Management Challenges for the National Science Foundation in Fiscal Year 2018

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

October 12, 2017

AT A GLANCE

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WHY WE DID THIS REPORT

The *Reports Consolidation Act of 2000* (Public Law 106-531) requires the Office of Inspector General to annually update our assessment of NSF's most serious management and performance challenges and the agency's progress in addressing those challenges.

WHAT WE FOUND

NSF leads the world as an innovative agency dedicated to advancing science. Beyond its scientific mission, as a Federal agency, NSF must be a responsible steward of taxpayer dollars and spend scarce research funds properly. Inattention to its fiscal and administrative responsibilities can compromise NSF's ability to reach its fullest potential. This year, we have identified six areas representing challenges NSF must continue to address to better accomplish its mission:

- Major Multi-User Research Facilities Management
- Business Operations Management
- Management of the *Intergovernmental Personnel Act* Program
- Management of the United States Antarctic Program
- Cybersecurity and Information Technology Management
- Encouraging the Ethical Conduct of Research

Most of these challenges are longstanding, and we are encouraged by the actions NSF has taken to address them during this fiscal year. Effective responses to these challenges will help position NSF to ensure the integrity of NSF-funded projects, to spend research funds in the most effective and efficient manner, and to maintain the highest level of accountability over taxpayer dollars.

AGENCY RESPONSE TO *MANAGEMENT CHALLENGES FOR 2017*

In its *FY 2017 Management Challenges Progress Report*, NSF provided a management overview, significant milestones for FY 2017, and anticipated milestones for the challenges identified in our *Management Challenges for the National Science Foundation in FY 2017* report.

FOR FURTHER INFORMATION, CONTACT US AT (703) 292-7100 OR OIG@NSF.GOV.

MEMORANDUM

DATE: October 12, 2017

TO: Dr. Maria Zuber
Chair
National Science Board

Dr. France Córdova
Director
National Science Foundation

FROM: Allison C. Lerner
Inspector General
National Science Foundation

SUBJECT: Management Challenges for the National Science Foundation in Fiscal Year 2018

Attached for your information is our report, *Management Challenges for the National Science Foundation in Fiscal Year 2018*. A summary of the report will be included in the National Science Foundation *Agency Financial Report*.

If you have questions, please contact me at (703) 292-7100.

Attachment

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ABBREVIATIONS

AICA	*American Innovation and Competitiveness Act of 2017*
AIMS	Antarctic Infrastructure Modernization for Science
America COMPETES Act	*America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act*
ASC	Antarctic Support Contract
DATA Act	*Digital Accountability and Transparency Act of 2014*
IPA	*Intergovernmental Personnel Act*
IPERA	*Improper Payments Elimination and Recovery Act of 2010*
IR/D	Independent Research/Development
IT	information technology
NAPA	National Academy of Public Administration
NARA	U.S. National Archives and Records Administration
OMB	Office of Management and Budget
OPP	Office of Polar Programs
RCR	Responsible Conduct of Research
Treasury	U.S. Department of Treasury
USAP	United States Antarctic Program

Introduction

This report presents our assessment of NSF's major management and performance challenges for fiscal year 2018. As required by the *Reports Consolidation Act of 2000*,[1] we update our assessment of management challenges annually. In this report, we summarize what we consider the most critical management and performance challenges to NSF, and we assess the Foundation's progress in addressing those challenges.

NSF leads the world as an innovative agency dedicated to advancing science. Its awards have led to many discoveries that have contributed to the country's and the world's economic growth. Beyond its scientific mission, as a Federal agency, NSF must be a responsible steward of taxpayer dollars and spend scarce research funds properly. Inattention to its fiscal and administrative responsibilities can compromise NSF's ability to reach its fullest potential.

This year, we have identified six areas representing challenges NSF must continue to address to better accomplish its mission. We have compiled this list based on our audit and investigative work; general knowledge of the agency's operations; and evaluative reports of others, including the U.S. Government Accountability Office and NSF's various advisory committees, contractors, and staff. The following list represents six areas of the most critical management and performance challenges for the Foundation:

- Major Multi-User Research Facilities Management
- Business Operations Management
- Management of the *Intergovernmental Personnel Act* Program
- Management of the United States Antarctic Program
- Cybersecurity and Information Technology Management
- Encouraging the Ethical Conduct of Research

This year's list leads with challenges faced in managing large facilities, or major multi-user research facilities[2] — an inherently risky portfolio due to the complex nature of these facilities, the associated high construction and operating costs, and the need to apply equal emphasis on sound business practices and innovative science in the awarding of cooperative agreements for such facilities. This is not a new challenge, and NSF has improved its oversight over its major facilities over the past few years. NSF is now challenged to implement all of its new controls, which we explore in the specific challenge section.

In the business operations challenge, we identify that ensuring that payments are proper at the time they are initiated continues to be a challenge for NSF because grant recipients are generally not required to provide supporting documentation in order to receive payments from the agency. Issues with accountability and transparency are further compounded due to the need for NSF to monitor awardees that "pass through" funds to subrecipients. NSF continues to be challenged to implement controls over

[1] Pub. L. No. 106-531
[2] The term "major multi-user research facility," or "major facility," is synonymous with the term "large facility," used previously in our reports. The new terminology better aligns with the *American Innovation and Competitiveness Act* (Pub. L. No. 114-329), signed into law on January 6, 2017.

the spending of grant funds that ensure transparency and accountability but do not unduly encumber awardees and Federal program officers.

While a core part of the Foundation's business operations, cybersecurity and information technology (IT) management is highlighted as a standalone challenge area this year. The protection of its information systems against unauthorized access or modification is critical to NSF's ability to carry out its mission. NSF's FY 2016 *Agency Financial Report* contained the first instance of an IT-related significant deficiency in internal control over financial reporting. NSF has taken steps to address the deficiency and should continue to take steps to improve IT controls over financial reporting.

We have also removed two challenges identified in previous periods from this year's list. In the past, we had a challenge focused on grants administration, which is integral to the Foundation's mission, and, accordingly, what processes and operations we review. However, due to its broad nature, instead of distinguishing grants administration as its own challenge this year, we instead have incorporated specific aspects of grant administration where we see issues in more narrowly focused challenge areas. In addition, as NSF successfully completed its relocation to its headquarters in Alexandria, Virginia, we no longer consider NSF's move to a new building as a challenge area and have removed it from the list. Although NSF has completed its move, we will continue to monitor associated challenges, such as with records management, which we include as a business operations management challenge.

Finally, while not designated as a challenge area, we continue to focus resources on other areas of high risk within grants administration, including the Small Business Innovation Research program, which provides equity-free funding and entrepreneur support at the earliest stages of research.

We are encouraged by NSF's progress in its efforts to address its most serious management and performance challenges. Effective responses to these challenges will help position NSF to ensure the integrity of NSF-funded projects, to spend research funds in the most effective and efficient manner, and to maintain the highest level of accountability over taxpayer dollars.

Major Multi-User Research Facilities Management

Overview

NSF's major multi-user research facility (major facility) portfolio is inherently risky due to the complex nature of these facilities and the associated high construction and operating costs. In FY 2016, NSF spent $241 million constructing major facilities and more than $1 billion operating them. These major facilities are state-of-the art infrastructure for research and education and include telescopes, ships, distributed networks, and observatories. NSF has improved its oversight over its major facilities, but challenges remain with implementing all of NSF's new controls.

Challenges for NSF

Since 2010, we have issued nearly 60 reports raising concerns with NSF's oversight of its major facility portfolio. Our reports highlight concerns with oversight including unsupported proposal budgets, lack of

incurred cost audits, lack of controls over management fees and contingency, and the absence of certified or validated earned value management systems. In addition to our reports, at the request of the NSF Director and the National Science Board, the National Academy of Public Administration (NAPA) examined NSF's use of cooperative agreements for major facilities and benchmarked its practices against other, similar Federal agencies. NAPA's December 2015 report[3] concluded that "[i]t is clear that, in the past, NSF has prioritized the innovative scientific aspects of large facility construction projects; the agency now needs to apply equal emphasis on increased internal management of the business practices critical to enhanced oversight and project success."

In addition, our May 2017 report, *NSF Needs Stronger Controls Over Battelle Memorial Institute Award for the National Ecological Observatory Network*,[4] found NSF strengthened some controls over the Battelle award, such as reviewing the reasonableness of certain proposed costs and retaining a portion of contingency. However, NSF did not fully comply with all of its new policy and implementing guidance. For example, NSF awarded funding to Battelle before completing the cost proposal review documents, and NSF waived or did not require full compliance with management fee policies and/or implementing guidance. Specifically, NSF allowed management fee to be used for charitable contributions and, at award issuance, based management fee on a percentage of total estimated project cost.

OIG Assessment of NSF Progress

Over the past few years, NSF has worked diligently to address our and NAPA's recommendations. As a result of NSF's progress, NSF's oversight of major facility construction agreements was no longer reported as a significant deficiency in NSF's FY 2016 financial statement audit. Only two suggestions for improvement remained in the FY 2016 management letter related to NSF's oversight of contingency. NSF has strengthened controls over its major facility portfolio through the development of several new policies and procedures. For example, NSF is now required to:

- Retain a portion of the awardee's contingency funds;
- Periodically conduct incurred costs audits of its major facility awardees;
- Complete a cost proposal review document prior to award to document its review of the reasonableness of proposed costs;
- Obtain a required independent cost review of an awardee's proposal budget;
- Conduct earned value management system verification and validation reviews; and
- Review proposed management fee uses prior to award and require awardees to track management fee expenditures.

We are encouraged by NSF's new policies and procedures; its challenge is now ensuring consistent implementation of its expanded controls. As previously discussed, our 2017 report found NSF strengthened some controls over the Battelle award, but NSF did not fully comply with all of its new policy and implementing guidance.

[3] *National Science Foundation: Use of Cooperative Agreements to Support Large Scale Investment in Research*, December 2015
[4] OIG Report No. 17-3-004, May 12, 2017

Further, as NSF implements its new policies and procedures, it may find it necessary to revise some controls due to new legislation or awardee feedback. For example, the *American Innovation and Competitiveness Act of 2017*[5] (AICA) requires many actions we recommended in prior reports to further strengthen NSF's controls. We are monitoring NSF's progress in implementing the controls required by the Act. In addition, on July 31, 2017, NSF revised its management fee policies and procedures due to awardee feedback. As NSF continues to revise its controls, it should ensure it does not decrease the accountability and safeguards built into the original strengthened procedures.

Moving forward, we will continue to invest resources in evaluating NSF's oversight of major facilities. As of October 2017, we are reviewing NSF's controls to ensure that major facility awardees properly charge project expenditures to construction or operations awards so that these award funds are used as intended, as well as reviewing NSF's efforts to ensure that awardees oversee their subrecipients, including those associated with major facilities.

Business Operations Management

Overview

NSF is a small agency in terms of staff, but one with a significant appropriation and a broad portfolio of responsibilities. To fulfill its mission, NSF selects and administers productive investments in research and the Nation's science infrastructure. Specifically, for FY 2017, NSF received appropriations of more than $7.1 billion to fund research and related activities; major research facilities; and education in science, mathematics, and engineering — while receiving $330 million for agency operations and award management.

Selecting and funding great science is the agency's primary mission. However, with responsibility for billions of dollars and a diverse portfolio of projects, NSF leadership cannot afford to overlook the importance of its financial and administrative operations. Effective executives and administrators in such operations are critical to NSF's success, as are strong systems and controls over such functions. In addition, it is critical that NSF oversee grantees' processes and controls regarding financial compliance of subrecipients. The "business" side of NSF faces a set of challenges aimed at improving the organization's management controls over payments, information security, recordkeeping, and reporting. Simply stated, NSF is challenged to deliver both scientific and organizational excellence.

Challenges for NSF

Finding and Eliminating Improper Payments

NSF has consistently faced challenges in ensuring that payments are proper at the time they are initiated because grant recipients are generally not required to present supporting documentation, such as invoices and receipts, to receive payments from the agency. As a result, NSF issues almost $7 billion

[5] Pub. L. No. 114-329

annually in grant and cooperative agreement payments without verification. Instead, NSF relies almost completely on the recipients' systems of internal control to ensure that only proper payments are requested and that any improper payments are identified and corrected by the recipient.

In May 2016, we issued a report[6] on NSF's compliance with the *Improper Payments Elimination and Recovery Act of 2010*[7] (IPERA) requirements for FY 2015. Although we concluded that NSF technically complied with the requirements of IPERA, we identified substantial concerns with the depth, substance, and documentation of the NSF risk assessment. Specifically, we found significant limitations in NSF's analysis of six of the nine Office of Management and Budget (OMB) risk factors and its assessment of NSF payments to employees.

With respect to the first concern, properly evaluating risks that could contribute to improper payments depends on collecting accurate, relevant information by asking the right questions of the appropriate personnel. We found that in some instances the interviews conducted did not address areas of known risks in sufficient detail, and at times raised concerns about why some questions were asked and not others. We also found that NSF sometimes accepted answers at face value and did not obtain key information to support the information provided.

With respect to the second limitation, NSF did not thoroughly assess payments to employees. The agency did not conduct IPERA-specific testing on payroll in FY 2015 or interview staff in NSF's Division of Human Resource Management, the division responsible for administering salary and benefits, to discuss any of the nine OMB risk factors during the IPERA risk assessment. As a result of these limitations, NSF's risk assessment may not have fully explored the agency's susceptibility to improper payments. We made eight recommendations to strengthen NSF's future IPERA risk assessments. NSF generally agreed with the recommendations, and plans to undertake corrective action to improve its IPERA risk assessment process.

According to the *Standards for Internal Control in the Federal Government*, "Internal control is a process effected by an entity's oversight body, management, and other personnel…." It further states that "…management designs control activities so that all transactions are completely and accurately recorded." NSF's challenges in this area are to develop an internal control process that provides reasonable assurance that payments are proper at the time they are made and to develop a sound process for assessing its risk of improper payments.

Promoting Accountability and Transparency

The *Digital Accountability and Transparency Act of 2014*[8] (DATA Act) required Federal agencies, including NSF, to report financial and payment data by May 2017 in accordance with data standards, definitions, and guidance established by the U.S. Department of Treasury (Treasury) and OMB to foster greater transparency over Federal spending. The DATA Act also includes oversight requirements for

[6] *NSF's Compliance with the Improper Payments Elimination and Recovery Act for FY 2015*, OIG Report No. 16-3-005, May 12, 2016
[7] *Improper Payments Elimination and Recovery Act of 2010*, Pub. L. No. 111-204
[8] Pub. L. No. 113-101

Inspectors General to assess the completeness, timeliness, quality, and accuracy of data submitted by the agencies; our first such review must be completed by November 2017.

Evolving Federal guidance and the late release of the Department of Treasury's system that tests and validates agency data and the patches to the software program used by NSF and other agencies for financial systems — all factors beyond NSF's control — were challenges to NSF's DATA Act implementation. The necessary modifications to agency systems and processes, human resource constraints, and the lack of a clear source of funding for NSF's DATA Act implementation efforts were also challenges.

Monitoring of Subrecipients

Transparency and oversight of NSF funds passed through to subrecipients also pose a challenge to NSF's business operations. It is NSF's responsibility to make sure that prime recipients are properly overseeing subrecipients. For example, NSF is challenged to ensure that its awardees review sufficient cost information to demonstrate that subrecipients' costs are allowable, fair, and reasonable.

Managing the Government's Records

OMB and the U.S. National Archives and Records Administration (NARA) issued a directive[9] in 2012, which required Federal agencies to eliminate paper and use electronic recordkeeping to the fullest extent possible and take specific actions by appointed dates to reform the policies and practices for the management of records. In 2014, Congress amended the *Presidential Records Act* and the *Federal Records Act* regarding the preservation, storage, and management of Federal records.[10]

Although NSF has until December 31, 2019, to comply with the memorandum issued by OMB and NARA to manage permanent electronic Federal records in electronic format to the fullest extent possible, in October 2017, NSF completed its relocation to a new headquarters building with less office space available for the storage of paper, supplies, and equipment. Accordingly, NSF undertook several initiatives to reduce the amount of paper, supplies, and equipment it uses and stores. These initiatives include continual contract services with a vendor to retire and scan paper records onsite; services with the relocation vendor to recommend and pilot an electronic records management system including scanning and digitizing paper records; and an agency-wide campaign since July 2016 with a goal to dispose of 500,000 pounds of excess supplies, equipment, paper, and trash before the relocation.

As the agency continues to pursue efforts to reduce its paper files, it must guide staff to distinguish between official records and nonrecord materials and personal papers. NSF is required to retain and destroy official records in accordance with record retention schedules approved by NARA. Our recent audit on records management determined that NSF implemented some records management actions to reduce the amount of paper records, but NSF's planning has not been sufficient, and NSF risks not

[9] *Managing Government Records Directive*, Memorandum M-12-18, August 24, 2012
[10] *Presidential and Federal Records Act Amendments of 2014*, Pub. L. No. 113-187, 128 Stat. 2203

completing its scanning/digitization project efficiently.[11] In addition, because only approximately 36 percent of NSF employees had taken records management training as of August 2017, there is a risk that staff may have inadvertently discarded official records before the relocation. We have made several recommendations to improve records management.

OIG Assessment of NSF Progress

NSF plans to perform a 3-year IPERA qualitative risk assessment by FY 2018, which we will review. During this 3-year cycle, NSF will continue to collect information for this risk assessment by leveraging the work completed as part of the OMB Circular A-123, Appendix A, and financial reporting assessment process. In addition, NSF will use the results of its award financial monitoring testing process to complement its IPERA assessment and develop a policy and procedure to clearly document the agency's risk assessment.

NSF implemented the DATA Act in April 2017, before the statutory May 2017 deadline. It submitted financial and award data for publication on USASpending.gov as required by the DATA Act for the second and third quarters of FY 2017. Our ongoing audit, which will be completed in November 2017, will assess the completeness, timeliness, quality, and accuracy of NSF's FY 2017 second quarter data; it will also assess NSF's implementation and use of the Government-side financial data standards established by Treasury and OMB.

Regarding subrecipient monitoring, we are conducting an audit of NSF's oversight of grantees' subrecipient monitoring, as previously discussed. The audit, required by the AICA, will review NSF's policies and procedures governing the monitoring of pass-through entities with respect to subrecipients.

With respect to records management, NSF is updating its records management policies, guidance, and training — including for electronic records — and hired a new records management official in FY 2016. NSF has agreed to take several actions as a result of our electronic records management report, including agreeing to update its records management training course and require all NSF personnel who create, receive, access, or use Federal records to complete initial records management training within 60 days of employment and annual refresher training at least once each fiscal year. However, NSF needs to implement additional actions to prepare agency staff to meet NARA directives by 2019.

Management of the Intergovernmental Personnel Act Program

Overview

To further the agency's mission of supporting science and engineering research and education, NSF draws scientists, engineers, and educators from academia, industry, or other eligible organizations on rotational assignment to supplement its workforce. All non-permanent appointments are Federal employees, except for individuals under the *Intergovernmental Personnel Act*[12] (IPA), who are paid

[11] *NSF's Relocation to its New Headquarters Location — Records Management,* OIG Report No. 17-3-003, Sept. 28, 2017
[12] Pub. L. No. 91-648

through grants and remain employees of their home institutions. Accordingly, these temporary staff members can have a heightened risk of conflicts of interest while they are working at NSF. NSF's reliance on individuals appointed under the IPA — hereafter referred to as IPAs — is significant.

Challenges for NSF

NSF benefits from IPAs' contributions, but it also faces challenges in managing the IPA program. For example, because individuals can serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions. As of September 2017, IPAs led 5 of NSF's 7 science directorates and 17 of 29 divisions.[13] Thus, the majority of the positions responsible for providing leadership and direction to accomplish the agency's mission were held by temporary employees.

In our June 2017 report, *NSF Controls to Mitigate IPA Conflicts of Interest*,[14] we found that although NSF has implemented internal controls to identify and mitigate IPA conflicts of interest, some of the controls could be strengthened, and additional controls may improve NSF's ability to identify or mitigate IPA conflicts of interest. Specifically, NSF's information system does not restrict conflicted parties from accessing proposal and award information, and rules on submitting proposals while at NSF are not clear or consistently enforced. In addition, NSF did not always ensure a substitute negotiator was named when negotiating awards with former IPAs or fully track completion of exit briefings for departing IPAs.

NSF's reliance on IPAs also comes with a high cost because IPAs are not subject to Federal pay and benefits limits. In 2015, NSF paid 22 IPAs more than the maximum rate of pay for Senior Executive Service. NSF paid nearly $8.9 million for salary, fringe benefits, lost consulting, and per diem for 27 executive-level IPAs in 2015. In light of these costs, the AICA requires NSF to report annually to Congress written justification for any IPA paid at a rate that exceeds the maximum rate of pay for the Senior Executive Service. In addition, the Act requires NSF to submit to Congress one year after the Act's enactment a report on NSF's efforts to control costs associated with IPAs, including how NSF implemented our recommendations.

In addition, NSF's Independent Research/Development (IR/D) program permits NSF staff, including IPAs, to engage in research projects while they are at NSF. IPAs participating in IR/D activities usually return to their home institutions to continue existing research projects. Of 250 working days in a year, IR/D participants can spend up to 50 days (20 percent of their work time) on research at their home institutions. In October 2016, NSF issued a policy change limiting IPA travel to the home institution under the IR/D program to 12 trips per year. The amount of time IPAs spend at their home institutions — rather than at NSF — raises concerns about their ability to fulfill their responsibilities at NSF and to be fully engaged in the agency's mission.

[13] There were vacancies in leadership positions for one science directorate and five divisions.
[14] OIG Report No. 17-2-008, June 8, 2017

OIG Assessment of NSF Progress

In response to our 2017 report, NSF has agreed to take corrective actions to strengthen controls over IPA conflicts of interests, including reassessing controls to ensure staff do not have access to awards and proposals for which they are conflicted; ensuring that staff obtain exit interviews; and clarifying and enforcing its rules on the submission of preliminary proposals by current employees and IPAs.

In response to recommendations in our 2013 audit report, *Audit of Cost Associated with NSF's Use of Intergovernmental Personnel Act Assignees*,[15] NSF established an IPA Steering Committee in April 2016 to analyze IPA costs and identify cost savings. In November 2016, the NSF Chief Human Capital Officer provided the National Science Board a status briefing of IPA program changes, which include NSF beginning a pilot program requiring 10 percent cost sharing of IPA salary and fringe benefits for new agreements in FY 2017 that was expected to save $2.8 million. NSF also eliminated lost consulting as a cost reimbursable to IPAs, with a cost savings expected of $400,000 annually.

Management of the United States Antarctic Program

Overview

NSF, through the United States Antarctic Program (USAP), manages U.S. scientific research in Antarctica. The Antarctic Support Contract (ASC) and its subcontractors provide logistical support in a variety of areas — from laboratory management and food services to IT and other support functions — that make NSF research possible in one of the most remote areas of the world. The ASC was awarded to Lockheed Martin in December 2011 and is NSF's largest contract, valued at nearly $2 billion over 13 years. In August 2016, Leidos Holdings, Inc. and Lockheed Martin's Information Systems & Global Solutions business segment merged. As a result of the merger, Leidos now holds the ASC. Challenges include ensuring a successful transition of the ASC project, modernizing the largest research station in Antarctica, and managing the heightened risks that come with the remote and isolated environment. In addition, NSF has indicated to us that it will apply its new major multi-user research facility policies and procedures, which typically apply to cooperative agreements, to the ASC, which follows the Federal Acquisition Regulation. As previously discussed, ensuring consistent implementation of its new policies and procedures is a new challenge for NSF.

Challenges for NSF

Ensuring a successful transition of the ASC project, together with its subcontractors, is a challenge for NSF. It is essential for NSF to have strong cost controls, especially through reorganizations and mergers, to protect the Federal Government against unwarranted increases in ASC costs and to oversee costs incurred under the ASC and its subcontracts.

[15] OIG Report No. 13-2-008, March 20, 2013

NSF has three sites — Port Hueneme, California; Punta Arenas, Chile; and Christchurch, New Zealand — where inventory is stored and maintained prior to shipment to Antarctica. The Port Hueneme facility alone handles approximately 40 million pounds of cargo each year. Sound management of the acquisition, storage, and shipment of inventory is critical to controlling cost, operational efficiency, and mission readiness. Management needs accurate data to make informed decisions regarding budgeting, financial management, and logistical and operational management. Inventory stored at these sites is at particular risk due to the large volume of material, long logistical lead time, and remoteness from the USAP program headquarters.

NSF will also face the challenge of modernizing McMurdo Station, the largest research station in Antarctica. The Antarctic Infrastructure Modernization for Science (AIMS) project is a major capital investment effort to ensure that McMurdo Station remains a viable platform for supporting Antarctic science for the next 35 to 50 years. AIMS, once fully developed and funded, will take approximately 10 years to complete through a series of large contracts. A major prerequisite for AIMS is that its planning and construction process have minimal impact on the science that will continue to take place there. Another prerequisite is obtaining the necessary funding from Congress. It is also important for NSF to apply lessons learned through its major facility work as it proceeds with this new construction project.

Finally, our 2015 report, *Audit of Health and Safety in the U.S. Antarctic Program*,[16] noted that misconduct in the Antarctic creates a heightened threat due to the remote and isolated environment.

OIG Assessment of NSF Progress

Regarding fiscal oversight of the ASC, NSF is obtaining an incurred cost audit of a large ASC subcontractor who billed approximately $46.5 million for 2012 and 2013.

In response to our 2015 audit report, NSF developed its *Process for Reporting and Reviewing Code of Conduct Violations*, which states that each year the Office of Polar Programs (OPP) will send a request to all USAP employing organizations and NSF's on-site representatives (for grantees) for a report of all significant instances of misconduct in Antarctica for the previous 12 months. OPP managers will convene to review all submitted reports and determine and document in a consolidated report whether any participants should be banned. We recognized this as a needed start towards OPP's ability to compile statistics on the occurrence of misconduct incidents and to identify any actions that need to be taken with respect to such incidents.

Cybersecurity and Information Technology Management

Overview

NSF depends on IT resources and systems to process, maintain, and report essential information. NSF staff and grantees must be able to rely on the integrity, availability, and reliability of the information

[16] OIG Report No. 15-2-009, July 2, 2015

contained in NSF financial and other IT systems. The agency is challenged to protect its information systems and IT resources as well as to manage records and applications on mobile devices.

Challenges for NSF

Protecting Agency Information and IT Resources

The protection of its information systems against unauthorized access or modification is critical to NSF's ability to carry out its mission. NSF's FY 2016 *Agency Financial Report* contained the first instance of an IT-related significant deficiency in internal control over financial reporting. Specifically, NSF did not take effective measures to authorize and recertify access for two financial feeder systems and to monitor privileged users'[17] actions for its core financial system and one of its feeder systems. Without these access controls, there is an increased risk of unauthorized transactions and unauthorized changes to data, audit logs, and configurations that remain undetected and affect the integrity of financial transactions.

In addition to IT security weaknesses related to its financial systems, NSF continues to experience long-standing issues that warrant increased attention, particularly with regard to the systems supporting the USAP. Although IT infrastructure updates are included in the AIMS project, NSF and USAP staff stated that ongoing budget constraints and the need to prioritize health and safety needs have limited NSF's ability to address these issues and to effectively modernize the USAP IT infrastructure. NSF management should allocate appropriate resources to correct these weaknesses and ensure that USAP systems and information are adequately protected.

Managing Records and Applications on Mobile Devices

NSF has not finalized its guidance related to the use of smartphone applications that support encryption or prevent the automatic deletion of messages for work-related communications, although it has been working to complete the guidance since NARA issued its memo on this topic in March 2017. In our July 2017 report, *NSF Could Strengthen Key Controls over Electronic Records Management*,[18] we identified that NSF has the capability to monitor the use of smartphone applications on NSF-owned mobile devices, but does not actively monitor their use. This allowed some NSF employees to download smartphone applications that support encryption or automatic deletion of text messages without consulting appropriate officials as required. In addition, NSF does not have a way to capture text messages on NSF-owned mobile devices or social media messages.

Without effective measures to capture text and social media messages or monitor the use of smartphone applications, NSF cannot ensure it is complying with Federal requirements and guidance for electronic records management. NSF could strengthen information system controls by either blocking applications it deems untrustworthy or allowing the use of only approved applications that it deems trustworthy and

[17] Privileged users are database and operating system administrators.
[18] OIG Report No. 17-2-009, July 6, 2017

in line with its mission. NSF has an application approval process for its laptop and desktop computers, but it could provide a similar guide for mobile devices.

OIG Assessment of NSF Progress

NSF has taken steps to address the significant deficiency reported in the FY 2016 *Agency Financial Report*. The agency has improved its monitoring and reviewing of audit logs related to its core financial system and has updated its process for renewing access to one of its financial feeder systems. However, areas for improvement remain regarding reviewing and granting new access to financial feeder systems as well as monitoring audit logs. NSF should continue to take steps to improve IT controls over financial reporting.

NSF has also begun to take steps to address the infrastructure issues at USAP. The McMurdo Master Plan, part of the AIMS project, lists several IT-related upgrades, including major renovations to the IT & Communications building (and the subsequent relocation of the data center) as well as modernization of telephone systems. NSF management should allocate appropriate resources to correct these weaknesses and ensure that USAP systems and information are adequately protected.

Regarding mobile device management, NSF has not issued guidance related to the use of smartphone applications that support encryption or the ability to automatically delete messages after they are read or sent for work-related communications. However, in response to our July 2017 report, NSF has agreed to implement controls to prevent prohibited applications from being downloaded onto NSF-issued mobile devices without authorization and to implement quarterly monitoring of applications installed on such devices by March 2018.

Encouraging the Ethical Conduct of Research

Overview

Research misconduct — plagiarism, data fabrication, and data falsification — damages the scientific enterprise, is a potential misuse of public funds, and undermines the trust of citizens in Government-funded research. It is imperative to the integrity of research funded with taxpayer dollars that NSF-funded researchers carry out their projects with the highest ethical standards. For this reason, it is essential that NSF continue to recognize the importance of its Responsible Conduct of Research (RCR) requirement, which it implemented in 2010, to help minimize the risk of unethical conduct.

Challenge for NSF

The scientific enterprise is based on a foundation of trust. If the trust is found to have been misplaced as a result of unethical or unprofessional conduct on the part of scientists, the impact of that breakdown is

not limited to the research community alone — it can undermine the relationship between science and society as a whole.[19]

Our investigations continue to substantiate allegations of fabrication, falsification, and plagiarism in NSF-funded research. We also continue to receive allegations related to violations of NSF peer review confidentiality, false representations in résumés, false representations of publications in annual/final reports, and fraudulent or otherwise improper use of grant funds. The number and variety of ethical issues identified in our investigative activities illustrate the importance of emphasizing research integrity as a core value — not only at the student level, but at the faculty level as well.

In accordance with the *America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2007*[20] (America COMPETES Act), NSF requires that each institution submitting a proposal certify that it has a plan to provide appropriate training and oversight in the ethical conduct of research to all undergraduates, graduate students, and postdoctoral researchers who will be supported by NSF to conduct research. The institutions are responsible for verifying that the training has been received. However, NSF left it to the institutions to define the content of the training programs and provided no guidance as to what constitutes appropriate training. In our review of a sample of institutional RCR training plans,[21] issued in July 2017, we found that some institutions had not developed a training plan. Most institutions in our review responded to the RCR mandate by utilizing online training modules, although some research suggests that many of the online ethics training programs currently available are less effective than programs that use a hybrid of online and face-to-face training.

While most of the institutions we sampled complied with NSF's RCR requirements, almost one quarter of the institutions did not initially do so. In light of that finding and the related observations we made during the course of our review, it appears that NSF's awardees could benefit from NSF providing written guidelines or templates for universities to follow, as requested by the America COMPETES Act's report language, and from the sharing of best practices with the broader community.

OIG Assessment of NSF Progress

In response to our July 2017 report, the NSF Director issued an Important Notice[22] to all institutions reminding them of the requirement to have an RCR plan. However, we believe that greater guidance to institutions is warranted. NSF has a unique opportunity to encourage institutions to incorporate best practices into their RCR programs. We also believe NSF should encourage institutions to extend their RCR programs to faculty, as our investigation statistics suggest they too are vulnerable to committing research misconduct. Such actions will help minimize the risk of unethical or unprofessional conduct by such individuals and, in so doing, help protect the relationship between science and society as a whole.

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[19] *On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition*, 2009
[20] Pub. L. No. 110-69
[21] OIG Tracking No. PR12030006, *OIG Review of Institutions' Implementation of NSF's Responsible Conduct of Research Requirements*, July 25, 2017
[22] NSF Office of the Director Important Notice No. 140, *Training in Responsible Conduct of Research – A Reminder of the NSF Requirement*, August 17, 2017

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