financial compensation. It is becoming more difficult to obtain reviews through the mail process. In FY 2002, only 58 percent of requests for mail reviews elicited positive responses, compared to 60 percent in FY 2001 and 62 percent in FY 2000.

Merit Review Criteria

In FY 1998 the NSB approved the use of the two current NSF merit review criteria now in effect:

What is the intellectual merit of the proposed activity?

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

What are the broader impacts of the proposed activity?

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

In FY 1999 NSF established annual GPRA performance goals to increase reviewer and program officer attention to both merit review criteria. Currently NSF Committees of Visitors and NSF Staff provide an annual evaluation of the Foundation's use of the merit review criteria. In NSB meetings discussions, members expressed concern that the broader impacts criterion is not being fully integrated into the review process, and that principal investigators and reviewers are unsure how it should be addressed. They agreed that efforts to ensure that both criteria are addressed in proposals and reviews should be continued and they asked staff to periodically report on these efforts.

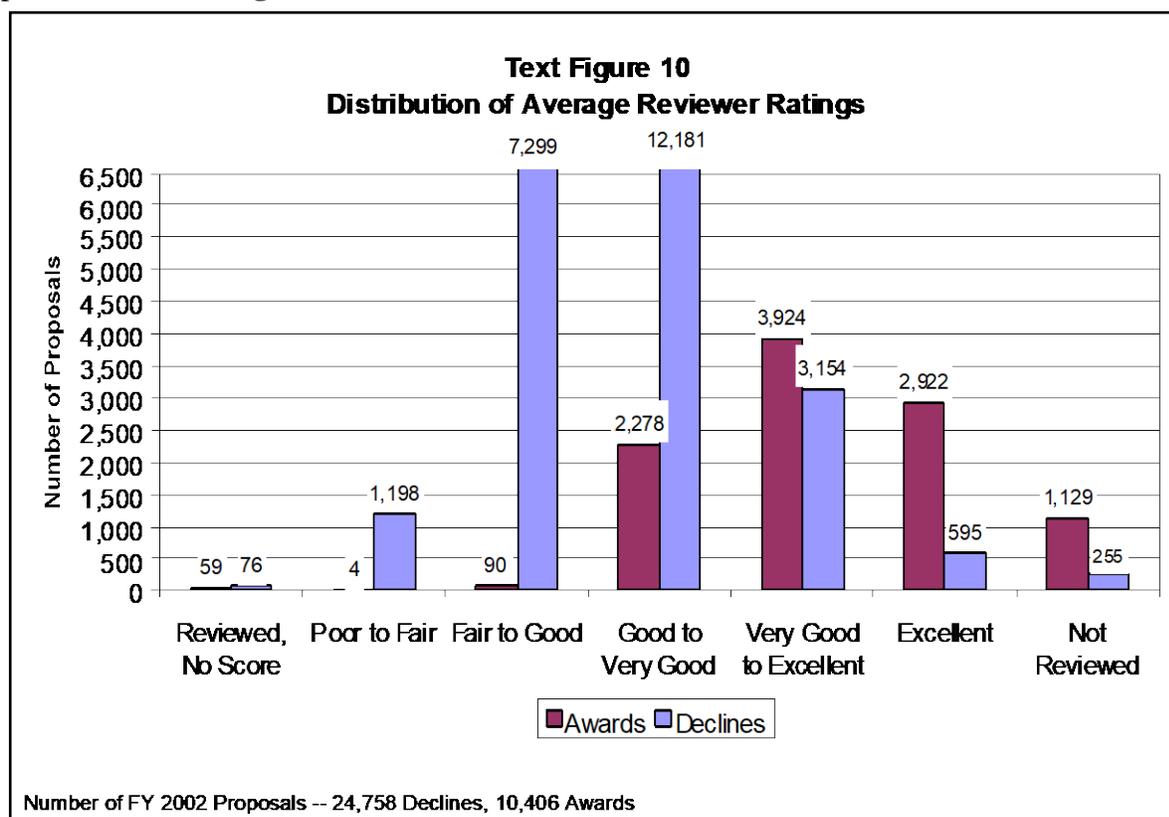
Since then, NSF has completed the following actions to raise awareness of the importance and use of the merit review criteria:

- Developed a draft set of examples of activities that address the broader impacts criterion. NSF will disseminate the set to proposers via a link embedded in the Grant Proposal Guide and in every NSF announcement and solicitation. It will also be available to proposers and reviewers via FastLane.
- Drafted revisions to the Grant Proposal Guide, the FastLane Proposal Guidelines, and the standard language in the Proposal Announcement Template System that instruct proposers that they *must* clearly address broader impacts in the project summaries of their proposals.
- Evaluated reviewer utilization of the broader impacts criterion and concluded that 84 percent of sampled reviews provided evaluative comments regarding the broader impacts criterion.

- Revised its guidance to proposers (in the Grant Proposal Guide) that requires Principal Investigators (PIs) to address both merit review criteria in separate statements within the one page Project Summary. The GPG also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative. Effective October 1, 2002, NSF returned without review proposals that failed to separately address both merit review criteria within the Project Summary. For the first half of FY 2003, 193 proposals were returned without review due to the failure to address the merit review criteria in the project summary.

Reviewer Proposal Ratings

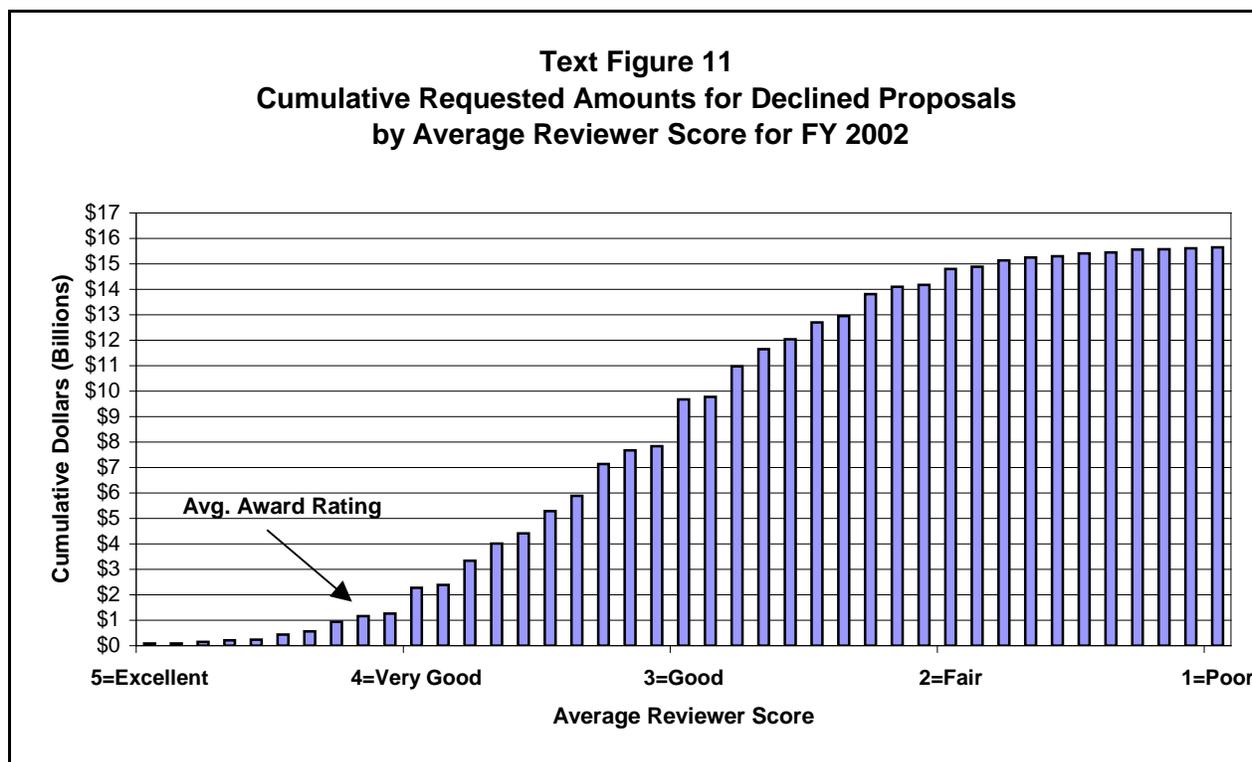
The distribution of average summary ratings⁸ of reviews for awarded and declined proposals is provided in **Text Figure 10**.



These data indicate considerable overlap among the average reviewer ratings of successful and unsuccessful proposals, most notably in the range of “very good” average ratings. **Appendix Tables 8-10** indicate that this overlap among the average reviewer ratings is present and similar in degree for each of the three proposal review methods used by NSF (panel-only, mail-only, and mail plus panel).

⁸ The NSF merit review system emphasizes reviewer narratives over summary ratings. Summary ratings are but one indicator of reviewer judgment of the proposal quality. The written narratives provided by reviewers, the deliberations by panel members, and the expert opinions provided by program officers are all important components of the merit review system. No one component is allowed to dominate over the others.

These data also indicate that a large number of potentially fundable proposals are declined each year. **Text Figure 11** indicates that in FY 2002, \$1.26 billion was requested for declined proposals that had received ratings at least as high as the average rating (4.1) for an awarded proposal. These declined proposals represent a rich portfolio of unfunded opportunities – fertile ground for learning and discovery that lies fallow.



NSF Program Officer Recommendations

As noted above, the narrative comments and summary ratings provided by external reviewers are essential inputs that inform the judgment of the program officers who formulate award and decline recommendations to NSF's senior management.

NSF program officers produce and manage a portfolio of awards, which must be appropriately balanced among various issues and objectives. For example, in addition to information contained in the external proposal reviews, NSF program officers must consider issues such as:

- Potential impact on S&E human resources and infrastructure;
- Balance of research approaches to significant research questions;
- Support for “risky” proposals with potential for significant advances in a field;
- NSF core strategies, such as the integration of research and education;
- Achievement of special program objectives and initiatives, and
- Balance of the overall program portfolio.

These issues are especially important in making difficult award/decline recommendations among proposals that are in the middle reviewer rating range (i.e. proposals with “very good” average

ratings). The number of program officers employed by NSF declined slightly in FY 2002, despite increases in workload. Dividing the number of proposals processed in FY 2002 (35,165) by the number of program officers (334) indicates that NSF program officers process an average of 105 proposals per year. The distribution of these program officers by characteristics is presented in **Text Figure 12**.

Text Figure 12
Distribution of NSF Program Officers by Characteristics
As of October 1, 2002

Program Officers	Total	Percent
Total	334	100%
<i>Gender</i>		
Male	220	66%
Female	114	34%
<i>Race</i>		
Minority	68	20%
White, Non-Hispanic	260	78%
Unknown	6	2%
<i>Employment</i>		
Permanent	139	41%
Visiting Scientists, Engineers & Educators (VSEE)	25	8%
Temporary	30	9%
Intergovernmental Personnel Act (IPA)	140	42%
Source: NSF Division of Human Resource Management Notes: VSEE: Individual employed as a Visiting Scientist, Engineer, or Educator (formerly termed "Rotator"). IPA: Individual employed under the Intergovernmental Personnel Act.		

Program Officers can be permanent NSF employees or non-permanent (includes VSEE, Temporary, and IPA categories) employees. About 59 percent of program officers fall into the non-permanent category, compared to 44 percent in FY 2000. Some non-permanent program officers are "on loan" as visiting scientists, engineers, and educators (VSEEs) for up to three years from their host institutions. Others are employed through grants to the home institutions under the terms of the Intergovernmental Personnel Act (IPA). The number of IPA Program Director positions has increased in recent years. Non-permanent employees provide NSF with new ideas and fresh science and engineering perspectives. In addition to Program Officers, NSF has 20 Science Assistant positions. These staff members assist Program Officers in the proposal review and award process.

Assuring Objectivity in the Merit Review Process

NSF program officers carefully check all proposals for potential conflict of interest and select expert outside reviewers with no apparent potential conflicts. All reviewers are provided guidance and instructed to declare potential conflicts. All program officers receive conflict-of-interest training annually.

Each program officer's recommendation to award or decline a proposal is subject to a programmatic review by a higher level reviewing official (usually the division director), and an administrative review by a grants officer in the Office of Budget, Finance, and Award Management (BFA). The Director's Review Board (DRB) reviews all award recommendations with an average annual award amount of 2.5 percent or more of a Division's prior year current plan. The National Science Board reviews and approves all recommended awards where the average annual award amount is 1 percent or more of the awarding directorate's prior year current plan.⁹

Every proposer receives (from the NSF program officer) a description of the context in which the proposal was reviewed, a panel summary explaining the rationale for the decision (if panel review was used), along with an anonymous verbatim copy of each review that was considered in the review process. A declined PI may ask the cognizant program officer for additional clarification of the decision. If after considering this additional information a PI is not satisfied that the proposal was fairly handled and reasonably reviewed, he or she may request formal reconsideration from the cognizant Assistant Director (AD). This request can be based on the PI's perception of procedural errors or on disagreements over the substantive issues dealt with by reviewers. If the AD upholds the original action, the applicant's institution may request a second reconsideration from the Foundation's Deputy Director (O/DD).

On average, NSF annually declines over 20,000 proposals but receives only 30-50 requests for formal reconsideration. Most program-level decisions are upheld in the reconsideration process. The number of requests for formal reconsideration and resulting decisions at both the AD and O/DD levels from FY 1998 through FY 2002 are displayed in **Appendix Table 11**. Out of the 204 requests for formal reconsideration of declined proposals during the past five years, 12 decisions have been reversed.

⁹ Other items requiring NSB prior approval are new programs and major construction projects that meet certain specifications. In FY 2002, the Board reviewed and approved nine recommended awards.

4. Other Issues Related to Merit Review

Doing Business Efficiently and Effectively

NSF recently developed a strategic plan specifically for its investments in administration and management, the centerpiece of which is an ongoing business analysis.¹⁰ This increased emphasis on administration and management also speaks directly to NSF's efforts under the President's Management Agenda (PMA). Last year, the PMA launched a government-wide effort to improve the management, performance, and accountability of federal agencies. An Executive Management Scorecard is now issued quarterly by the Office of Management and Budget (OMB) to track the progress of agencies in meeting specific criteria under the initiatives that constitute the PMA. At year-end, NSF maintained its "green" successful status for Financial Performance and received a second "green" for E-Government. For the second consecutive year, NSF remains the only federal agency to receive a green rating for any of the PMA initiatives.

President's Management Agenda Scorecard		
	Baseline 9/30/2001	Status: 12/31/2002
Strategic Management of Human Capital	R	R
Competitive Sourcing	R	R
Financial Management	G	G
Expanding E-Gov't.	Y	G
Budget & Performance Integration	R	R

Note: Green represents success; yellow for mixed results; and red for unsatisfactory. www.whitehouse.gov/omb/budget/fy2003/msr06.html.

Doing more with less and working smarter by instituting more efficient and cost-effective business processes have always been hallmarks of the Foundation. In FY 2002, NSF established the Business and Operations Advisory Committee. The committee is composed of 15 members selected from the research administration, education management and business communities, including business professionals and academics in the field. The Committee is charged with providing advice on issues related to NSF's business practices and operations, including innovative approaches to the achievement of NSF's strategic goals.

In FY 2002, NSF retooled a number of business processes which yielded significant cost savings. Conservative estimates put the savings from these cost efficiencies at more than \$500,000. These new business processes included electronic dissemination of information, which resulted in significant savings in both printing and mailing costs. The use of electronic signatures and videoconferencing resulted in considerable savings as well.

A mechanism that highlights NSF's success in Financial Performance and E-government is virtual panels (developed through the synthesis of the Interactive Panel System (IPS) and videoconferencing/teleconferencing). Around 65 percent of panels are using IPS. This system allows panelists to electronically collaborate during the panel meeting. IPS is a part of FastLane that permits the viewing of proposals, reviews, basic panel discussions, collaboration on panel

¹⁰ The Administration and Management Strategic Plan is available at: <http://www.inside.nsf.gov/od/am/>

summaries, and approval of the draft panel summary through the web. Currently, 5-10 percent of panels using IPS have some panelists who are not able to actually be at the panel meeting site but participate virtually using IPS. This allows for panelists who are unable to attend a panel meeting at NSF (due to child care issues, illness, disabilities, scheduling conflicts, travel difficulties, etc.) to participate with the panel through the use of advanced technology. This has improved the quality of panel deliberations.

NSF also focused considerable efforts on enhancing customer service. In FY 2002, 94 percent of all NSF program announcements were available at least three months before the proposal due date and 74 percent of proposals were processed within six months of submission. Both results were significant accomplishments that represented multi-year efforts focused effort across the Foundation.

Performance Evaluation

Because of its importance to the success of NSF's mission, "operating a credible, efficient merit review system" is cited as one of the four critical factors for success in NSF's FY 2002-2006 GPRA Strategic Plan. Performance evaluation, with respect to the operation of the merit review system, is viewed as a process of continuous improvement. It is currently supported with information obtained from the following activities:

- **Applicant and Grantee Information/Merit Review.** All applicants and grantees provide results from previous NSF support, information about existing facilities and equipment available to conduct the proposed research, biographical information on the primary investigators, other sources of support, and certifications specific to NSF. Such information is required at the time of application, at the time of an award, and in annual and final project reports. It is reviewed by NSF staff, utilized during merit review and included in the package of information available to external committees conducting performance assessment.
- **Program Evaluation by Committees of Visitors (COVs).** To ensure the highest quality in processing and recommending proposals for awards, NSF convenes Committees of Visitors (COVs), composed of qualified external evaluators, to review each program approximately every three years. This includes disciplinary programs in the various directorates and offices, and some cross-disciplinary programs managed across directorates. The COVs are comprised of independent, external experts from academia, industry, government, and the public sector. These experts assess the integrity and efficiency of the processes for proposal review and provide a retrospective assessment of the quality of results of NSF's programmatic investments. COV reports are submitted for review through Advisory Committees to the directorates and the NSF Director. The recommendations of COVs are reviewed by management and taken into consideration by NSF when evaluating existing programs and future directions for the Foundation. In FY 2002, about a third of NSF's 200+ programs were evaluated by COVs. See **Appendix Table 12** for a schedule of future COV program evaluations.
- **Advisory Committee (AC) Reporting on Directorate/Office Performance.** Advisory committees advise the seven directorates and the Office of Polar Programs. They are typically composed of 18-25 experts who have broad experience in academia, industry and

government. The role of the ACs is to provide advice on priorities, address program effectiveness, review COV reports, and examine directorate/office responses to COV recommendations. In FY 2001 and previous years, directorate/office advisory committees assessed directorate/office progress in achieving NSF-wide GPRA goals. With the advent of the AC/GPA (see below), advisory committees no longer assess directorate progress toward these goals.

- **Advisory Committee for GPRA Performance Assessment (AC/GPA)** During FY 2002, NSF determined that a more efficient and effective process for the assessment of agency performance with respect to GPRA strategic goals was to charge a single external committee of experts with review of all Foundation accomplishments. That decision resulted in the chartering of a new advisory committee on July 15, 2002. The committee's first meeting was held in September 2002. The AC/GPA is comprised of about 18-25 independent external experts representing academia, industry, and government. The AC/GPA looks at Foundation-wide portfolios linked to the agency's strategic goals related to People, Ideas, and Tools.
- **Government Performance and Results Act (GPRA).** Several of the investment process goals in the FY 2002 GPRA Performance Plan are focused on various aspects of the award selection process, such as the use of the merit review criteria, the need to keep the awards system open to new people and new ideas, and the time it takes to process a proposal. Some of these goals have been discussed in previous sections of this report. These goals and NSF's progress in meeting them are more fully described in **Appendix Table 13**.

Special Proposal and Grant Mechanisms

Preliminary Proposals

Some NSF programs invite the submission of preliminary proposals. The intent of preliminary proposals is to limit the burden imposed on proposers, reviewers and NSF staff. Normally, preliminary proposals require only enough information to make fair and reasonable decisions regarding encouragement/discouragement of a full proposal. Review practices for preliminary proposals vary widely, ranging from non-binding advice from program officers to proposers to formal recommendations from external reviewers or panels.¹¹ In FY 2002, NSF acted on 1,747 preliminary proposals, compared to 2,183 proposals in FY 2001, and 2,069 in FY 2000. Based upon the review of these proposals, NSF encouraged the submission of full proposals in 665 cases, discouraged submission of a full proposal in 519 cases, invited the submission of a full proposal in 168 cases, and did not invite the submission of a full proposal in 372 cases (23 preliminary proposals were withdrawn).

Small Grants for Exploratory Research (SGER)

Since the beginning of FY 1990, the Small Grants for Exploratory Research (SGER) option has permitted program officers throughout the Foundation to make short-term (one to two years),

¹¹ A binding (invite/non-invite) decision is the type of mechanism used when the NSF decision made on the preliminary proposal is final, affecting the PI's eligibility to submit a full proposal. A non-binding (encourage/discourage) decision is the type of mechanism used when the NSF decision made on the preliminary proposal is advisory only. This means that submitters of both favorably and unfavorably reviewed proposals are eligible to submit full proposals (Source: NSF Proposal and Award Manual).

small-scale grants *without formal external review*. Characteristics of activities that can be supported by an SGER award include: preliminary work on untested and novel ideas; application of new approaches to “old” topics; ventures into emerging research areas; and narrow windows of opportunity for data collection, such as natural disasters and infrequent phenomena.

Potential SGER applicants are encouraged to contact an NSF program officer before submitting an SGER proposal to determine its appropriateness for funding. Directorate-level data on SGER proposals and awards are presented in **Appendix Table 14**. In FY 2002, NSF made 278 SGER awards, compared to 256 awards in the previous year. The total amount awarded to SGERs in FY 2002 was \$16,694,405, about 0.4 percent of the operating budget for research and education, far below the five percent of budget that program officers are authorized commit to SGER awards.

Accomplishment Based Renewals

In an accomplishment-based renewal, the project description is replaced by copies of no more than six reprints of publications resulting from the research supported by NSF (or research supported by other sources that is closely related to the NSF-supported research) during the preceding three- to five-year period. In addition, a brief (not to exceed four pages) summary of plans for the proposed support period must be submitted. All other information required for NSF proposal submission remains the same. In 2002 there were 80 requests for accomplishment based renewals, 27 of which were awarded.