

NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
ARLINGTON, VIRGINIA 22230



OFFICE OF
INSPECTOR GENERAL

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MEMORANDUM

To: Dr. Steven C. Beering
Chair, National Science Board

Dr. Arden Bement
Director, National Science Foundation

From: Dr. Christine C. Boesz
Inspector General, National Science Foundation

Subject: Management Challenges for NSF in FY 2008

In accordance with the Reports Consolidation Act of 2000, I am submitting our annual statement summarizing what the Office of Inspector General (OIG) considers to be the most serious management and performance challenges facing the National Science Foundation (NSF). We have compiled this list based on our audit and investigative work, general knowledge of the agency's operations, and the evaluative reports of others, such as the Government Accountability Office and NSF's various advisory committees, contractors, and staff.

This year's management challenges are again organized under six broad issue areas: award administration; human capital; budget, cost and performance integration; information technology; U.S. Antarctic Program; and merit review. Ten challenges are drawn from last year's list, some of which reflect areas of fundamental program risk that are likely to require management's attention for years to come. Two new management challenges appear on this year's list: USAP property plant and equipment, and audit resolution. We note that NSF continued to make progress this past year on several longstanding challenges.

If you have any questions or need additional information, please call me at 703-292-7100.

Award and Contract Administration

Post-award administration policies. NSF has worked toward developing and implementing an improved post-award administration regimen since 2002, when the OIG audit of NSF's financial statements first recommended that the agency strengthen its policies and practices. 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. In FY 2007, NSF continued to make progress toward achieving those goals by correcting problems, such as poor documentation, that prevented the auditors from determining whether the program had been effectively implemented. Along with improving the quality and consistency of the documentation, the agency increased its oversight of high risk awardees by conducting 22 site visits and 115 desk reviews this year. NSF's administrative oversight of these awards has greatly improved over the past five years, and the financial statement auditors determined this year that it should no longer be classified as a significant deficiency. However, our auditors will continue to monitor NSF's efforts to follow up and act on problems identified in NSF's site visits and reviews.

The challenge for the agency going forward is to maintain its commitment to effective post-award administration and refocus its efforts toward improving the monitoring of *programmatic* performance. The responsibility for this activity resides with NSF's program officers, who need adequate time, written guidance, appropriate training, and effective monitoring tools to perform this vital function. But, since their primary responsibility is proposal review and award selection, little time is left for managing on-going awards. In addition, NSF provides limited guidance to program officers on how to oversee the programmatic performance of awardees, and no formal training is offered on the administrative and financial requirements contained in OMB Circulars. Finally, a recent OIG audit indicated that over the five-year period from May 1, 1999 to May 31, 2004, more than 45,000 (42%) required annual project reports on the progress of individual NSF awards had not been submitted. Without adequate support from the agency in the form of additional time, training, guidance, and monitoring tools, program officers may not be able to detect problems with an award in time to intervene.

Post-award oversight of cost-shared commitments by NSF awardees continues to pose a challenge to the agency. Although new cost-shared commitments by awardees have steadily decreased since the National Science Board decided to eliminate non-statutory cost-sharing requirements in 2004, our audits continue to find poorly documented cost-shared contributions on awards made before the Board acted. Last year, OIG auditors reviewed awards with more than \$13 million in cost-shared funds. In one case, a university was not able to document 90 percent of the \$2.1 million it claimed to cost-share. Recently the National Science Board decided to reconsider its policy on cost sharing. The Board has formed a task force to review the implications of their 2004 action and has been asked by Congress to report on the impact of suspending cost-sharing

for existing programs that were developed around industry partnerships and that historically required cost sharing. Whether or not cost sharing is reintroduced in the future, the challenge for the agency is to assure that awardees fulfill their remaining cost sharing obligations, which are still significant.

Contract monitoring. The monitoring and administration of NSF contracts first appeared as an internal control deficiency in the FY 2004 audit of the agency's financial statements because NSF did not adequately review vouchers submitted by contractors who received advance payments. NSF has initiated corrective actions over the past two years, including reviewing vouchers submitted by larger contractors on a regular basis. It has also updated its contracting manual to strengthen its pre-award risk assessment guidance, contracting personnel roles, and contracting responsibilities to provide assurance that the problem will not recur.

However, contract monitoring remains a major management challenge because NSF does not have a comprehensive, risk-based system to oversee and monitor its contract awards and ensure that the requirements of each contract are being met. This year the financial auditors reviewed NSF's progress and identified additional areas for improvement in post-award contract monitoring activities. They found that the contracting manual lacks sufficient material on post-award monitoring, risk assessment, and risk mitigation procedures. In fact, the problems that have affected NSF's recordkeeping for its property, plant and equipment in Antarctica (see USAP management challenge) are a direct result of inadequate monitoring of an NSF contractor. The agency also needs a program to provide training for contracting officer's technical representatives and detailed policies and procedures that make clear what is required of them.

Management of large infrastructure projects. NSF's investment in large infrastructure projects and instruments such as telescopes and earthquake simulators presents the agency with a host of administrative and financial issues. In past audits, we have focused on the difficult challenge of managing the design, construction, and financing of these cutting edge projects and completing the facilities on time and within budget. The agency made progress this past year in addressing some of our longstanding concerns. For example, NSF has implemented our recommendation to establish a system that tracks the total costs of major equipment and facilities. Such information is necessary to maintaining effective project management during the construction phase and fostering an increased awareness of the total life-cycle costs of a large facility, including operations and maintenance. Training of agency staff on the new systems is scheduled for the coming year.

However, some of the issues we have raised in the past persist. While NSF has increased the personnel assigned to its Large Facilities Office to four, we are concerned that it is not adequately staffed to handle its increasing responsibilities for oversight of the full life-cycle of these facilities. Though the agency updated its facilities manual during the past year, it still has not completed the in-depth guidance necessary to carry out the broader policy. In addition, recommendations made last year by the Business and

Operations Advisory Committee¹ to establish annual facility reviews, formal risk-assessments, and a process for projecting how long the facility will meet future research needs, have not yet been implemented. Though progress was made on developing a guide for on-site visits, a final version of the guide has yet to be issued.

While NSF has improved its management of the construction phase of new facilities, it must continue to not only improve its management of and knowledge about the entire facility life cycle but also plan for the increased impact that facilities are having on NSF's portfolio of awards as a whole. NSF's challenge for managing future investments in facilities and infrastructure projects lies in the agency's ability to perform more comprehensive planning for the overall life-cycle of these projects, and to include consideration of project risk management principles in making funding and other significant decisions.

In addition, NSF needs to determine a method for making strategic portfolio-management decisions. Operating costs of large facilities are continuing to grow, as are the number of active facilities in all phases of development. NSF is now faced with making tough funding decisions among competing priorities. Proposed facilities are competing for scarce resources not only with other new facilities, but also with existing facilities and traditional single-investigator research. NSF's challenge is to create a portfolio management plan that takes into account these competing priorities and the research needs of the entire scientific community.

Audit resolution. Audit resolution, closure, and follow-up represent the final critical steps of the oversight process envisioned by the Congress when it passed the IG Act of 1978. Without properly developed and executed procedures to evaluate audit findings and correct the problems that have been identified, the value of audits and program reviews is largely lost, and a key element of an agency's internal control system is seriously impaired. It is vital that NSF ensure prompt and proper resolution of OIG audits, the complete and timely implementation of audit recommendations, and the optimal recovery of questioned costs. For unknown reasons, the historic rate at which NSF has sustained costs questioned by its auditors has been low relative to other government agencies. Another challenge for NSF is to ensure effective implementation of proposed corrective actions given resource constraints and the large number of NSF awardees. OIG plans to contract with a third party in FY 2008 to review this important agency responsibility.

Human Capital

Workforce planning. OIG has identified workforce planning as a management challenge since 2002, the year that NSF's Management Controls Committee first highlighted human capital as "a significant concern" during a long period in which its workload was growing much more rapidly than its workforce. By some measures, NSF's workload has

¹ Report by the Facilities Subcommittee of the NSF Business and Operations Advisory Committee, June 10, 2006

become more manageable over the past two years as the number of program officers has risen from 385 to 438, effectively reducing the number of proposals handled per program officer from 113 in FY 2004 to 97 in FY 2006.

NSF appears to have made progress toward the goal of improving the planning process. During FY 2006, the agency developed a workload analysis tool to determine the FTE needs of the agency as a whole based on a directorate-by-directorate analysis. Although the tool is currently of limited use in allocating FTEs across directorates or prioritizing needed FTEs, it provides an objective basis for projecting and justifying the agency's overall staffing needs. Over the past year NSF has initiated a succession planning process for recruiting, developing, and training NSF's future managers. The agency also reports that a workforce plan aligned to the goals of the new NSF strategic plan has been completed and is being reviewed for compatibility with other key planning documents, such as the human capital plan and the succession plan.

However, in June 2007, OMB downgraded NSF's score for human capital because it did not deliver a skill gap assessment for all mission-critical occupations to the Office of Personnel Management (OPM). NSF has subsequently worked with OMB and OPM to revise the list of future deliverables and expects to recover its "green" status for human capital within the next two quarters. The agency acknowledges that it has other remaining human capital challenges, including distributing administrative functions more effectively, implementing the workforce and succession plans, and completing a new human capital management plan.

The agency is also considering potential solutions to the various issues associated with the employment of temporary professional staff known as "rotators". NSF has long valued rotators for the fresh scientific knowledge they bring to the agency, but are vulnerable to criticism for their lack of institutional knowledge and management skills, which are particularly important at the senior level. In 2008, NSF expects to initiate an executive-level mentoring and training program called "on-boarding" that will include learning modules specifically geared toward those who lack experience and knowledge about the ways of NSF and the federal government. The proposal came out of a report issued by a committee of senior staff tasked with assessing the adequacy of the agency's senior executive leadership in terms of quantity, quality, and balance between permanent and temporary professionals. The committee recommended that the agency improve the balance between permanent and temporary executive-level leadership across NSF's organizational units to ensure organizational stability, the retention of institutional knowledge, and the infusion of new talent. While senior management has accepted these recommendations, implementation will pose a challenge.

Administrative infrastructure. Inadequate office space and travel funds continue to constrain NSF's ability to administer its growing award portfolio by limiting the number of new hires that can be processed and on-site visits made to monitor the performance of awardees. The amount spent on office space has risen at a rate of just 6% per year, while funds available for travel have increased just 7% per year over the past 4 years, barely keeping pace with price increases. Meanwhile, the widespread perception of problems

that has beset NSF's hiring and travel processing systems continued to produce low ratings from staff that participated in the most recent employee satisfaction survey. Both systems have been improved and upgraded over the past year, and the agency expects that this year's surveys will reflect increased satisfaction with these two systems. However, problems in integrating the travel and financial systems in particular persist, causing inconvenience to the staff and consuming more of the traveler's time than necessary. The challenge for NSF is to continue to improve the systems so they are easier for staff to use.

Budget, Cost and Performance Integration

Performance reporting. The Government Performance and Results Act (GPRA) was enacted in 1993 for the purpose of making government agencies more results-oriented. The Act requires each agency to develop a strategic plan that establishes specific goals against which its performance can be measured. GPRA poses a significant challenge to agencies engaged in scientific research because the benefits are notoriously difficult to measure and in some cases may only become apparent over many years. To assist in this assignment, NSF convenes an Advisory Committee on GPRA each year to assess progress in achieving its strategic goals. As in past years, this year's committee made its evaluations based on a judgmental sample of awards chosen by NSF staff. The committee suggested that their conclusions would be more "robust" if it had better assurance that the awards selected by NSF for their review were representative of the entire project portfolio. The committee also stated that the issue, which had been raised in previous years, "needs to be addressed to enhance the credibility of the assessment process." Lastly, the committee expressed additional concerns pertaining to the portfolio balance of some strategic goal areas and the criteria it was asked to apply in carrying out its evaluation responsibilities.²

Publicizing the results of scientific research is also important to advancing NSF's science and education goals. OIG issued two related reports during 2006 on disseminating the results of NSF-funded research to the public. In the first report, we recommended that the agency make publication citations for each research project that it funds available on its website.³ In a follow-on report, OIG assessed interest among NSF's stakeholders and managers in making even more information about research outcomes available to the public, and found strong interest in providing brief summaries of the results of each project NSF funds on the agency website.⁴ NSF agreed to take action in both cases and is in the process of implementing the recommendations. Most recently, the Congress has mandated through legislation that the agency report research results. The America Competes Act (Public Law No. 110) requires that NSF ensure that all final project reports and citations of published research documents resulting from research funded, in whole or in part, by the agency are made available to the public in a timely manner and electronically through NSF's website. The agency should expeditiously implement this provision in order to further the public's knowledge and understanding of scientific

² Report of the Advisory Committee for GPRA Performance Assessment FY 2007, pp. 10-11

³ NSF's Policies on Public Access to the Results of NSF-Funded Research, February 2006, OIG 06-2-004

⁴ Interest in NSF Providing More Research Results, September 2006, OIG 06-2-013

research, assist researchers in building on prior work in their fields, and ultimately make its operations more transparent and accountable.

Cost information. Managerial (cost) accounting information is used to evaluate operational effectiveness and efficiency. However, NSF does not collect enough information about its operational costs to enable its managers and oversight officials to adequately assess its past performance or to provide a historical context that would inform future decisions. We continue to believe that the measurement and comparison of inputs to outputs is essential to any meaningful review of an organization's efficiency and that NSF would greatly benefit by adding this capability. In recent years, the agency has enhanced its cost accounting system so it can track costs according to strategic goals, as well as the ten investment categories that are subject to OMB evaluation. While the current system provides aggregated costs that may be useful in assessing strategy, it does not track the costs of NSF's internal business processes and activities, such as soliciting grants, conducting merit reviews, or performing post-award grant administration. Such information would have been especially useful in evaluating the costs and benefits of many of the recommendations to re-engineer its business processes that the agency received as a result of its recent Business Analysis contract. The challenge for NSF is to obtain such information at a modest expense and without placing an additional recordkeeping burden on staff.

Information Technology

Implementing enterprise architecture. Enterprise architecture (EA) is a key component of the President's Management Agenda and its Expanded Electronic Government initiative. EA refers to a blueprint for organizational change that describes, in both operational and technological terms, how an entity currently operates and how it intends to operate in the future. It also includes a plan for transitioning to this future state. A well-defined EA is an essential tool for leveraging information technology (IT) in the transformation of business and mission operations.

In 2006, the Government Accountability Office (GAO) issued a report on the progress made by 27 federal departments and agencies toward establishing EA programs. GAO found that NSF lagged behind all but four of the agencies studied, satisfying only 52 percent of GAO's core elements for effective EA management. In 2007, the Office of Management and Budget (OMB) reviewed NSF's EA program, rated the program as "Green" both overall and in each individual assessment area, and gave it one of the highest scores of the 26 programs it reviewed. However, OMB also made several recommendations pertaining to various elements of EA such as transition strategy, cross agency initiatives, value measurement, outcomes, and performance data. NSF has developed a plan to address these recommendations as it continues to implement its EA program.

Successful implementation of its EA program is critical to almost all of NSF's activities, and should result in both cost savings and improved performance. Some of the desired outcomes NSF describes in its EA Management Guide are fewer applications, reduced

system complexity, and improved application and systems interoperability, data integration, and information sharing. In particular, we note that navigating NSF systems to get coordinated financial and programmatic information can be difficult and may impede the efforts of program managers and other staff from overseeing the financial and administrative requirements of their awardees. We, therefore, consider EA to be a challenge that continues to require management attention and support.

United States Antarctic Program

USAP long-term planning. At a time of growing public interest in scientific research, the U.S. Antarctic Program (USAP) carries a higher profile than many other NSF-funded projects. The agency's Office of Polar Programs (OPP) oversees the USAP and manages all U.S. activities in the Antarctic serving the scientific community as a single program. Like a small government, OPP provides basic services through a number of contractors to as many as 3000 Americans who reside and work in Antarctica, as well as the infrastructure, instrumentation, and logistics necessary to support the research efforts of scientists from around the world. The successful operation of the USAP requires a unique management and administrative skill set. OPP staff must not only know the science, but must also manage contractors engaged in delivering a broad range of services to the American scientific community located in a difficult and dangerous environment.

Over the past few years, several program reviews have focused on needed improvements in long-range planning for the USAP. A 2003 OIG audit recommended that NSF develop a life-cycle oriented capital asset management program to ensure that infrastructure is replenished as needed and does not jeopardize the safety, security, or mission of those who locate in Antarctica.⁵ This recommendation remains unresolved. However, during FY 2007, OPP began to address recommendations to improve long-range planning made by last year's Committee of Visitors (COV). The COV identified the important need for long-range planning to 1) take into account future research needs and their attendant logistical challenges, and 2) include improved projections for the cost of servicing specific research projects in order to ensure adequate planning. At the USAP annual planning conference attended by scientists, contractors, and NSF staff, OPP presented future infrastructure improvements that are either being planned or contemplated and listened as researchers discussed their future needs for services and technology. In response to the second recommendation, OPP presented a new costing methodology at the conference aimed at simplifying cost projections and making them more accurate. However it is too soon to know if this approach will resolve the issues identified by the COV.

Information technology systems also play an essential life-support role in such a harsh environment. The evaluation report our office is required to prepare under the Federal Information Security Management Act (FISMA) noted again in 2007 that NSF needed to make improvements in the USAP operating platform and in disaster recovery, though

⁵ Audit of Occupational Health & Safety and Medical Programs in the United States Antarctic Program, OIG 03-2-003, March 2003

progress had been made in both areas.⁶ The agency is funding studies on what course of action will best address the problems raised in the report. The lack of a disaster recovery plan means that USAP may not be able to recover in a timely or complete manner from a significant incident, possibly resulting in USAP incapacity to carry out its life-support mission at the Antarctic bases. The risks inherent in the USAP program create a significant ongoing challenge for NSF.

Property, plant, and equipment. In FY 2006, the financial statement auditors noted that NSF had not been verifying cost information submitted by its primary USAP contractor or by third parties providing shipping and transportation services. The cost of shipping construction materials to Antarctica is significant, sometimes more than that of the materials themselves, and is capitalized as part of the construction cost of the asset. The auditors also noted that NSF had not maintained original source documentation for USAP property plant and equipment (PP&E) acquisitions.

Without proper verification, as the auditors' FY 2006 report pointed out, NSF could not be certain that the cost information provided by the contractors was reliable. Therefore, NSF management could not have assurance that the millions of dollars related to PP&E carried on NSF's balance sheet are accurate. The auditors have recommended that NSF obtain documentation for capitalized property acquired in past years, implement documentation verification procedures for Antarctic contractor's FY 2007 and future activity, and maintain an electronic copy of significant source documentation examined during that verification process. In FY 2007, NSF began to verify accounting information from its primary contractor for current year activity, but not for prior years nor for transportation services.

During the past year, auditors have found numerous instances in which NSF's contractor did not record property transactions in a timely manner, support recorded transactions with the proper documentation, or properly calculate and record freight costs. The auditors found that NSF's oversight of the contractor's internal controls over the processing, recording, and reporting of PP&E needs improvement.

NSF and its contractor use various PP&E systems to capture and report their activities for the USAP. Financial information from those systems is not integrated with NSF's general ledger system so the data are more vulnerable to internal control problems and error, as the information must be manually reentered in each system. In addition, a majority of USAP PP&E financial activities originate from the contractor's outdated software, resulting in a manually intensive and time-consuming financial reporting process that is prone to human error. Because NSF's contractual relationship with the contractor is not permanent in nature, the change to another contractor also exposes NSF to potential loss of data.

⁶ NSF Federal Information Security Management Act, 2007 Independent Evaluation Report

Merit Review

Broadening Participation in the Merit Review Process. At the core of NSF's operations is the merit review process, which is intended to ensure that the review and selection of proposals for funding are fair and conducted according to the highest standards. Broadening the participation of minorities and women in the merit review process continues to be a high priority of the agency and a critical step in accomplishing the broader goal of diversifying the STEM⁷ workforce. NSF's 2006-2011 strategic plan elevated the status of broadening participation, stating that it will "expand efforts to broaden participation from underrepresented groups and diverse institutions in all NSF activities".⁸ During FY 2006, the funding rate for both underrepresented minorities and women increased from the previous year by one percentage point, but failed to keep pace with the increase in the funding rate for all PIs, which increased by two points. The funding rate for African American PIs ran counter to the trend of an increasing overall funding rate and slipped from 24% to 22%, three points below the rate for all PIs. Year-to-year variation in the funding rate of any particular group is not necessarily a cause for concern, but it should be monitored to determine if there are any developing trends that require further review or corrective action.

Although NSF cannot legally require its merit panel reviewers to provide demographic information, it has since 2001 requested that they provide such data to determine the extent to which underrepresented groups participate in the NSF reviewer population. The percentage of reviewers who report demographic information has increased from just 9% in 2002 to 25% in 2006. Among reviewers who voluntarily provided demographic information, 36% indicated that they were members of an underrepresented group, a proportion that has remained fairly stable over time. Last year, both the National Science Board and the Advisory Committee on GPRA recommended that NSF improve the information in the reviewers database. In its most recent report, the Committee on Equal Opportunities in Science and Engineering recommended that NSF "survey and report annually on the participation of women, underrepresented minorities, and persons with disabilities in each review panel, advisory committee, and committee of visitors".⁹ Because developing the full potential of underrepresented groups is likely to confer important social and economic benefits, the effort to broaden participation will continue to be an important challenge facing NSF.

⁷ Science, Technology, Engineering and Mathematics

⁸ National Science Foundation Strategic Plan FY 2006-2011, pp. 9-10

⁹ 2005-2006 CEOSE Biennial Report to Congress, p.32