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October 16, 2006

MEMORANDUM

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

Dr. Arden Bement
Director, National Science Foundation

From: *James C. Cross*
for Dr. Christine C. Boesz
Inspector General, National Science Foundation

Subject: Management Challenges for NSF in FY 2007

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 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. One new management challenge appears on this year's list: enterprise architecture. We note that NSF continued to make progress this past year on several difficult 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. Since FY 2002, independent audits of NSF’s financial statements have repeatedly cited weaknesses in the agency’s monitoring of grantee institutions, after an award is made, as a major deficiency. In response, NSF has revamped its policies pertaining to post-award administration and has made continued progress in establishing a risk-based program for monitoring its 35,000 ongoing grants. In FY 2006, NSF initiated a new program for performing desk reviews of all high-risk institutions that did not receive site visits. The desk reviews extend NSF’s monitoring program to all awardee institutions considered high-risk, closing a significant gap in its coverage. However, OIG is not yet able to evaluate the effectiveness of the post-award program NSF has implemented. It is too soon to assess the desk reviews, and the quality of the documentation associated with the site visits continues to be inconsistent.

Meanwhile, the monitoring of *programmatic* performance is also a concern. NSF provides limited guidance to program officers on how to oversee programmatic performance of awardees, and offers little or no formal training on the administrative and financial requirements contained in OMB Circulars or NSF grant conditions. An effective post-award monitoring program should ensure that 1) awardees are complying with award terms and conditions and federal regulations 2) adequate progress is being made toward achieving the objectives and milestones of the program; and 3) expenditures listed on NSF’s financial statements are accurate.

Cost-sharing commitments by the institutions have become less of an issue since the National Science Board decided to eliminate non-statutory cost-sharing requirements in 2004, but commitments that pre-date that policy change continue to pose problems. Our most recent Semiannual Report, for example, described two school districts and a university that lacked systems to document and track a total of \$42 million of claimed cost sharing. In addition, OIG investigations of two universities that falsely reported cost-sharing contributions were recently settled with substantial repayments of award funds to NSF. The challenge for NSF in the remaining cost-sharing obligations, as in the other aspects of post-award administration, is to ensure that awardees live up to their commitments.

Management of large infrastructure projects. NSF’s administration of large, state-of-the-art infrastructure projects, such as telescopes and supercomputing databases, poses an unusual project management challenge. Two OIG audits that were issued in 2000 and 2002 found weaknesses in the financial controls surrounding the funding and operation of these projects.¹ Since then, NSF has steadily strengthened its oversight of large infrastructure projects. A Deputy Director for Large Facilities Projects was appointed in 2003, but until recently had trouble obtaining the staffing, resources and authority needed for the new Large Facility Projects Management & Oversight Office (LFP) to carry out its mandate of conducting post-award oversight of business operations, financial and internal control systems, and project management at large NSF-funded facilities. In the past year, the LFP has grown to include four permanent full-time staff. The agency has also implemented a system for tracking *budgeted* costs for Major

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



Research Equipment and Facilities Construction (MREFC) projects. However, NSF has not yet addressed OIG recommendations for a system that identifies, records and tracks the total costs of major equipment and facilities. In addition, corrective actions to ensure the appropriate use of the MREFC accounts, and the implementation of good project management methods is still incomplete.

In May 2006 NSF's Business and Operations Advisory Committee recommended, among other things, that NSF: 1) arrange for annual reviews of NSF-led large facilities by an expert group that includes outside peer consultants; 2) conduct formal risk assessments of each of its facilities; and 3) implement a process for identifying how the facility will meet future research needs and for projecting its eventual termination, along with the associated costs and legal requirements.² These recommendations are similar to those pertaining to post-award administration in past OIG reports and the independent audits of the agency's financial statements. Given the annual investment of more than \$200 million in large research facilities and equipment, they remain a challenge for the NSF managers responsible for MREFC oversight.

Contract Monitoring. NSF does not adequately review public vouchers submitted by contractors who receive advance payments, according to the last two independent audits of NSF's financial statements. In both cases, this deficiency was identified as a reportable condition. The most recent audit identified significant gaps in NSF's policies pertaining to contract administration. In FY 2006, the agency obligated approximately \$214 million through advance payments to three contractors, the largest being for logistical support of the United States Antarctic Program. Without a proper review, NSF's advance payments may be subject to error or impropriety. In fact, recent cost-incurred audits by the Defense Contract Audit Agency (DCAA) have identified \$55 million in questioned costs over the past five years from just one contractor. Federal law requires that responsible officials check the public vouchers for accuracy and propriety to ensure that the reported costs are authorized under the contract. To correct the situation, NSF has contracted with DCAA to review vouchers submitted by its larger contractors on a regular basis. These reviews were initiated too late in the fiscal year to evaluate their effectiveness, so we will continue to identify contract monitoring as a management challenge.

Promoting integrity. OIG has experienced a doubling of allegations of research misconduct over the past decade, including an approximately seven-fold increase for plagiarism and a notable rise recently in fabrication allegations against graduate students and postdoctoral researchers. There has been a dramatic increase in the number of cases requiring investigation either by the affected institution or by OIG, and approximately 70 percent of the recent findings by NSF have been in cases involving foreign collaborations. These data are consistent with a study³ published last year that found that one-third of NIH-supported researchers surveyed acknowledge engaging in activities that are best described as questionable research practices. The authors concluded that the "questionable practices . . . are striking in their breadth and prevalence." These practices can reasonably be expected to occur in research supported by other federal agencies, and the level of activity experienced in recent years by OIG indicates that NSF faces similar issues. The prevalence of such practices suggests that integrity in science is eroding. Since 1990, HHS has

² Report by the Facilities Subcommittee of the NSF Business and Operations Advisory Committee, June 10, 2006

³ Martinson, B.C.; Anderson, M.S. and R. de Vries; Scientists behaving badly; *Nature*: Vol. 435 pp. 737-738, 9 June 2005.



had programs designed to encourage responsible conduct of research, and NSF has implemented similar instruction in selected programs. Since the early 1990’s both HHS and NSF have had regulations for addressing allegations of research misconduct. NSF plays a vital role in the education of future generations of researchers and engineers. In light of what appears to be a growing challenge to the agency, NSF needs to implement a more comprehensive, agency-wide program to instill ethics and integrity at all levels of the scientific, engineering and education enterprise it supports.

Human Capital

Workforce planning. NSF reports that it has made progress in FY 2006 toward implementing an effective workforce planning process based on sound, objective criteria. The agency has drafted a three-year strategic workforce plan, and each Directorate created its own staffing plan during this year’s budget planning cycle according to a methodology developed by a committee of managers. In addition, the Division of Human Resources is reportedly developing tools for prioritizing staffing needs and projecting turnover. During the past year the strain of NSF’s workload actually eased a bit as the average number of proposals each program officer handled declined from 113 to 104, reflecting a slight increase in the number of program officers and a modest decrease in the number of proposals received.

Despite progress toward developing a comprehensive agency workforce plan, the management of NSF’s growing workload continues to be one of the agency’s most pressing challenges. The Advisory Committee for GPRA expressed concern in its annual report about the workload that program officers face and recommended that NSF examine ways to reduce unnecessary work.⁴ NSF’s growing workload was one of the primary reasons that the agency launched the Business Analysis initiative four years ago to review and reengineer NSF’s core business processes. But as the initiative nears completion, OIG estimates that 75 percent of the improvement opportunities identified by the contractor for the merit review and award management business processes have not been acted on. Some of these proposals have the potential to alleviate workload pressures by rationalizing NSF’s operations and improving customer service. The immediate challenge for NSF management is to determine which of these proposals have merit and are financially feasible, and then to implement those that will ensure the most efficient deployment of the workforce in the years ahead.

Another workforce planning issue is the extent to which NSF should use rotators from the research community to fill key program management positions. NSF has a longstanding practice of recruiting scientists, engineers, and educators from their home institutions or agencies to spend a few years at the Foundation. In FY 2005, approximately half of NSF’s 400 program officers were rotators. While acknowledging their contributions to keeping NSF current on the latest research, we believe that their employment poses several administrative and management challenges for NSF. Rotators who serve at more senior levels lack institutional knowledge and are less likely to make long-term planning a priority. In addition, rotators require more frequent recruiting, hiring and training.

⁴ Report of the Advisory Committee for GPRA Performance Assessment FY 2006, p. 57



Two reports issued in the past year have highlighted the importance of having permanent, experienced managers in senior positions. In its 2005 Report on NSF's Merit Review System, the National Science Board stated that "at the higher management levels, including the division director, experienced individuals need to oversee the complete system of the merit review process and be able to recruit the best program officers."⁵ The Advisory Committee for GPRA commented that NSF "requires highly experienced program managers with a broader understanding of the operation of the Foundation and the evolution that it is undergoing. If NSF seeks to undertake activities such as identifying a portfolio of "transformative" research, the expertise of experienced program managers will play a critical role."⁶ We believe that a significant challenge for NSF is to ensure a stable and experienced managerial corps. To attain that goal, it needs to give careful consideration to whether the agency would be better served by reserving specific management positions for permanent professional staff.

Administrative infrastructure. Issues related to administrative infrastructure and support continue to limit the size and effectiveness of NSF's workforce. Inadequate office space, tight travel funds, and flawed systems to support traveling and hiring actions place serious constraints on the staff's ability to perform its work. Office space limitations remain the most critical issue, impeding the recruitment of staff, the ability to obtain space for panels and meetings, and the capacity to store sensitive documents. In developing their departmental staffing plans this past year, NSF directorates informed the agency that insufficient office space restricted the number of people they could hire.

Travel funds are also inadequate for the purpose of properly overseeing existing awards. In addition, staff members have been hampered in making travel arrangements by recurring problems with *FedTraveler*, NSF's on-line system for booking and reimbursing official travel. The agency continues to work with the contractor responsible for the system on correcting them. In the past year, NSF has taken several actions aimed at improving performance in the area of human resource management so that hiring actions will be processed more quickly, but progress has been uneven. NSF needs to make allocating more funding for administrative resources a priority in order to maximize the effectiveness of staff.

Budget, Cost and Performance Integration

Performance reporting. The purpose of the Government Performance and Results Act is to improve the efficiency and effectiveness of federal programs by establishing a system to set goals for program performance and to measure results. However, the results of funding basic scientific research are difficult to measure in the short term, as the value of many research projects only becomes apparent over time. To assist in this endeavor, NSF convenes an Advisory Committee on GPRA (AC/GPRA) each year to assess progress in achieving its strategic goals. Last year's AC/GPRA assessment suggested that NSF could better demonstrate the relevance of its accomplishments to its outcome goals. This year's Committee was more specific, recommending that NSF's "nuggets" (selected success stories) include the specific activities and outcomes that are desired, and include more "measures of effectiveness." Among

⁵ Report of the National Science Board on the National Science Foundation's Merit Review System, NSB-05-119, p.14

⁶ Report of the Advisory Committee for GPRA Performance Assessment FY 2006, p.49, 52



other things it also recommended that NSF develop baselines to better demonstrate how the agency’s efforts are contributing to positive change.

Communicating the results of scientific research is also key to furthering science and demonstrating the effects of federal funding. The Office of Science and Technology Policy recently affirmed that the administration regards the timely, complete and accurate communication of scientific information as an important aspect of public service. In the past two years, OIG has issued three reports that underscore the need to improve NSF’s reporting of research results. In 2005, auditors found that approximately 47 percent of final and annual reports required by their NSF awards over a five-year period were submitted late or not at all. Moreover, 8 percent of the 43,000 *final* project reports were never submitted.⁷ NSF agreed with the report’s recommendations to strengthen project reporting and is in the process of developing a new project-reporting notification and tracking system.

Two related reports on disseminating the results of NSF-funded research to the public were issued during this past year. In February, OIG recommended that the agency make publication citations for each research project that it funds available on its website.⁸ The agency agreed and is planning to make the citations available by July 2007. In September, a follow-on report assessed interest among NSF’s stakeholders and managers in making even more information about research outcomes available to the public.⁹ The auditors found that there was overwhelming interest in providing brief summaries of the results of each project NSF funds on the agency website. Significant support was also registered for posting conference proceedings, abstracts, and final project reports. NSF agreed that increased public access to the results of its research was desirable, and is working with other government agencies toward developing a standardized reporting template. The significant challenge for NSF is twofold: to develop a credible process for evaluating the impact of its overall effort, rather than relying on selected nuggets to suggest the success of its investments, and to ensure that the research community and the public have ready access to the scientific results.

Cost information. NSF does not maintain basic information about the cost of its operations that would enable managers and those responsible for its oversight to better assess the agency’s past performance and make more informed decisions about its future. In recent years, NSF has enhanced its cost accounting system so it can track costs according to its strategic goals, as well as the ten investment categories that are subject to OMB evaluation. While the current system provides aggregated costs that are useful to 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. Information about the cost-effectiveness and efficiency of an organization’s workforce and work processes is critical to any effort to carry out such initiatives as business-process improvements or activity-based costing. We believe that management should consider the use of more detailed cost information as a tool for improving its business processes and maximizing limited resources.

⁷ Audit of Project Reporting for NSF Awards, December 2004, OIG 05-2-006

⁸ NSF’s Policies on Public Access to the Results of NSF-Funded Research, February 2006, OIG 06-2-004

⁹ Interest in NSF Providing More Research Results, September 2006, OIG 06-2-013



Information Technology

Enterprise Architecture. Enterprise architecture involves planning for organizational change using detailed models that demonstrate, in both business and technical terms, how an entity intends to transition from its current operations to a more optimal system in the future. It is widely accepted that a carefully designed enterprise architecture is vital to an organization's efforts to modernize and improve its IT environment. The Government Accountability Office (GAO) recently issued a report on the progress made by 27 federal departments and agencies toward establishing enterprise architecture programs. They found that NSF lags behind all but four of the agencies studied, satisfying just 52 percent of GAO's core elements for effective enterprise architecture management.¹⁰ GAO recommended that NSF, as well as other federal agencies, implement a plan for fully satisfying each core element to ensure that there is a mature enterprise architecture program in place to guide future IT development.

United States Antarctic Program

USAP long-term planning. The United States Antarctic Program, which is managed by NSF, is responsible for the coordination and support of America's scientific research program in Antarctica. The USAP operates three scientific stations and provides researchers with logistical, operational, and laboratory support. Some 3500 researchers and support personnel annually participate in the USAP, which cost \$295 million in FY 2006. Providing for the safety and well-being of so many in such an isolated, high-risk, and extreme environment has been a long-term management challenge for NSF.

A 2003 OIG audit report cited examples of aging USAP infrastructure and recommended that NSF provide a separate line item in its budget for the replenishment of its buildings and facilities according to a capital asset management plan, to ensure that the useful lives of buildings and equipment would not be stretched beyond the point where they become unsafe.¹¹ NSF responded that its current practices were adequate and that a dedicated fund would restrict needed financial flexibility. Two additional issues with long-term planning were raised last year by a Committee of Visitors report that recommended that the agency: 1) develop a long-term planning process to anticipate future research needs and the attendant logistical challenges before they reach the proposal stage; and 2) improve its projections of the actual costs of doing field and lab science to assure adequate planning. This past year NSF asked outside experts to analyze the USAP's expected logistics and infrastructure needs.

Information technology systems also play an essential life-support role in such a fragile environment. The evaluation report our office is required to prepare under the Federal Information Security Management Act (FISMA), noted that NSF needed to make improvements in the USAP operating platform and in disaster recovery.¹² The auditors believe that these weaknesses have the potential to adversely affect the well-being of the personnel, as well as the

¹⁰ Leadership Remains Key to Establishing and Leveraging Architectures for Organizational Transformation, GAO-06-831, August 2006, p. 21

¹¹ Audit of Occupational Health & Safety and Medical Programs in the United States Antarctic Program, OIG 03-2-003, March 2003

¹² NSF Federal Information Security Management Act, 2006 Independent Evaluation Report



conduct of science, in Antarctica.¹³ The risks inherent in the USAP program create a significant ongoing challenge for NSF.

Merit Review

Broadening Participation. Increasing the participation of women and minorities in the merit review process by adding more applicants, awardees, and reviewers from underrepresented groups is an important priority of NSF. Developing the unrealized potential of underrepresented groups will benefit the U.S. through expanded individual opportunities and enhanced national prosperity. However, in FY 2005, NSF overall received fewer proposals and made fewer awards than the previous year, and women and minorities were proportionately represented in that trend, although the rate of decline for the underrepresented groups was slightly less than that of the general population. The success rate (the percentage of proposals that NSF decides to fund) for both women and minorities remained the same as in FY 2004.

In the past NSF has had difficulty measuring the participation of underrepresented groups as reviewers, but has gradually increased the percentage of reviewers who report demographic information from 9 percent in 2002 to 22 percent in 2005. Among reviewers who voluntarily provided demographic information, 35 percent indicated that they were members of an underrepresented group, the same as last year. During the past year, the National Science Board issued a report on the Merit Review System that recommended that the agency seek to improve the information on traditionally underrepresented groups in the reviewer’s database.¹⁴ The Board’s recommendation was affirmed by NSF’s Advisory Committee for GPRA Performance Assessment, which suggested that NSF consider methods other than self declaration to collect more demographic data. The Committee also urged NSF to provide more conclusive evidence on whether it has indeed increased opportunities for underrepresented individuals and institutions. Because diversity is widely viewed as allowing for more creative ideas and better-informed decisions, resulting in more innovative research, the effort to broaden participation will continue to be an important challenge facing NSF.

¹³ Ibid p. 1

¹⁴ Report of the National Science Board on the National Science Foundation’s Merit Review System, NSB-05-119, p. 15