National Science Foundation

MANAGEMENT CHALLENGES FOR 2005

This document reports agency actions corresponding to Management Challenges from the Office of Inspector General (OIG) memorandum "Management Challenges for the NSF in FY 2005."

Workforce Planning and Training

OIG Management Challenge

Workforce planning continues to be one of the most serious challenges facing NSF. Since 1999 the number of proposals processed has increased by 40 percent, while the number of program officers assigned to their review has remained relatively flat. Last year alone, the number of proposals increased by 14 percent to 40,075, the largest annual percentage increase in over a decade. The quantity of proposals transmitted to NSF is perhaps the single best indicator of its overall workload. According to NSF, program officers now spend 55 percent of their time on merit review, leaving less time available for other important responsibilities such as award management and oversight and program planning.[1]

NSF's reliance on "non-permanent" personnel is another area of concern. Forty-seven percent of NSF's 700 science and engineering staff is visiting personnel, temporary employees, or intermittent employees. Visiting personnel make an important contribution to NSF's mission by enabling the agency to refresh and supplement the knowledge base of its permanent professional staff. But managers who serve at NSF on a temporary basis frequently lack institutional knowledge and are less likely or able to make long-term planning a priority. In fact NSF's *Business Analysis* project (a multi-year review aimed at reengineering the agency's core business processes) reports that NSF in general is spending less time on forward-looking activities such as strategic planning and program development. Moreover, there are administrative costs that NSF incurs in recruiting, hiring, processing, and training personnel that rotate every 1 to 4 years. In FY 2004, we conducted an audit that identified the additional salary, fringe benefits, travel and other costs of visiting or temporary personnel, and found three areas where NSF could improve its administration of the programs.[2] Therefore, while visiting personnel are an important resource for NSF, the agency must continually balance the benefits of their services against the additional costs involved.

The agency's response to these and other workforce issues is being formulated as part of the *Business Analysis*, which is scheduled for completion by the end of FY 2005. In FY 2004, NSF initiated an agency-wide workforce planning effort based on the findings of the business analysis to date. NSF's Human Capital Management Plan, which was delivered in December 2003, integrates and links Human Capital activities to the NSF business plan and to the Human Capital Assessment and Accountability Framework provided by the Office of Personnel Management. While the current plan provides a roadmap for identifying NSF's future workforce needs, the needs themselves are still in the process of being defined.

NSF Actions

NSF's Human Capital Management Plan (HCMP) and the accompanying Human Capital Accountability Plan identify NSF human capital goals and high-level action strategies, establish a framework for evaluation of NSF human capital policy and operations, and identify key metrics associated with each of the goals in the HCMP. The HCMP includes specific strategic goals and action strategies for strategic workforce planning and educating and developing NSF managers and staff.

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[1] Report to the National Science Board on NSF's Merit Review Process FY 2003 (May 2004)

[2] *Audit of Costs Associated with Visiting Personnel*, July 23, 2004, OIG 04-2-006. Opportunities for improvement cited in the report include consulting income documentation, IPA pay computations, and VSEE cost of living adjustments.

Workforce planning and training are activities with critical strategic importance to the National Science Foundation. Capitalizing on findings from the *Business Analysis* project, NSF is currently engaged in a comprehensive agency-wide workforce planning effort that will result in an agency-wide process for workforce planning that is coordinated with the budget cycle, data-driven; and understandable to managers and staff; more effective distribution of administrative work in program directorates; better-defined roles, responsibilities, and career paths for administrative staff in these organizations; and more effective application of change management principles as NSF business processes and systems are revised and updated.

Management's difference of opinion with the OIG on the issue of agency use of rotators is well documented. Management does not agree that use of IPAs and other rotators and contractors places agency programs at risk. Rather, management believes that the use of rotators at the Foundation is critical to fulfilling NSF's statutory mandate. The National Academy of Public Administration (NAPA) recently endorsed the continued use of both permanent and temporary personnel at NSF. In an April 2003 report, NAPA noted the value of rotators to the NSF mission, and found that, generally, NSF has the right mix of rotators and career employees.[3] The report recommended that NSF continue to use rotators in the positions of program officers, managers, and assistant directors; and that NSF continue to balance the number of rotators and permanent employees based on its experience and the specific requirements of individual positions.

An Office of Personnel Management (OPM) review of NSF's use of the Intergovernmental Personnel Act was conducted in FY 2004 at the direction of Congress.[4] OPM made a number of constructive observations and recommendations in this report, and NSF is working with OPM to implement them. The OPM report states that, "…When NSF looks to universities and research centers, it is able to recruit diverse quality candidates with a wide variety of academic and professional backgrounds and demonstrated leadership skills." In addition, NSF uses IPA's "as conduits to the scientific and engineering research community and as competent employees that can manage NSF's workforce."

Administrative Infrastructure

OIG Management Challenge

A shortage of administrative resources continues to hinder NSF's staff from keeping pace with its growing workload. NSF states that over the past year it has leased an additional 26,576 square feet of space and the travel budget increased from $4.32 million in FY 2003 to $6.05 million in FY 2004 to support the merit review process and increase oversight activities. Management reports that it conducts ongoing assessments of space management and allocation in addition to its regular budget analysis and planning activities. It also encourages video conferencing and telecommuting as methods of leveraging scarce administrative resources. While these efforts provided some relief, more than a third of the management control issues noted by NSF's managers in the FY 2004 controls assessment involves a shortage of human or administrative resources.

Space remains a critical issue, impeding the recruitment of quality staff and the ability to store sensitive documents. In some cases, program officers are sharing cubicles, while contractors are located in file rooms.

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[3] *National Science Foundation: Governance and Management for the Future*, NAPA, April 2004, pp. 91-115.
[4] *The National Science Foundation's Use of the Intergovernmental Personnel Act*, Audit, released December 10, 2004, U.S. Office of Personnel Management, pp. 10-11.

Travel funds were repeatedly cited as inadequate for the purpose of properly overseeing existing awards. NSF must make it a priority to allocate more of its funding for administrative resources in order to maximize the effectiveness of staff.

NSF Actions

Management agrees that administrative resources are constrained at NSF. As reflected in the agency's budget requests since FY 2004, management continues to seek additional staff and the funds necessary to provide additional office space and travel resources. To provide relief for some of the most critical space shortages, NSF leased an additional 8,487 square feet of space in FY 2005. To continue to support the merit review process and increase oversight activities – as NSF's science and engineering and research programs continue to emphasize more complex, interrelated sets of activities – the NSF travel budget increased from $4.79 million in FY 2004 to $7.26 million in FY 2005. The FY 2006 Budget Request emphasizes this priority by investing an additional $1.49 million, or 20 percent, for a requested total of $8.75 million.

In addition to budget analysis and planning, management conducts ongoing assessments of space management and allocation, and encourages innovative and creative approaches to work management, such as video conferencing and telecommuting. Since NSF's formal telework plan went into affect on August 6, 2004, 430 staff have established signed telework agreements.

Management of Large Infrastructure Projects

OIG Management Challenge

NSF's investment in large facilities and infrastructure projects presents management with a number of budgetary and operational challenges. The construction of projects such as telescopes, research equipment, supercomputing databases, and earthquake simulators are inherently risky due to their complex design, cutting-edge technology, and expense. A disciplined project management approach is essential to success; at the same time, modifications are sometimes necessary when developing a new technological tool. NSF spends approximately $1.1 billion a year on these scientific tools, with many of the projects costing as much as several hundred million dollars each.

NSF continues to make measured progress towards addressing the recommendations we offered during two past audits of large facility projects.[5] Our audit reports identified the need to improve oversight of large projects by enhancing organizational accountability, providing better guidance (particularly in the area of financial management), and improving NSF's systems to capture complete information about project costs. During the past two years, NSF has hired a Deputy Director for Large Facility Projects and developed more detailed guidance to support its *Facilities Management and Oversight Guide.*

However, we remain concerned that NSF does not have adequate staff assigned to oversee and manage large projects, and that those assigned may not have sufficient resources or authority to carry out their responsibilities.

[5] Audit of the Financial Management of the Gemini Project, December 15, 2000, OIG 01-2001; Audit of Funding for Major Research Equipment and Facilities, May 1, 2002, OIG 02-2007

In addition, many of the modules intended to support the *Facilities Management and Oversight Guide* are still under development, including those pertaining to financial management. Finally, the problem of recording and tracking the full costs of projects has not yet been addressed. A contract to enhance the financial system for tracking life cycle costs of Major Research Equipment and Facilities Construction projects was awarded at the end of FY 2004.

NSF Actions

During FY 2005, NSF worked with contractors to develop and design an enhancement to its financial accounting system. The system will obligate funds for MREFC projects by lifecycle phases. It will also generate reports on obligation data related to MREFC projects by lifecycle phase. LFP presented and reviewed the design with program officers and budgeting representatives from each Directorate involved in construction or operation of major research facilities. Identifying beta participants for initial adoption has been completed. Completion of testing is expected before the end of the first quarter of FY 2006. A user guide and training for Phase I on the facility tracking system will be available during the first quarter of FY 2006. NSF has included the facilities tracking system in the work plan to integrate budget, cost and performance that has been approved by OMB and enables NSF to achieve success in the President's Management Agenda initiative to integrate budget and performance. Milestones have been established beginning with the fourth quarter of FY 2005.

Three additional modules to accompany the Facilities Management and Oversight Guide have been developed during this fiscal year. The Financial Management module is being written in parallel with the development of the life-cycle tracking software.

An additional staff person, with expertise in financial and administrative oversight of awardee business systems, is now onboard. Recruitment of a second person, to further strengthen project management and oversight, is planned during FY 2005. This will be a total of four, full-time permanent FTEs.

Post-Award Administration

OIG Management Challenge

Since FY 2002, independent audits of NSF's financial statements have cited weaknesses in the agency's post-award monitoring of grantee institutions as a major deficiency. An effective post-award monitoring program should ensure that: awardees are complying with award terms and conditions and federal regulations; adequate progress is being made toward achieving the objectives and milestones of the program; and expenditures listed on NSF's financial statements are accurate. While NSF has taken some steps over the past three years toward establishing a risk-based program for post-award monitoring of its grants, more needs to be done. NSF must broaden its approach to award monitoring to go beyond high-risk awardees, develop more effective award oversight guidance, and increase the coordination between program and financial officers.

In FY 2004, NSF reorganized the Office of Budget, Finance and Award Management to establish the Division of Institution and Award Support. The Division's role is to manage federal funds awarded by NSF, including providing financial and administrative assistance to institutional awardees and NSF directorates to implement business models, processes and practices.

In addition, NSF has increased its outreach to at-risk institutions and developed creative ideas for partnering with other agencies to monitor common grantees. Together these actions represent progress toward addressing post-award administration issues at NSF.

However, NSF's approach to post-award administration focuses too narrowly on high-risk awardees. Because the agency considers only 42 out of its 34,011 awards to be high-risk, the impact of the Award Monitoring and Business Assistance Program (AMBAP) is effectively limited to 0.1% of its award portfolio. To broaden the scope of its activities, NSF should apply more cost-effective monitoring procedures such as desk reviews of reports from awardees and computer-assisted screening to medium and low risk awardees on a random basis.

NSF also issued an award-monitoring guide in FY 2002 and a revised site-visit guide in FY 2003 for agency staff; however, both guides need improvement. In an assessment of NSF's post-award monitoring efforts, IBM Business Consulting commented, "the staff did not follow or only loosely followed the AMBAP guide noting that it was too broad and extensive to be implemented in a realistic timeframe." Meanwhile, the site visit guide does not address many important details for conducting a review, such as how and what types of reviews should be conducted, and therefore does not assure quality or consistency.

The site-visit guide does not standardize documentation for performing or recording the results of the review, thereby increasing the risk that procedures may not be consistently applied. IBM noted that this lack of documentation undermined the follow-up of site visits, and recommended standardized procedures for writing the report, following up, and maintaining documentation in a database for analysis of overall findings. Furthermore, in a recent audit report we cited close coordination between the program and administrative offices as an effective practice of organizations engaged in post-award monitoring and oversight, [6] NSF should seek to develop one comprehensive approach to award monitoring that would include both a financial and programmatic component.

Finally, the Improper Payments Improvement Act of 2002 requires agencies to review all programs and activities annually and identify those that are susceptible to significant improper payments. In May of 2003, the Office of Management and Budget (OMB) issued guidance requiring agencies to statistically sample those programs at high risk for improper payments and establish baseline error rates and improvement targets for future reporting. NSF, like other grant making agencies, is challenged to implement the OMB requirements. Since improper payments include those made by NSF's awardees and subawardees, designing a methodology to statistically sample the voluminous number of payments made by NSF's 2500 awardees is complex.

NSF Actions

NSF's Award Administration Enterprise

Over the past several years, the substance of the findings and attendant recommendations with regard to post-award monitoring have changed annually, owing to NSF's substantial progress in the implementation of NSF's post-award administration program. In the FY 2001 audit, the auditors recommended that NSF establish a risk-based post-award monitoring program; NSF did so the following fiscal year. For FY 2002, the auditors critiqued the program and recommended changes; NSF implemented the changes.

[6] Management Framework: Award Monitoring; September 30, 2003; OIG 03-2-015

In FY 2003, the auditors recommended that increased resources be committed to award monitoring, standardization of review processes, and full implementation of the award-monitoring program; during FY 2004, the Office of Budget, Finance and Award Management realigned its staff and resources, and established a new Division of Institution and Award Support with a primary role to monitor federal funds awarded by NSF, including providing financial and administrative assistance to institutional awardees and NSF directorates to implement business models, processes and practices. In addition, NSF has increased its outreach to at-risk institutions and developed creative ideas for partnering with other agencies to monitor common grantees.

In FY 2004, the auditors recommended 1) revision of the risk assessment model to identify all known high-risk awards; 2) development and implementation of a plan for required baseline and advanced monitoring of all grantees; 3) development of a corrective action plan to address the suggestions in the "Overall Assessment Opportunities for Improvement" section in the IBM *Post Award Monitoring Assessment Report*, dated March 2004; and 4) an increase of resources dedicated to post-award monitoring. In addition to meeting these requests, NSF management initiated a series of information exchange meetings with OIG Audit Staff and KPMG, the external auditor for the NSF Financial Statement Audit.

As of FY 2005 year end, the following strategy for post-award administration has been implemented, including 1) subjecting all awards to baseline monitoring; 2) broadening the scope of monitoring activities to include both medium and low risk awards identified on a random basis with an NSF contract in place to perform the statistically valid sample of medium and low risk awards; 3) issuing in June 2005 Standing Operating Guidance that provides a single comprehensive reference for the financial and administrative policies, procedures, and activities that comprise BFA's Post Award Monitoring program with links to several documents including a completely updated, expanded and improved Site Visit Review Guide and the Risk Assessment Guide; and 4) establishing closer coordination between the program and administrative offices to ensure effective practices with regard to post-award monitoring and oversight.

With regard to the requirement under the Improper Payments Improvement Act of 2002, it is important to note that NSF has put a contract in place to sample transactions drawn from a statistically valid sample of grant awards made under the appropriations for programs identified as being at high risk for improper payments. To be more specific in terms of the statistical validity of the sample, the universe of samples is all FCTR transactions for the review period; as such, the sample includes transactions from each of the quarterly reports by grant recipient.

Cost-Sharing

OIG Management Challenge

Cost sharing refers to the contribution of financial or in-kind support by recipients of federal grants to the cost of their research projects. Federal guidelines require that the accounting of cost-shared expenses be treated in a manner consistent with federal expenditures. However, our past audit work indicates that many awardees do not adequately account for or substantiate the value of cost-shared expenditures, raising questions about whether required contributions are actually being made.

Two years ago, NSF changed its policy to require cost sharing above the statutory requirement *only when there is tangible benefit to the awardee*, such as a facility that will outlast the life of the research project or income derived by the awardee as a result of the research. There is evidence that the new policy has effectively curtailed new cost sharing agreements. The number of new awards that include cost sharing declined from 3346 in FY 2001 to just 1556 during FY 2004. During the same period, the amount of promised cost sharing declined by 54 percent. Less cost sharing reduces the potential for compliance problems and the burden on the agency for correcting them.

While reducing cost sharing requirements mitigates the challenge, it does not eliminate it since some cost sharing is required by statute and some is voluntary. The agency states that it is providing greater oversight in the risk assessment protocol and site reviews.
Cost sharing is also identified as a high-risk factor and a focus of the new protocol. It is too early to assess the effectiveness of these efforts. In October, the agency acted to eliminate future cost sharing except for what is required by statute. The policy is likely to further reduce the amount of cost sharing entered into by the agency but to what extent is not known. We will continue to monitor the substantial amount of cost shared funds still outstanding and reassess changes brought about by the new policy.

NSF Actions

On October 14, 2004, the National Science Board (NSB) approved a major revision to the NSF cost sharing policy. The NSB eliminated program specific cost sharing; and further specified that only statutory cost sharing (1%) will be required for unsolicited proposals. Initial implementation guidance was issued in the fall and an Important Notice and Frequently Asked Questions will be issued to further inform the research community regarding this change. The relevant NSF policy documents, e.g., the *Grant Proposal Guide*, the *Grant Policy Manual*, the *Proposal and Award Manual* and the award terms and conditions, also will be updated to ensure consistency with the revised cost sharing policy.

Previously, the cost sharing line on the NSF budget (Line M) was masked from reviewers to ensure that cost sharing was not considered in the review process. To fully implement the concept of elimination of program specific cost sharing, NSF intends to modify the current NSF Budget Form to eliminate Line M and therefore, an organization's ability to include cost sharing in a budgetary submission to NSF.

All new NSF program solicitations issued after October 15 specify, "cost sharing is not required."

All previously issued (prior to October 14, 2004) program solicitations that specified a cost-sharing requirement remain in effect, unless NSF formally modifies the program solicitation to eliminate the cost-sharing requirement. The Foundation will ensure that future versions of these solicitations no longer contain a cost-sharing requirement. The award data from the past five years reveal a significant reduction in awards with required cost sharing (non-statutory):

Fiscal Year	C/S Dollars	Awards	Total Award Actions	%
FY 2000	$508 M	3109	19,789	15.71
FY 2001	$534 M	3346	20,529	16.30
FY 2002	$419 M	3188	21,369	14.92
FY 2003	$325 M	2359	22,782	10.35
FY 2004	$244 M	1556	22,862	6.80
FY 2005*	$170 M	897	22,492	3.99

*FY 2005 cost share data as of 9/30/05.

The data above will eventually fall to zero as current active awards that contain cost sharing commitments expire over the next several years. As part of NSF's Award Monitoring and Business Assistance Program, the Foundation will continue to monitor the remaining ongoing awards that have specific cost sharing requirements.

Information (IT) Security

OIG Management Challenge

NSF must have a comprehensive and effective information technology (IT) security program both to meet Federal requirements and to mitigate risks that threaten the successful operation and development of its IT systems. These systems and the information they contain need to be protected from unauthorized access, use, disclosure, disruption, modification, and destruction. Over the past several years, NSF has taken a number of steps to strengthen its IT security program. For example, it formed a Security Working Group comprised of managers from across the agency to set NSF policy and procedures, and established a new security office to implement them. All staff are required to complete security awareness training each year. NSF has undertaken penetration testing of its systems in order to find and address vulnerabilities more quickly. In addition, the agency completed the certification and accreditation of 18 of its 19 general support systems and major applications by the end of FY 2003, and in FY 2004 began a triennial cycle of recertification of all systems.

Also in FY 2004, the Office of Polar Programs completed a comprehensive inventory of the systems supporting the U.S. Antarctic Program (USAP), classifying them as one general support system and two major applications, rather than one major application as they had been classified in 2003. The agency plans to certify and accredit those systems by the end of CY 2004.

Despite these accomplishments, IT security is an ongoing challenge for NSF, as for all federal agencies, and some weaknesses remain. The OIG's FY 2004 Federal Information Security Management Act (FISMA) report issued on June 30, 2004, noted that the systems serving the USAP still had not been certified and accredited, information security policies had not been established and implemented, and required background investigations for key information security personnel had not been performed. Our review also found that NSF had not updated its risk assessments and security plans to account for the migration of its payroll and personnel systems to another federal agency, NSF's disaster recovery plan had not been fully tested, and access controls could be strengthened. These vulnerabilities could result in unauthorized access to and modification of financial, programmatic, and other sensitive information; loss of assets; health and safety risks; and disruption of critical operations and the ensuing costs associated with business downtime and recovery. NSF has reported that it has made significant progress in all these areas since our review.

NSF Actions

NSF's Information Technology (IT) Security Program is committed to assuring that the NSF infrastructure and assets are appropriately protected while maintaining an open and collaborative environment for scientific research and discovery. NSF has established a strong and comprehensive security program that is consistent with Government-wide guidance and patterned after industry best practices. NSF continued to strengthen all areas of its information security program in FY 2005, and our investment in security continues to produce excellent results. NSF maintains a balanced approach to information security based on risk management where information security risks are assessed, understood and mitigated appropriately. A comprehensive Federal Information Security Management Report (FISMA) is submitted to OMB annually describing accomplishments during the year.

NSF has invested significant time and resources to certify and accredit 100% of its general support systems and major applications. The general support systems and major applications are on a 3-year schedule for re-accreditation. NSF believes that continuous monitoring is a critical aspect of managing risk within the NSF IT infrastructure.
Continuous monitoring has been aggressively implemented through regularly scheduled vulnerability scans, internal and external penetration tests and a 24x7 intrusion detection system capability and remediation process. Leading edge tools such as enterprise automated vulnerability management applications are used to support remediation of vulnerabilities on network devices.

NSF has quickly adopted and implemented new federal guidance to categorize information systems, and assesses security controls on all nineteen major applications and general support systems. Virtually every aspect of NSF business operations is dependent on continuous, reliable availability of computing resources. NSF has a comprehensive disaster recovery program and continuity of operations plan. In FY 2005 NSF conducted two Disaster Recovery Exercises and, as a best practice, initiated an integrated Continuity of Operations and Disaster Recovery exercise.

NSF has addressed development of new security policies in 2005 by developing and publishing policies for Malware/Virus Protection, IT Privacy Policy, Security Awareness Training and updating it Personal Use for NSF's Technology and Communication Resources and Sensitive Information Policy. NSF has a process and multi-year plan in place to review personnel sensitivity levels for background investigations. Effective access control procedures are in place to remove access privileges for separated employees and contractors.

Risk assessments and security plans for the personnel and payroll migration were updated to reflect connectivity with another federal agency.

Antarctic Program: The United States Antarctic Program (USAP) made significant progress in 2005 toward strengthening its security posture. USAP certified and accredited its two major applications and resolved a number of vulnerabilities. USAP has developed security policies and is developing procedures to support its program-wide security policies. USAP conducted contingency plan testing and monitors a comprehensive Plan of Action and Milestones (POA&M). USAP is also implementing an online security awareness program. USAP has worked closely with NSF to achieve an aligned and closely integrated security program to secure the Foundation environment.

Recognizing there are always risks that must be appropriately assessed and mitigated, NSF's overall security program and posture continues to be positive and reflects our commitment to continuous and sustained improvement to what will remain complex and challenging issues in the years ahead.

GPRA Reporting

OIG Management Challenge

Congress enacted the Government Performance and Results Act (GPRA) in 1993 as a means of making government more results oriented. The Act requires each agency to develop a strategic plan that establishes specific goals against which its performance can be objectively evaluated. To further focus government agencies on results, the President's Management Agenda requires that performance be considered in funding and management decisions and that programs work toward continual improvement. In support of these objectives, OMB introduced the Program Assessment Rating Tool (PART) to provide a framework for evaluating performance and generate program effectiveness ratings for Congress to consider when making budget decisions.

GPRA poses a significant challenge to agencies involved in science or education research because the benefits are difficult to measure and may only become apparent over time. Moreover performance measures must be carefully formulated so as not to discourage appropriate high-risk research that offers the potential for a "transformational" discovery.

Because of the complexity involved in measuring the benefits of research, a full discussion of the methodology employed in reporting performance results should be prominently included in each performance report. Last year we issued an audit report on the Committee of Visitors panels that are used by NSF to provide qualitative data for GPRA reporting. We found that some of the limitations associated with the use of the data were not fully disclosed in the agency's GPRA report. Further, we noted that NSF relied on judgmentally selected "nuggets" (research success stories) as evidence that it has achieved its GPRA goals, again without full disclosure. Our report indicated that a user of NSF's performance report might infer that the nuggets are representative of the performance of the entire portfolio, and the credibility of the reports could become compromised. We recommended that NSF more clearly disclose the limitations associated with both issues.

In FY 2004, NSF expanded its disclosure of the methodology it employed and, while this disclosure has resolved the issues raised in the audit report, we continue to believe NSF should report on the performance results of its entire research portfolio. To do this, NSF will need to develop a knowledge management system to capture, categorize and analyze the research results.

NSF Actions

While GPRA and PART do pose significant challenges to agencies involved in science and education research, NSF has balanced these challenges through an integration of quantitative and qualitative metrics. OMB's approval of the "alternative format" permitted development of a multi-layered assessment approach. This approach uses multi-year Committees of Visitor evaluations as one input into the strategic goal and R&D Investment Criteria analysis of the Advisory Committee for GPRA Performance Assessment (AC/GPA). The AC/GPA process, together with all NSF's results for GPRA and PART goals in the Performance and Accountability Report, is further assessed by an external party for verification and validation (V&V). The FY 2004 V&V concluded "NSF provided information of adequate quality for the AC/GPA to reach a valid and verifiable conclusion on NSF's progress in achieving its Strategic Outcome Goal indicators."[7] As the Committees of Visitors evaluate the entire program or set of programs under their review, including random sampling of proposal and award jackets, it is incorrect to imply that the evaluation process does not encompass the entire NSF portfolio.

Budget and Performance Integration/Cost Accounting

OIG Management Challenge

An effective accounting and reporting system is essential to attaining the objectives of the President's Management Agenda and complying with GPRA. However, NSF's current information systems do not readily provide the cost accounting information necessary to link its costs to program performance. While NSF has been a leader in generating annual financial statements that have received "unqualified" audit opinions for the past six years, it is only beginning to focus on developing a cost accounting system to address its program performance evaluation and reporting needs.

For the past four years, each financial statement audit has recommended that NSF identify management cost information requirements for each organizational unit or program, establish activities/projects and corresponding outcomes within each unit, and develop and report cost efficiency measures that align with outputs and outcome goals.
The auditors have also noted that NSF's systems do not track complete cost data for projects in which the costs are borne by more than one NSF directorate or organizational unit. Consequently, program officers cannot monitor the full cost of a project.

In FY 2004, NSF management developed a Budget, Cost and Performance Integration (BCPI) work plan that was approved by OMB. The agency states that cost accounting is a key element of the BCPI plan. A crosswalk was developed between the costs accounted for in the appropriations reporting system and those in the new programmatic reporting framework.

[7] *NSF GPRA and PART Performance Measurement Validation and Verification Report on FY 2004 Results*, October 2004, IBM Business Consulting Services.

When NSF is able to interface the crosswalk with the Financial Accounting System, the agency will be able to identify the full direct costs of its programs and projects, including its large facility projects. However, the plan does not provide for tracking costs of NSF's internal business processes and activities such as the cost of soliciting grants, conducting merit reviews, or performing post-award grant administration. Identifying the costs of these internal functions is important for evaluating NSF's performance accomplishments under its organizational excellence strategic goal.

NSF Actions

In December 2004, NSF received a "Green" for the President's Management Agenda (PMA) Budget and Performance Integration Initiative. OMB noted on its website, "NSF can estimate the resources necessary to achieve its long-term strategic goals and track those resources from operating plans to obligations to expenditures."

NSF's Statement of Net Cost reports the full cost of the agency's strategic goals of People, Ideas, and Tools and NSF's 10 primary programmatic activities, which are the "investment categories" that undergo PART assessment each year. Costs are identified at the lowest program element level and aggregated to the primary program activities. Only those transactions that cannot be directly attributed to a specific program activity – less than 9% in FY 2004 Q4 – are allocated using a pre-established methodology.

A crosswalk that links the appropriations reporting system to the new reporting framework and interfaces with the Financial Accounting System allows NSF to track budgetary resources, commitments, obligations, and expenditures. NSF can identify the full costs of its programs and projects, including its large facilities projects.

With respect to NSF's internal business processes, NSF accomplishes its mission with notable efficiency. Approximately 95% of the agency's budget goes to support the actual conduct of research and education and only about 5-6% to administration and management. NSF is recognized as a leader in streamlining and implementing technological and business practices; in 2004, NSF received the President's Quality Award for Management Excellence for exemplary performance in expanding electronic government and NSF holds the longest track record for "Green" ratings for both the E-Gov and Financial Management PMA initiatives.

To develop data on the cost of internal processes such as the cost of soliciting grants, conducting merit reviews or performing post-award grant administration would require changing the Financial Accounting System and establishing a time distribution system. This would be a prohibitively large agency investment – a cost that would outweigh the benefits since there is no clear indication that this information would enable NSF managers to make better resource allocation or management decisions. In fact, the most critical information that determines how to best allocate limited resources is derived from NSF's merit review system, of which 90% of NSF annual research funding undergo. Moreover, due to separate appropriation lines, NSF managers cannot make trade-offs among administrative, program and construction resources.

Management of U.S. Antarctic Program

OIG Management Challenge

As part of its mission, NSF finances and supports Antarctic research, providing over $197 million in FY 2004 for research activities in Antarctica. Its single largest award is a contract for Antarctic logistics and support services valued at $1.116 billion over 10 years. Each year the United States Antarctic Program (USAP) deploys about 700 people to the continent to perform scientific research and another 2,500 to provide logistics in support of this research, including the operation and maintenance of year-round research stations. Those deployed include research teams from academia, industry, and government, military personnel, and contractor employees.

NSF's contract for Antarctic support contains many inherent risks and complex requirements. The contractor must have technical expertise in a variety of disciplines, including medical and environmental engineering, and is responsible for managing a number of subcontractors in the U.S. and overseas. Therefore, NSF's oversight of the programmatic and financial performance of this large contract is itself a formidable challenge, requiring considerable administrative and technical skill. The remote and harsh Antarctic landscape leaves little margin of error for many basic support activities. For example, weaknesses in the USAP information system were cited as a reportable condition during the agency's most recent IT audit since they could potentially disrupt essential life support or science activities. The agency also has yet to resolve an outstanding recommendation from an audit report issued last year aimed at strengthening the USAP's capital asset management program and renewing its aging infrastructure. The issue involves how best to assure funding is available to maintain the infrastructure in a timely manner. NSF comments that it has sustained an ongoing effort to maintain and upgrade facilities at McMurdo and Palmer Stations, albeit at a slower pace than is ideal, and affirms that the USAP is providing a safe and healthy environment.

A recent audit identified instances of over billing by the contractor. Consequently, the OIG is planning to conduct a financial and compliance audit of the Antarctic Logistics and Support Contractor that will include a review of internal controls over cash management and compliance with various fund restrictions. We will also continue to monitor its information systems.

NSF Actions

NSF addressed the recommendations made by the OIG in its 2003 audit of the occupational health and safety, and medical programs. NSF is fully committed to providing infrastructure that provides a safe and healthy environment, and we believe we have done so.

We continue to employ, though our own Program Managers as well as through arrangements for subject matter experts from other Federal Agencies, the expertise required to meet the challenges posed by supporting research in Antarctica. overseeing construction and maintenance of all infrastructure, and overseeing environmental, health, safety and medical activities. In FY 2005, the Office of Polar Programs (OPP) established a new section to address environmental, health and safety issues at the policy and oversight level for both Antarctic and Arctic research.

Also in FY 2005 OPP, continued to develop and improve its IT security posture. Certification and Accreditation of the USAP's major applications and its General Support System have been completed.

Policies were formalized and issued, and implementing procedures are due to be complete by the end of FY 2005. The IT systems have been the subject of two penetration tests, and findings from those tests have been resolved. Finally, a security awareness program, first deployed in FY 2004, will be expanded this year and it is expected that virtually all USAP participants will receive the required training.

NSF management is currently negotiating resolution of an audit of the USAP support contractor.

Broadening Participation in the Merit Review Process

OIG Management Challenge

The merit review process is a cornerstone of NSF's operations, ensuring the integrity and fairness of the proposal review process and maintaining the high standards of excellence for which NSF is known. NSF was able to fund only 27 percent of the more than 40,000 proposals it received in FY 2003. The agency decides which research, engineering and education projects to fund by subjecting most proposals to a rigorous merit review process that ensures each will receive knowledgeable and unbiased consideration based on specific criteria. It is largely through the merit review system that NSF adds value to the national research and education enterprise. One objective in NSF's Strategic Plan is to increase the participation of underrepresented groups and institutions in all NSF programs and activities, including merit review. Developing the untapped potential of underrepresented groups should lead to expanded individual opportunity and improved national competitiveness and prosperity.

During FY 2003, the percentage of underrepresented groups that received awards remained steady, with female and minority PIs funded at approximately the same rate as the overall proposer population. The number of awards made to minority PIs remains at 5 percent of total awards. Beginning in FY 2001, NSF started requesting demographic data from all merit panel reviewers to determine the extent of participation of underrepresented groups in the NSF reviewer population. However, NSF cannot legally require reviewers to provide demographic information. In FY 2003, out of a total of 40,020 reviewers who returned reviews, only 5,336 provided demographic information. Thirty-four percent of those indicated they were members of an underrepresented group. In FY 2004, NSF continued to use seminars and workshops at minority-serving institutions in an effort to expand interest in NSF's programs. Reviewer diversity is emphasized through the use of a large and expanding Foundation-wide reviewer database, explicit policy guidance, mandatory training for all program officers, and directorate-level initiatives. The agency will also continue to request demographic information and adjust the FastLane reviewer module to make it more convenient for reviewers to provide such information.

NSF Actions

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

In FY 2004, the number of proposals received from minority PIs increased by 19 percent over the previous fiscal year (from 2,141 to 2,551). The funding rate for minority PIs was 23 percent, slightly lower than the overall funding rate for NSF.

During FY 2004, the number of proposals received from women PIs increased by 15 percent over the previous fiscal year (from 7,335 to 8,427), and the funding rate was 25 percent.

Obtaining data about the gender and ethnicity of individual reviewers remains a challenge due to the fact that provision of such data is voluntary. For example, in FY 2004, out of a total of 41,263 distinct reviewers who returned reviews, 7,092 provided demographic information. Out of the 7,092 who provided information, 2,449 (35 %) indicated they were members of an underrepresented group. In FY 2004 NSF altered the FastLane reviewer module to make it more convenient for reviewers to provide demographic information. During FY 2005, for all reviewers entering or updating their demographic information on FastLane, 35 percent provided demographic data. Prior to the FastLane modification, approximately 20 percent of reviewers provided demographic information. NSF will continue to monitor the situation over time, and take additional measures as needed in order to obtain the data necessary to evaluate increased participation.

In FY 2005, NSF continued to use seminars and proposal writing workshops for the purpose of broadening participation. For example, NSF held a grants writing workshop for tribal colleges in May 2005. In addition, the Computer & Information Science & Engineering directorate (CISE) held meetings to disseminate information on Broadening Participation in Computing, a new program designed to increase the number of students receiving postsecondary degrees in computing sciences, with an emphasis on students from underrepresented groups.

In FY 2005, Dr. Thomas Windham, Senior Advisor for Science and Engineering Workforce, and NSF senior staff contributed ideas and strategies to broaden participation, promoting the sharing of effective approaches across the agency. In addition, an NSF committee of executives, managers, and staff completed "Diversity in the NSF Science and Engineering Workforce: A Report and Plan for Action" to address NSF's performance goal of increasing the diversity of the agency's science and engineering staff.

Math and Science Partnership Program

OIG Management Challenge

NSF has responsibility for the Math and Science Partnership (MSP) program, a key element of the President's initiative, *No Child Left Behind*, aimed at strengthening and reforming K-12 education. In FY 2002 and 2003, NSF awarded a total of $280 million to fund partnerships between school districts, colleges and universities, and other organizations for the purpose of improving math and science education at the K-12 level. NSF has requested an additional $80 million to support ongoing activities of the MSP program in FY 2005. The program poses several challenges for NSF, including the need to facilitate partnerships among institutions that do not normally collaborate, monitor awardees that are unaccustomed to handling federal funds, and ensure that projects are implemented as proposed and have effective evaluation plans that adequately report their impact on student achievement.

In a recent report, we reviewed the evaluation plans for nine of the first 23 MSP projects and found that five had effective evaluation plans. The other four projects in our sample were missing key elements of an effective evaluation process. In response to this finding, NSF plans to enlist the help of evaluation experts to frame a statement of practice to serve as a framework for current and future MSP award recipients. We also recommended that the agency develop a comprehensive management plan for evaluating the MSP program.

An award for an external evaluation of the MSP program consistent with the research and development nature of the program was recently made.

NSF Actions

NSF has developed a comprehensive plan for the oversight and management of all Math and Science Partnership (MSP) awards. Larger, more complex awards have been made as cooperative agreements. These cooperative agreements describe the post-award management and oversight needed to support the Partnerships in realizing their goals. In making decisions for continued funding, the MSP program draws upon NSF's strong, community-based site visit processes. With few exceptions, the lead partners responsible for both fiscal and project management of Partnerships are institutions with significant experience and a track record of responsibility in handling federal funds.

In FY 2005, the MSP program continued its oversight and management of all existing Partnerships but made no awards for new Partnership projects.

In November 2004, NSF hosted a financial management and oversight meeting of all 2004 MSP Targeted and Institute Partnership awardees to enhance awardees' fiscal management capacity and understanding of their responsibilities in such critical areas as subaward monitoring, proper documentation of time and effort, participant support, etc. **All** 2004 Partnership awardees – each Principal Investigator and a representative from his/her institutional business/accounting office – participated in this fiscal management workshop at NSF. NSF had hosted in November 2003 a similar meeting for all 2002 and 2003 Partnership awardees.

In summer 2005, critical site visits (midpoint reviews) to inform NSF decisions about continued funding were completed for the five Comprehensive Partnerships awarded in FY 2003. Two Comprehensive Partnerships awarded in FY 2002 also each received a second critical site visit. Furthermore, any questions or concerns about a grantee's financial management identified through review of annual progress reports (which include financial reports), through site visits, or by other means are pursued further as appropriate, in consultation with NSF's Division of Grants and Agreements (DGA) and/or staff in Cost Accounting and Audit Resolution, Division of Institution and Award Support (DIAS).

Ongoing Management and Oversight: MSP employs a six-pronged approach to project management and oversight: (1) site and reverse site visits to awardees; (2) Program Officer review of annual progress reports and project-specific formative evaluations; (3) use of co-operative agreements for all Comprehensive Partnerships and – starting in FY 2003 – all Targeted Partnerships, and other mechanisms, such as carefully formulated "conditions of award" in grants, that enable focused oversight; (4) technical assistance, especially for new awardees; (5) an information management system [MSP-MIS] for data collection and monitoring of awards; and (6) a substantial overall program evaluation. The award for the overall external evaluation of the MSP program was made at the end of FY 2004 to COSMOS Corporation, in partnership with Vanderbilt University, George Mason University, and The McKenzie Group.

Evaluation in the Context of a Research & Development (R & D) Effort: Because the MSP program extends beyond traditional domains and calls for innovative practices that go beyond the commonplace, its intellectual foundations and progression of work define it as an R & D effort. R&D efforts are necessarily administered and evaluated in ways that differ from implementation efforts, where the nature of the work is predetermined and where the tools and best practices needed for effective evaluation and administration are known in advance.

R & D "habits of mind" drive all aspects of the program, including project- and program-level evaluation.

In October 2004, the MSP Program convened a workshop meeting of principal investigators and evaluators of Cohort 1 and 2 projects to formulate a statement that would guide effective project-level evaluation in the context of a national R & D effort, such as the MSP.
In recognition of evaluation as an area of expertise and scholarship, the Program sought to bring together this community of evaluators and principal investigators who were experienced in the work of MSP, as well as other experts representing a range of perspectives on evaluation. The Program requested that the leadership of the MSP-funded project *Building Evaluation Capacity of STEM Projects* at Utah State University assume primary responsibility for planning the workshop and for the overall development of any resulting statement and guiding frameworks. Through the workshop discussions, subsequent discussions by the entire MSP community at its January 2005 Learning Network Conference, and a considerable amount of additional work by a team of experienced evaluators, the MSP community produced the document *Evidence: An Essential Tool – Planning for and Gathering Evidence using the Design-Implementation-Outcomes (DIO) Cycle of Evidence* (NSF 05-31), which has been posted at the NSF MSP website. All MSP Partnership projects have been asked to continue their engagement with the *DIO Cycle of Evidence* and to make intelligent use of it as a guiding framework to plan for, gather and use evidence in project-level evaluation.

On June 13, 2005, the OIG issued a memorandum pursuant to its audit of MSP evaluation, noting that the Program's actions had addressed satisfactorily the concerns/recommendations in the Audit and that all recommendations from the MSP audit report had now been closed.