

## **CHALLENGE: Establishing Accountability over Large Cooperative Agreements**

**Overview:** Since 2010, OIG has issued 28 reports containing more than 80 recommendations related to NSF's use and management of cooperative agreements for the construction and operation of high-dollar, high-risk research facilities. Audits of over \$1.1 billion in proposed costs for three construction projects raised serious questions about the adequacy of the proposed budgets, which led us to examine NSF's cost surveillance throughout the lifecycle of large facility projects.

Accountability weaknesses occurred at multiple facilities and contributed to the decision by the NSF Director and the National Science Board to procure a report by the National Academy of Public Administration (NAPA) focused on NSF'S large cooperative agreements. NAPA determined that NSF should strengthen oversight and monitoring of cooperative agreements to ensure that the billions of Federal funds invested in large facilities are spent properly. The NAPA report included thirteen recommendations, which if implemented by NSF in a timely manner, will significantly improve NSF's ability to ensure accountability over high-dollar, high-risk projects and thus will go a long way toward addressing many of the issues OIG has raised.

**Challenge for the Agency:** NSF's challenges with large facility construction agreements go beyond ensuring that proposed budgets and expenditures are supported. Our extensive audit work focused on construction awards surfaced similar risks for NSF's oversight of operations awards for large facilities. This is important because NSF spends significantly more for operating its facilities than constructing them. For example, NSF requested over \$193 million for fiscal year 2017 to pay for four NSF construction projects. In contrast, NSF's operation and maintenance request for its existing facilities and Federally Funded Research and Development Centers for the same time period was over \$947 million.

NSF's challenge to ensure accountability in large facility cooperative agreements is compounded by the Foundation's emphasis on scientific results at the expense of sound business practices. This issue was noted in the NAPA report, which stated that:

It 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 doing so, the Panel believes that NSF and NSB will enhance the agency's ability to fulfill its mission of supporting groundbreaking science.<sup>1</sup>

Proper financial management and oversight can play a crucial role in ensuring that a project achieves intended scientific benefits. It is critical for NSF to have a sound and reliable estimate of project costs and then to ensure that project funds are spent appropriately. Absent such oversight there is a heightened risk that scientific benefits will be lessened. For example, NSF did not become aware of the NEON project's potential \$80 million budget overrun until it was notified of it by NEON. While some of the factors that may have contributed to increased project costs, such as permitting delays, may have been outside of NSF's control, NSF could have

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<sup>1</sup> *National Science Foundation: Use of Cooperative Agreements to Support Large Scale Investment in Research*, National Academy of Public Administration (December 2015), pp. 6-7.

addressed other matters such as unsupported costs in NEON's budget and questionable spending for meals and entertainment activities, among other things, if it had identified them earlier.

The Foundation's ability to monitor a project's progress is enhanced if it has access to quality Earned Value Management (EVM) data. We have recommended that NSF validate the information awardees provide in EVM reports and that NSF require that EVM systems be certified. There were problems with the EVM systems for two of NSF's largest, riskiest construction projects, which could increase the risk of cost overruns and misuse of funds. For example, NSF has not certified the EVM system for \$344 million Daniel K. Inouye Solar Telescope project, and is not validating the EVM data provided by the awardee.

It is imperative that NSF apply the same rigorous attention and scrutiny to its financial management and oversight of its large facility projects that it applies to determining the scientific merit of the projects it decides to fund.

NSF management agreed with all of the NAPA report's recommendations and said that the agency plans to implement them "in some form". The agency has also agreed with a number of OIG recommendations. NSF now faces the challenge of implementing multiple new policy changes based on these recommendations, which will require obtaining an increased amount of data from its awardees. Implementing these new practices will also require sustained management attention, effective communication with the awardee community, clear award terms and conditions, and, most importantly, a culture change in NSF.

The Foundation applies its highest level of attention and scrutiny to determine the scientific merit of the projects it decides to fund. To ensure that these projects deliver the promised scientific benefits to the public, a culture change at NSF is needed that makes sound financial management a priority and ensures that sufficient resources are allocated to ensure that federal funds are spent properly. We remain concerned about NSF's ability to accomplish this change, and about its progress toward improving cost surveillance and implementing these new rules to ensure effective oversight.

### **OIG's Assessment of the Agency's Progress**

NSF has developed new policies and procedures for large facility awards to address some OIG and NAPA recommendations. Examples of NSF's new requirements to strengthen oversight of large facilities include a Cost Proposal Review Document to document NSF's analysis of awardees' proposed costs, an independent cost assessment to validate proposed costs, an incurred cost reporting tool for cooperative agreements over \$100 million, retaining a portion of an awardee's contingency funding, and prohibiting use of management fee for certain activities.

NSF's actions represent important steps toward the goal of increased accountability; however, the agency continues to study how to address other recommendations, such as whether to require certification of Earned Value Management systems.

## **CHALLENGE: Management of NSF's Business Operations**

**Overview:** NSF may be a small agency in terms of staff but it spent over \$7 billion in FY 2016 to select and administer productive investments in research and the nation's science infrastructure. Consequently most of NSF's managers and staff are successful science or engineering professionals that are well qualified to help determine the composition of the agency's investments, but vary in terms of their managerial experience and skill.

Selecting and funding great science is the agency's most important job but 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 are as critical to NSF's success as its scientists. The "business" side of NSF faces a set of challenges aimed at improving the organizations' management controls over payments, information security, recordkeeping, and reporting. Simply stated, NSF is challenged to deliver both scientific and organizational excellence.

### **Challenge for the Agency:**

#### *Finding and Eliminating Improper Payments*

Ensuring that payments are proper at the time they're initiated has always been challenging for NSF because grant recipients are generally not required to present supporting documentation in order to receive payments from the agency. As a result, NSF issues approximately \$6 billion annually in grant and cooperative agreement payments relying almost completely on the *recipients* to ensure that only proper payments are requested, and that if improper payments are ever made, they will be identified and corrected by the recipient after the fact.

In May 2016, we issued a report on NSF's compliance with the Improper Payment Elimination Act (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 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 NSF's Division of Human Resource Management (HRM), 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 address the root causes of the finding.

The *Standards for Internal Control in the Federal Government* states that, "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.

#### *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. As demonstrated by the recent failure of the Uninterruptible Power Supply that shut down NSF's network for three days last July, access to agency information and IT resources is extremely dependent on external factors. With the agency scheduled to vacate its current buildings next year, the owner may not be as motivated to keep infrastructure updated. To compensate, NSF should increase the timing and robustness of IT resource testing until the time of the move to the new building in 2017.

After the move to the new building in 2017, NSF's challenge will be to ensure that agency information and IT resources remain available, secure, and complete. Its efforts in this area may be assisted by the use of information security continuous monitoring (ISCM) strategies as mandated by OMB through the DHS Continuous Diagnostic and Mitigation Program.

In addition to certain recurring IT security weaknesses, NSF has some long-standing issues that warrant increased attention, particularly with regard to the systems of its Antarctic Program. In particular, there are two deficiencies still outstanding that were first identified in 2006 that threaten the continuity of mission support and communications from the USAP's key Denver location in the event the site becomes unavailable or the data center is interrupted. NSF management should allocate appropriate resources to correct these weaknesses and ensure that the systems and information are adequately protected.

#### *Promoting Accountability and Transparency*

The Digital Accountability and Transparency Act (DATA Act) directs the federal government to standardize and publish a wide variety of reports and data in order to foster greater transparency over federal spending. Federal agencies must implement and report the DATA Act data elements by May 2017. The DATA Act also includes oversight requirements for 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. The government-wide implementation is being led by a joint team from the U.S. Department of the Treasury and the Office of Management and Budget (the DATA Act Project Management Office or PMO).

The iterative nature of the DATA Act PMO's implementation strategy and evolving federal guidance make it difficult for agencies, including NSF, to integrate the implementation effort into existing IT governance and resource requirements planning structures. Also, there are issues that still need to be resolved on a government-wide basis, including the late release of Treasury's production-ready broker (to test and validate agency data); and the software patches to the iTRAK financial system used by NSF and other agencies, both of which are beyond NSF's control. Further, NSF has indicated that it needs additional guidance and clarification from OMB and Treasury to fully report under the DATA Act.

Other factors also present a significant challenge for NSF in successfully implementing the requirements of the Act including: the necessary modifications to agency systems and processes; the limited agency FTEs available to ensure that adequate staff with the necessary skills and competencies are dedicated to DATA Act implementation; and the potential that NSF's relocation in 2017 may impact DATA Act activities. Also, the lack of a clear source of funding for NSF's DATA Act implementation efforts presents a potential risk to its success. As the guidance on DATA Act requirements is released in stages, cost estimates and implementation activities will continue to change, making it difficult for the agency to adequately prepare.

### *Managing the Government's Records*

In 2011, President Obama signed a memorandum initiating a government-wide effort to reform federal recordkeeping in light of the dramatic increase in the amount of electronic information that the government manages. The Office of Management and Budget (OMB) and the National Archives and Records Administration (NARA) issued a follow-up directive in 2012, which required federal agencies to take specific actions by appointed dates to reform the policies and practices for the management of records, and provide a framework for the management of electronic records.

Although NSF has until 2019 to be in compliance with all of the directives issued by NARA, NSF plans to relocate to a new headquarters building in less than one year which will have less office space available for the storage of paper, supplies, and equipment. Accordingly, the agency must reduce the amount of paper, supplies and equipment it uses and stores. As a result, NSF has set a goal of disposing of 500,000 pounds of such material prior to moving to the new building.

Before the agency begins to reduce its paper files, it must guide staff to distinguish between *official* records and non-record materials and personal papers. NSF is required to retain and destroy official records in accordance with record retention schedules approved by NARA. With the upcoming relocation, employees will begin reviewing and purging their files and records and will require clear guidance to prevent the inadvertent disposal of official records. NSF prepared optional online records management training for employees and issued a September 2016 bulletin to help staff identify federal records. However, NSF does not require employees to take the training and has not encouraged employees to voluntarily take the online records training since the end of 2014. Without the training and guidance from NSF, employees are at risk of disposing official records.

In addition, NSF needs to 1) update its NARA record retention schedules to classify electronic records as official NSF records, and 2) review, scan, and digitize its paper records into an electronic format. The agency has a schedule to finish scanning and digitizing records within each directorate by May 2017, however schedule delays are already occurring due to directorates not being prepared to scan and digitize their records.

### **OIG's Assessment of the Agency's Progress:**

Though OIG found the agency in technical compliance with IPERA this past year, we remain concerned about NSF's approach to conducting IPERA risk assessments and will continue to engage in discussions on this issue. With regard to Information and IT Resources, the agency reports that it has initiated implementation of Phase 1 of Continuous Diagnostics Mitigation, and expects to be the first agency to complete it by the end of the year.

NSF has reported that it is on track to implement the DATA Act by the statutory May 2017 deadline. We agree that NSF had made progress towards implementing the DATA Act, including putting in place a governance structure, following government-wide guidance, implementing plans to mitigate the risk of delays in software patch releases, and participating on government-wide working groups. However, due to factors outside of NSF's control, and project management challenges caused by inadequate resources, meeting the May 2017 reporting deadline continues to be a challenge.

With respect to records management, NSF has hired a professional to head the Records Management Section. However, more needs to be done to prepare agency staff to meet the challenging records management goals it has set prior to the relocation of its headquarters.

### **CHALLENGE: Management of the IPA Program**

**Overview:** To further the agency's mission of supporting science and engineering research and education, NSF draws on scientists, engineers, and educators on rotational assignment from academia, industry, or other eligible organizations. All of the non-permanent appointments are federal employees, except for Intergovernmental Personnel Act (IPA) assignments; individuals on IPA appointments remain employees of their home institutions.

As a result, IPAs' home institutions administer their pay and benefits, and IPAs are therefore not subject to federal pay and benefits limitations.

**Challenge for the Agency:** While there are benefits that come from having IPAs at NSF, there are also challenges. For example, since individuals can serve in a temporary capacity for up to four years, there is almost constant turnover in staff at NSF, especially in senior leadership positions. In July 2016, IPAs led five of NSF's seven science directorates and 22 (of 30) divisions. Thus, the majority of the positions responsible for providing leadership and direction to accomplish the agency's mission were help by temporary employees.

Relative to the number of permanent employees, NSF is a major user of IPA authority; IPAs comprised less than one percent of the workforce for five other science-centric federal agencies. In addition, IPAs at those agencies were generally used in research-related positions, such as science advisors, and did not typically fill management positions.

The 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 institution 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. IPAs are more likely to participate in IR/D and to travel as part of their IR/D activities than permanent employees.

For example, for a one year period ending August 1, 2012, NSF spend nearly \$1.3 million for travel to support IPA's IR/D activities compared with \$183,631 for permanent employees. The amount of time IPAs spend at their home institutions rather than at NSF, raises questions about their ability to fulfill their responsibilities at NSF and to be fully engaged in the agency's mission.

Because IPAs remain employees of their home institutions while at NSF and expect to return there after their tenure at NSF, most come to the Foundation with known conflicts of interests. In light of the Foundation's reliance on rotators to make funding decisions, it is critical that strong controls be in place to identify and mitigate conflicts of interest that occur as a result of IPAs' own research activities or their connections with their home institutions. We are conducting an audit to evaluate the Foundation's controls over IPAs' conflicts of interest.

Finally, NSF's reliance on IPAs comes with a high cost. Both the number of IPAs and their cost have increased in the last three years. NSF has 29 percent more executive level IPAs in 2015 than in 2012, costing nearly \$2.4 million more. NSF paid nearly \$8.9 million for salary, fringe benefits, lost consulting, and per diem for 27 executive level IPAs in 2015 and \$6.5 million for the same expenses for 21 executive level IPAs in 2012.

In addition, as noted previously, IPAs are not subject to federal pay and benefits limits. In 2012, the highest paid annual IPA salary was \$301, 247; in 2015, the highest paid annual IPA salary was \$440,165. The average executive IPA salary also increased from \$223,632 to \$243, 571. Because IPA salaries and benefits are funded with program-related appropriations, savings in IPA costs would free up funds for additional research.

**OIG's Assessment of the Agency's Progress:** NSF established an IPA Steering Committee to analyze IPA costs and identify cost savings, among other things. NSF informed us that it continued to identify and manage conflicts of interest related to IPAs.

### **CHALLENGE: Moving NSF Headquarters to a New Building**

**Overview:** NSF has four months (September through December 2017) to complete its move to the new headquarters and vacate the two buildings in Arlington before its current leases for the Arlington offices expire. During this time, NSF needs to relocate about 2,100 people; move furniture and IT equipment; and decommission its current buildings, with two of these tasks expected to take over one month. Prior to NSF's physical move, the agency must also ensure the new building is operational, with workstation furniture installed, functional IT systems, and operational conference rooms so employees can perform their work.

**Challenge for the Agency:** NSF is faced with significant challenges to completing the move to the new headquarters before leases on its existing buildings expire at the end of 2017. Because of prior delays, there is little margin for error and the risk of any additional delay is high— after the December 31, 2017 deadline, NSF will have to pay approximately \$64,000 per day in rent for its new building. If NSF has not moved by the end of 2017, the General Services Administration will have to re-negotiate leases on its current buildings, which will likely result in increased rental costs the Foundation will have to pay at the same time it begins paying rent for its new headquarters.

To meet its move deadline and avoid additional costs, it is critical for NSF to have a complete and accurate baseline schedule, which plays a critical role in NSF's ability to identify and manage risk. The baseline schedule should be updated frequently and in a timely manner to reflect progress, identify delays, and determine the impact of delays on remaining activities. Although the baseline schedule includes both NSF and the contractor's activities, NSF is responsible for the schedule. We are currently examining NSF's baseline schedule to determine the robustness of this crucial tool.

The frequent turnover in personnel managing the move raises concerns about NSF's ability to meet deadlines and underscores the importance of the baseline schedule to track and measure progress. Since 2014 there have been five project managers overseeing the move. In January 2016, five months after the leases were renegotiated, NSF hired the first person dedicated to managing the schedule, and that person left the agency after one month. In March 2016, NSF hired another scheduler.

**OIG's Assessment of the Agency's Progress:** In the past year, NSF has made progress by successfully meeting its deadlines for reviewing the building designs in condensed timeframes. The agency also completed Phase II negotiations with the union without delaying the move and informed us that it plans to complete the third phase of negotiations without delaying the project schedule. NSF also said that in 2017 it plans to develop a detailed relocation plan and determine what furniture can be re-used in the new building.

### **CHALLENGE: Management of the U.S. Antarctic Program**

**Overview:** NSF, through the United States Antarctic Program (USAP) manages U.S. scientific research in Antarctica. The Antarctic Support Contract (ASC) was awarded to Lockheed Martin in December 2011 and is NSF's largest contract, valued at nearly \$2 billion over 13 years. The Antarctic Support Contract and its subcontractors provide logistical support in a variety of areas, from laboratory management and food services, to information technology and other support functions that make NSF research possible in one of the most remote areas of the world.

In August 2016, Leidos Holdings, Inc. and Lockheed Martin's Information Systems & Global Solutions business segment merged. As a result of the merger, Leidos will hold the ASC, once plans for all contracts affected by the merger have been reviewed.



**Challenges for the Agency:** Ensuring a successful transition of the ASC project, together with its subcontractors, will be a challenge for NSF. It is essential for NSF to have strong cost controls, especially through reorganizations and mergers, to protect the government against unwarranted increases in ASC costs.

In addition to challenges related to the merger, NSF will also face the challenge of modernizing McMurdo and Palmer research stations. It is important for NSF to apply lessons learned through its large facility work as it proceeds with this new construction project.

NSF must also oversee costs incurred under the ASC and its subcontracts. In 2013 we examined the agency's oversight of medical expenses related to the Antarctic program. The Antarctic Support Contractor (ASC) and its subcontractors prepare, process, and pay as many as 1,600 individual reimbursement requests each year for costs related to medical screening. In the course of our audit which identified opportunities to reduce costs for the medical screening process for Antarctic program participants, we found that guidance about what medical expenses would be reimbursed by the contractor was unclear. As a result, applicants may be submitting claims for expenses that are not eligible for reimbursement.

In addition, the contractor does not have a robust system to ensure the accuracy of invoices for medical costs. NSF should consider increasing its investment in the oversight of invoiced costs until it is better assured of the contractor's internal controls. The Contracting Officer's Representative told us that NSF cannot tell if it is being accurately invoiced by LM for medical processing costs and that NSF relies on the contractor to charge them accurately.

Although medical processing constitutes approximately \$1 million out of the first full year's contract value of \$173 million, weak internal controls over relatively small costs for medical processing raises questions about sufficiency of controls over larger contractor costs. NSF could consider increasing its investment in the oversight of invoiced costs until it is better assured of LM's internal controls over invoicing accuracy.

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. 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.

**OIG's Assessment of the Agency's Progress:** NSF reported that it has addressed infrastructure upgrades for McMurdo station through continued design efforts. For example, NSF stated that it has initiated design efforts for upgrades to McMurdo lodging, vehicle equipment/operations center, and the Palmer Pier replacement.

In addition, NSF stated that it continued to review and approve invoices to the USAP contractor and that it documented this process in 2013. The agency reported that it will continue to monitor invoices from the USAP contractor in accordance with its established procedures.

## **CHALLENGE: Improving Grant Administration**

**Overview:** Making grants in support of promising scientific research is NSF's primary business. In FY 2015, NSF evaluated over 49,600 proposals for research, education and training projects through a competitive review process, and funded over 12,000 new competitive awards. As of June 30, 2016, NSF had a portfolio of over 42,000 active awards totaling approximately \$28.2 billion to over 2800 awardees. Given the size and exposure to risk that its portfolio represents, it is vital that NSF's grant administration practices ensure that grantees spend their funds appropriately.

**Challenge for the Agency:** Ensuring that grant funds are spent as intended has always been challenging because grant recipients are not required to produce supporting documentation, such as invoices and receipts, in order to receive payment from the agency. While recent efforts to reduce the administrative burden on grantees have value, the agency should proceed carefully so that accountability for public funds is not compromised in the process. Issues with accountability and transparency are further compounded due to the need for NSF to monitor awardees that "pass-through" funds to sub-recipients that perform a significant amount of the work. Therefore, the challenge for NSF is to implement controls over the spending of grant funds that ensure transparency and accountability, but do not unduly encumber awardees and federal program officers.

OMB issued its streamlined guidance, 2 CFR Part 200, "Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards" (Uniform Grant Guidance or UGG), in December 2013. NSF's *Proposal & Award Policies & Procedures Guide* to implement the UGG became effective in December 2014. Also, as noted in prior years' Management Challenges, OMB raised the single audit threshold from \$500,000 to \$750,000, effectively removing audit coverage on millions of dollars in NSF funding. While the new guidance and higher audit threshold potentially increases exposure to risk, NSF's monitoring program continues to focus on awardees receiving between \$2 million and \$15 million in NSF funds. This focus does not take the additional steps needed to oversee the NSF awards to recipients who fall below the new threshold.

Transparency and oversight of NSF funds passed through to sub-recipients poses a challenge to NSF's grant administration. NSF's large facility construction awards include significant amounts of funding that goes to sub-recipients. It is NSF's responsibility to make sure that prime recipients are properly overseeing sub-recipients. Recent audits have shown that NSF lacks the necessary information and visibility over sub-recipients to ensure that they are following federal requirements. Additionally, OIG audits found that some sub-recipients have provided incomplete information in their incurred cost submissions. These submissions are intended to ensure that the costs charged the government are fair and allowable, providing needed visibility over how money is spent. NSF is challenged to require its awardees to provide sufficient cost information to demonstrate that sub-recipients' costs are allowable, as well as fair and reasonable. Without this information, NSF risks over paying or paying costs that are not allowed by federal requirements.

**OIG's Assessment of the Agency's Progress:** NSF continued to take actions this past year to strengthen grant administration. As previously noted, the agency's revised *Proposal & Award Policies & Procedures Guide*, implementing the UGG, became effective in December 2014. In October 2016, OIG will transfer responsibility for identifying single audit findings that require NSF resolution to NSF. NSF reported that it had implemented statistically based baseline award monitoring of financial transactions to uncover anomalies and inaccurate payments. Finally, NSF continues to use its Award Monitoring and Business Assistance Program (AMBAP), which includes baseline and advanced monitoring activities, to ensure awardee compliance with the revised guidance. During advanced monitoring, NSF assesses the internal controls of its awardees to ensure adequate administration of the NSF awards. During FY 2016, NSF planned and completed 28 Advanced Monitoring Site Visit reviews and 64 desk reviews.

### **Challenge: Encouraging the Ethical Conduct of Research**

**Overview:** Congress passed the America COMPETES Act in 2007 to increase innovation through research and development, and to improve the competitiveness of the United States in the world economy. NSF responded to the Act by mandating mentoring plans for all postdoctoral positions and directing that grantees provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduate and graduate students, and postdoctoral researchers participating in the proposed research project.

NSF requires that institutions submitting a proposal to certify that they provide RCR training and oversight. However, information collected during investigations, site visits, and reviews of institutional Responsible Conduct of Research (RCR) plans suggests that some institutions have not adopted an effective approach to RCR training. Furthermore, some research suggests that many of the ethics training programs currently available do little to change the perspectives of students and postdocs regarding the ethical conduct of research. As more stories about research misconduct circulate in the media, the public's confidence in the research community as a whole is weakened and taxpayer support of science is undermined. NSF is therefore challenged to provide more oversight to institutional implementation of these requirements and to provide meaningful guidance regarding RCR training.

**Challenge for the agency:** NSF's primary challenge is to ensure that awardees implement effective RCR programs. At a time when opinion surveys indicate more Americans are becoming distrustful of science, it is important that key science agencies such as NSF do all it can to promote a more ethical culture within the research community, and thereby minimize instances of misrepresentation or cheating. Surveys also suggest that cheating is endemic at various levels of education, with 30% of researchers admitting to engaging in questionable research practices or knowing someone who has engaged in such practices.

The significant number of substantiated allegations of research misconduct investigated by OIG continues unabated. Particularly concerning is the increase in allegations of data fabrication/falsification by students/post-docs. From 2004-2010 our office received 21 such allegations; from 2011-present we received 49 such allegations, an increase of over 100%. In addition, OIG has seen a substantial increase of allegations related to violations of NSF peer review confidentiality, false representations in CVs, false representations of publications in

annual/final reports, false or incomplete listing of all affiliations and current support (especially at overseas institutions), and fraudulent or otherwise improper use of grant funds. The number and variety of ethical issues identified in our investigative activities suggest that institutions have not sufficiently emphasized research integrity as a core value – not only at the student level, but at the faculty level as well.

The NSF Act places responsibility on NSF to strengthen scientific and engineering research potential. NSF funds research in virtually every non-medical research discipline and reaches a vast range of educational levels, kindergarten through post-PhD. The agency is therefore in a unique position to lead the government response to these disturbing trends in the responsible conduct of research and foster positive change at all levels of education. NSF's research and training programs reach individuals who are ultimately employed throughout the research community – in academia, industry, and government.

Effective RCR training of the science, engineering, and education workforce will pay substantial dividends. Early educational intervention remains critical to any effort to ensure that future scientists understand proper professional practices and the implications of failing to follow them. While NSF has been responsive to our recommendations contained in individual research misconduct investigation reports, such corrective actions only address incidents after the fact. Broader proactive measures are needed.

**OIG's Assessment of the Agency's Progress:** The agency responded to the America COMPETES Act by requiring that grantees provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduate and graduate students, and postdoctoral researchers who are financially supported by proposed NSF-funded research projects. However, in contrast to the RCR requirements adopted by NIH in 2010, those implemented by NSF do not have specific course requirements. Nor do they provide guidance about the content, structure, or format of the courses.

Other initiatives the agency has undertaken include the development of a new ethics research program called Cultivating Cultures for Ethical Science Technology Engineering Mathematics (CCE STEM). The CCE STEM research effort is focused on identification of factors that create cultures that foster and encourage research integrity, rather than on curriculum development on integrity issues. In February of 2016, NSF upgraded its Online Ethics Center to provide resources to institutions and researchers aimed at helping them navigate ethical issues. The Agency also worked with the National Academies to develop and make available ethics materials that will be applicable across all scientific fields that NSF supports.

OIG is completing a review of institutional responses to NSF's implementation of the America COMPETES Act.