Chapter 3

Appendices (Other Information)

SUMMARY OF FY 2021 FINANCIAL STATEMENT AUDIT AND MANAGEMENT ASSURANCES

Table 3.1 – Summary of Financial Statement Audit

Effectiveness of Internal Control over Financial Reporting (FMFIA § 2)					
Audit Opinion	*Unmodified*				
Restatement	*No*				
Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Ending Balance
Total Material Weaknesses	*0*	-	-	-	*0*

Table 3.2 – Summary of Management Assurances

Effectiveness of Internal Control over Financial Reporting (FMFIA § 2)						
Statement of Assurance	*Unmodified*					
Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
Total Material Weaknesses	*0*	-	-	-	-	*0*
Effectiveness of Internal Control over Operations (FMFIA § 2)						
Statement of Assurance	*Unmodified*					
Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
Total Material Weaknesses	*0*	-	-	-	-	*0*
Conformance with Federal Financial Management System Requirements (FMFIA § 4)						
Statement of Assurance	*Systems conform to financial management system requirements*					
Non-Conformances	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
Total non-conformances	*0*	-	-	-	-	*0*
Compliance with Section 803(a) of the Federal Financial Management Improvement Act (FFMIA)						
	Agency		Auditor			
Federal Financial Management System Requirements	*No lack of compliance noted*					
Applicable Federal Accounting Standards	*No lack of compliance noted*					
USSGL at Transaction Level	*No lack of compliance noted*					

Management Challenges for the National Science Foundation in Fiscal Year 2022

NATIONAL SCIENCE FOUNDATION
OFFICE OF INSPECTOR GENERAL

October 13, 2021

AT A GLANCE

Management Challenges for the National Science Foundation in Fiscal Year 2022

October 13, 2021

WHY WE DID THIS REPORT

The *Reports Consolidation Act of 2000* (Pub. L. No. 106-531) requires us to annually update our assessment of NSF's "most serious management and performance challenges facing the agency … and the agency's progress in addressing those challenges."

WHAT WE FOUND

NSF leads the world as an innovative agency dedicated to advancing science. Its support of basic research has led to many discoveries that have contributed to the progress of science, as well as the national health, prosperity, and welfare. Beyond its scientific mission, NSF must be a responsible steward of taxpayer dollars.

This year, we have identified eight areas representing challenges NSF must continue to address to enhance mission performance:

- Increasing Diversity in Science & Engineering Education and Employment
- Overseeing the United States Antarctic Program (USAP)
- Overseeing Grants in a Changing Environment
- Managing the Intergovernmental Personnel Act Program
- Overseeing Major Multi-User Research Facilities
- Mitigating Threats Posed by Foreign Government Talent Recruitment Programs
- Mitigating Threats Posed by the Risk of Cyberattacks
- Managing Transformational Change

When appropriate, we have included information about challenges NSF faces in addressing the public health and economic crises resulting from the Coronavirus Disease 2019 (COVID-19) pandemic within each challenge section.

We are encouraged by NSF's progress in its efforts to address critical management and performance challenges. Effective responses to these challenges will promote the integrity of NSF-funded projects, help ensure research funds are spent effectively and efficiently, and help maintain the highest level of accountability over taxpayer dollars.

AGENCY RESPONSE TO *MANAGEMENT CHALLENGES FOR FISCAL YEAR 2021*

Following the issuance of this report, NSF will include its Management Challenges Progress Report and its response to *Management Challenges for the National Science Foundation in Fiscal Year 2021* in its Agency Financial Report.

FOR FURTHER INFORMATION, CONTACT US AT OIGPUBLICAFFAIRS@NSF.GOV.

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

MEMORANDUM

DATE: October 13, 2021

TO: Dr. Ellen Ochoa
Chair
National Science Board

Dr. Sethuraman Panchanathan
Director
National Science Foundation

FROM: Allison C. Lerner Allison C. Lerner
Inspector General
National Science Foundation

SUBJECT: Management Challenges for the National Science Foundation in Fiscal Year 2022

Attached for your information is our report, *Management Challenges for the National Science Foundation in Fiscal Year 2022*. The *Reports Consolidation Act of 2000* (Pub. L. No. 106-531) requires us to annually update our assessment of NSF's "most serious management and performance challenges facing the agency … and the agency's progress in addressing those challenges." 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

Table of Contents

Introduction

NSF leads the world as an innovative agency dedicated to advancing science. Its support of basic research has led to many discoveries that have contributed to the progress of science, as well as the national health, prosperity, and welfare. Beyond its scientific mission, NSF must be a responsible steward of taxpayer dollars.

The *Reports Consolidation Act of 2000* requires us to annually update our assessment of NSF's "most serious management and performance challenges facing the agency … and the agency's progress in addressing those challenges" (Pub. L. No. 106-531). Accordingly, we identify the challenges we consider most critical based on our audit and investigative work; general knowledge of the Foundation's operations; and reports of others, including the U.S. Government Accountability Office (GAO) and NSF's various advisory committees, contractors, and staff. We identify management challenges as those that meet at least one of the following criteria:

- The issue involves an operation that is critical to an NSF core mission.[1]
- There is a risk of fraud, waste, or abuse of NSF or other government assets.
- The issue involves strategic alliances with other agencies, the Office of Management and Budget (OMB), the Administration, Congress, or the public.
- The issue is related to key initiatives of the President.
- The issue involves a legal or regulatory requirement not being met.

This year, we have identified eight areas representing the most serious management and performance challenges facing NSF:

- Increasing Diversity in Science & Engineering Education and Employment
- Overseeing the United States Antarctic Program (USAP)
- Overseeing Grants in a Changing Environment
- Managing the Intergovernmental Personnel Act Program
- Overseeing Major Multi-User Research Facilities
- Mitigating Threats Posed by Foreign Government Talent Recruitment Programs
- Mitigating Threats Posed by the Risk of Cyberattacks
- Managing Transformational Change

We describe our work and NSF's progress in addressing these eight critical challenges areas in more detail in the following pages.

This year, we have recast some prior challenges and added two new challenge areas. First, we broadened our previous challenge focused on overseeing the Antarctic Infrastructure Modernization for Science (AIMS) Project to include other areas of potential concern within USAP. In our continuing oversight, we have found that NSF has a robust plan to address AIMS construction delays. Although we will continue to be vigilant in our oversight of AIMS, broadening the challenge allows us to highlight other areas that could impact overall USAP operation; in addition, the expansion of this challenge will give new Office of Polar Programs leadership a fuller picture of the challenges the program may face. Second, we also expanded last year's challenge focused on overseeing grants during a pandemic to reflect the continuing changes to the research environment, including the potential for increased funding for traditionally smaller and mid-size institutions that may need to strengthen their grant management controls.

[1] The *National Science Foundation Act of 1950* (Pub. L. No. 81-507) sets forth the mission: "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes."

Introduction

Finally, we are introducing two new challenge areas: Mitigating Threats Posed by the Risk of Cyberattacks and Managing Transformational Change. We added the first challenge because, although recent audits have found NSF has an effective information security program under current standards, there is significant risk to federal systems and data, demonstrated by recent attacks on commercial software programs used by federal agencies in 2021. We introduced the second challenge because NSF would grow significantly if pending legislation were to become law, which would demand NSF effectively manage substantial changes in staffing, grant management approaches, and internal processes.

NSF has demonstrated its ability to achieve its mission in an ever-changing environment. As the agency moves into FY 2022 and beyond, it is well positioned to address both familiar and new challenges it may face with acuity, agility, and adaptability.

CHALLENGE 1 Increasing Diversity in Science & Engineering Education and Employment

Why is this a serious management challenge? This challenge involves an operation that is critical to an NSF core mission.

NSF's April 2021 *Women, Minorities, and Persons with Disabilities* report stated:

> Women, persons with disabilities, and some minority groups—Blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives—are underrepresented in science and engineering (S&E). That is, their representation in S&E education and S&E employment is smaller than their representation in the U.S. population.

These conclusions echoed those in the NSB's *Vision 2030*, which stated that to lead globally in S&E and to remain competitive, by 2030 the number of women in the S&E workforce must nearly double, the number of Black or African Americans must more than double, and the number of Hispanics or Latinos must triple compared to the respective numbers in the 2020 S&E workforce. To address this challenge, NSF created the Racial Equity Task Force in September 2020 to focus on the missing millions in STEM. Subsequently, the President issued multiple EOs on diversity, equity, inclusion, and accessibility (DEIA). The EOs' requirements, summarized in Appendix A, include actions to advance these goals both internally — such as providing agency-specific plans to advance DEIA — and more broadly — such as advancing racial equity and support for underserved communities, and preventing and combatting discrimination.

In some instances, NSF had already addressed the EOs' requirements. In other instances, the EOs were broader, requiring NSF to take additional steps. In response to EO 13985, NSF created an Equity Team of 14 leaders from across the agency, has submitted three progress reports, and is required to submit i

Further, NSF maintains a comprehensive portfolio to increase diversity in S&E, including the NSF INCLUDES program, which focuses on scaling up proven approaches to broadening participation, and NSF's Build and Broaden 2.0 program, which encourages research collaborations between scholars at minority-serving institutions and scholars in other institutions. In addition, broadening participation is part of the Broader Impacts criteria in merit review. NSF leadership recognizes the importance of this challenge and recently identified this issue as an "exceedingly important priority." In FY 2022, we will continue to monitor NSF's efforts to develop strategies and programs to increase diversity in S&E education and employment and to measure their effectiveness. We will also monitor its actions to alleviate the disproportionate impact of the COVID-19 pandemic on the careers of scientists and trainees from underrepresented groups.

Completed Actions

- ☑ Prepared *Women, Minorities, and Persons with Disabilities* report.
- ☑ Prepared *The STEM Labor Force of Today: Scientists, Engineers, and Skilled Technical Workers*.
- ☑ Responded to multiple requirements in 2021 EOs.
- ☑ Funded rapid response grants on the effects of COVID-19 on underrepresented groups.
- ☑ Created four Employee Resource Groups to advise NSF on achieving equity.

Ongoing Actions

- Including accessibility and inclusivity in Strategic Plan.
- Continuing to respond to requirements in 2021 EOs.
- Continuing to strengthen the broadening participation element of the Broader Impacts merit review criteria.
- Continuing NSF INCLUDES, Build and Broaden 2.0, and comparable activities impacting S&E education and employment in the broadening participation portfolio.
- Continuing to share *Indicators*, a quantitative summary of the S&E enterprise's scope, quality, and vitality over time and within a global context.

CHALLENGE 2 Overseeing the United States Antarctic Program (USAP)

Why is this a serious management challenge?

This challenge involves an operation that is critical to an NSF core mission. There is also risk of fraud, waste, or abuse of NSF or other government assets.

NSF, through the United States Antarctic Program (USAP), manages U.S. scientific research in Antarctica. Leidos Innovations Corporation (Leidos) currently holds the Antarctic Support Contract (ASC) for USAP logistical support. It is NSF's largest and most visible contract, valued at $2.3 billion over 13 years. Through this and other contracting vehicles, NSF is also implementing a long-range infrastructure investment program across the three U.S. Antarctic stations (McMurdo, Palmer, and South Pole).The Office of Polar Programs (OPP) monitors the contract, with several other NSF offices and divisions collaborating to manage the USAP, including the Division of Acquisition and Cooperative Support (DACS), the Large Facilities Office, the Office of Budget, Finance and Award Management, the Division of Information Systems, the Division of Administrative Services, and the Division of Human Resources Management (HRM).

The advent of COVID-19 in 2020 added unprecedented complexity and uncertainty to USAP operations. For example, deployments in the 2020–2021 and 2021–2022 seasons have been limited to only those necessary for health and safety or to preserve long-term data sets. In addition, construction at McMurdo under the Antarctic Infrastructure Modernization for Science (AIMS) project and the Information Technology and Communications (IT&C) primary addition was put on hold, and both projects will need rebaselining. OPP is working closely with DACS to implement a new approach that will use NSF's Antarctic Infrastructure Recapitalization program to address the unfunded phases of AIMS.

Additionally, recent information security audit findings[2] have identified challenges in USAP's implementation of authentication and incident response requirements. These findings, first identified in FY 2019, demonstrate the extended time needed to fully enact security measures for the USAP network consistent with those of NSF. This audit work also revealed concerns relating to the onboarding and vetting process for ASC contractors. Namely, NSF relies on the contractor's internal pre-employment screening procedures for most ASC employees; thus, NSF does not directly adjudicate most ASC personnel who conduct work for or on behalf of USAP for suitability. OPP is working with various NSF offices to identify and implement the appropriate approach for personnel screening and to issue contract modifications and procure solutions as necessary. However, because of these ongoing issues, USAP remains at an increased risk of negative impacts to personnel, systems, and data.

Completed Actions

- ☑ Collaborated with DACS to restructure AIMS' latter phases into stand-alone projects that will be evaluated in accordance with other infrastructure priorities.
- ☑ Developed a Project Execution Plan (PEP) to implement Personal Identification Verification (PIV) for access to USAP applications.
- ☑ Initiated acquisition for Managed Security Service Provider.
- ☑ Identified all positions on the ASC contract with elevated access to data or systems and began implementing NSF personnel security screenings on those individuals.

Ongoing Actions

- Assessing COVID-19 impacts and evaluating options to minimize any negative impacts to USAP operations and construction.
- Implementing PIV for access to USAP applications.
- Implementing Security Information and Event Monitoring tools for the USAP network to automatically detect malicious network events.
- Implementing Trusted Internet Connection for the USAP network.

[2] FISMA *Audit of NSF's Information Security Program for FY 2020*, November 20, 2020

CHALLENGE 3 Overseeing Grants in a Changing Environment

Why is this a serious management challenge?

This challenge involves an operation that is critical to an NSF core mission. There is also risk of fraud, waste, or abuse of NSF or other government assets.

Making grants to support promising scientific research is NSF's primary business and a key element of its mission. The COVID-19 pandemic continues to add complexity to grant management and oversight due to the need to expend additional federal funds to address its impacts and because of the health, economic, and societal impacts on NSF's recipient population. Despite these challenges, NSF and the research community continued conducting the work that creates opportunities, spurs innovation, and improves quality of life for individuals, families, and communities across the nation. In 2020, NSF developed a Coronavirus Aid, Relief, and Economic Security (CARES) Act Spending Plan, which used existing funding mechanisms with established policies, procedures, and controls to disperse the supplemental funds, reduce the risk of misuse, and help ensure accountability. In 2021, NSF developed a similar approach for the supplemental funds provided under the *American Rescue Plan Act* (ARP).

Even with NSF's efforts to address the impacts of the pandemic, institutions continue to confront mounting fiscal constraints, related in part to lower-than-anticipated tuition revenue and declining support from state governments, endowments, or other funding sources. If those factors lead to staff cuts in sponsored research offices or offices responsible for identifying and managing scientists' conflicts of interest and commitment, recipients' ability to ensure compliance with NSF award terms and conditions and proper stewardship over NSF funds could be undermined. Additionally, NSF is devoting significantly more resources to growing the STEM workforce and increasing the proportion of underrepresented groups within STEM fields. This effort will create new risks by increasing the number of awards to both smaller institutions, which traditionally have less robust grant management environments, and mid-sized institutions, which will have to strengthen their grant management controls to account for more funding. Further, the risk of inappropriate foreign influence, which we further address later in this report, continues to be a challenge.

NSF has begun planning how to address some of these risks. However, the ever-changing grant management environment increases the risk that recipients will misuse funds, and, as a result, increases the need for NSF to develop an even stronger control environment. The combination of these risks will require a concerted outreach effort from NSF to broaden the recipient community's understanding of grant management guidance and expectations and to monitor the varying ways in which the community responds to those risks.

Completed Actions

- ☑ Conducted targeted Enterprise Risk Management Science Directorate workshops.
- ☑ Conducted risk and control checkpoints, walkthroughs, and tests of design and operating effectiveness to validate existing grants monitoring/oversight controls.
- ☑ Conducted baseline monitoring; used data analytics to better identify potential risk areas/improve monitoring.
- ☑ Established controls for CARES Act and ARP funds.
- ☑ Created task force to evaluate the pandemic's impact.
- ☑ Developed NSF Coronavirus Information webpage to share guidance with recipient community.

Ongoing NSF Actions

- ➢ Continuing development of the Awardee Internal Control/Financial Solvency Dashboard.
- ➢ Continuing advanced monitoring site visits and desk reviews.
- ➢ Continuing development of an Enterprise Project Report Scorecard.

CHALLENGE 4 Managing the Intergovernmental Personnel Act Program

Why is this a serious management challenge? This challenge involves an operation that is critical to an NSF core mission.

As part of its workforce strategy, NSF provides scientists, engineers, and educators the opportunity to temporarily serve as NSF program directors, advisors, and senior leaders. Most non-permanent staff members are individuals assigned under the *Intergovernmental Personnel Act* (IPA, Pub. L. No. 91-648), who are not federal employees but are paid through grants and remain employees of their home institutions. These individuals — referred to as IPAs or rotators — bring in fresh perspectives from all fields of science and engineering to support NSF's mission. However, IPAs can have a heightened risk of conflicts of interest while working at NSF because most come from institutions receiving NSF grants. Also, because they only serve up to 4 years, there is frequent staff turnover at NSF. In addition, IPAs can spend up to 50 days each year on Independent Research/Development (IR/D), and their salaries are not subject to federal pay and benefits limits.

Over the past several years, NSF has taken steps to address these risks. After a successful pilot period, NSF implemented a cost share policy, effective January 31, 2020, requiring that institutions provide a minimum of 10 percent cost share for every full-time IPA agreement. Total cost share increased by more than $1 million between FY 2019 and FY 2020, with the percent of assignments that cost share near 90 percent.[3] Additionally, NSF facilitated a focus group for IPAs who onboarded during the pandemic to help identify unique challenges associated with onboarding in a remote-work environment. NSF has also continued to strengthen its policies around the IR/D program, potential conflicts of interest, and managing turnover.

However, ongoing audit work indicates that challenges remain with overseeing the IPA program. Increased coordination across the varying offices involved in the vetting and hiring process would further reduce the risks inherent to the IPA program and strengthen the control environment. This includes reducing the risk of hiring individuals who are ineligible to serve as IPAs, verifying IPA salary and employment history prior to appointment, complying with financial disclosure requirements, and adjudicating suitability and fitness determinations in a timely manner.

Completed Actions

- ☑ Migrated Program Director and Executive IPAs to the USA Performance system for managing performance plans.
- ☑ Submitted the IPA Program Annual Report covering the prior fiscal year to NSF Director.
- ☑ Submitted to Congress annual responses to the AICA (P.L. 114-329 Section 111 on Personnel Oversight) on the Justifications for Rotator Pay Exceeding the SES Pay Max.
- ☑ Engaged in IPA Program Enterprise Risk Management to clearly identify IPA Program objectives and associated risks.

Ongoing Actions

- Continuing to submit IR/D Annual Report, including data on program participation, average days and dollars requested and used, and training.
- Continuing to train IR/D experts annually, including on updates to the IR/D Guide and online IR/D plan.
- Continuing to monitor turnover risk for IPAs.
- Continuing to use existing onboarding, training, knowledge transfer, and performance management systems to minimize impact of staff turnover.
- Continuing to integrate activities in response to GAO-18-533 into NSF's human capital goal of "Adapting the Workforce to the Work."

[3] Strongly justified requests to waive cost share requirements may be considered.

CHALLENGE 5 Overseeing Major Multi-User Research Facilities

Why is this a serious management challenge?

This challenge involves an operation that is critical to an NSF core mission. There is also risk of fraud, waste, or abuse of NSF or other government assets.

As part of its mission, NSF funds the scientific community to manage the development, design, construction, operation, and divestment of major multi-user research facilities (major facilities), which are state-of-the art infrastructure for research and education that include telescopes, ships, distributed networks, and observatories. NSF's major facility portfolio is inherently risky because the facilities are technically complex, and their construction and operating costs are high. In FY 2020, NSF spent almost $154 million constructing major facilities and more than $900 million operating them.

Major facilities have always faced risks including protecting the safety of personnel and property, construction delays, and unanticipated additional costs. We previously reported about the risk of inadvertent misuse of funds when re-budgeting and improper use of contingency funds. The COVID-19 pandemic presented additional, unique challenges for major facilities. Following the flexibilities granted by OMB in response to the pandemic, NSF took action to address these risks by developing internal and external guidance for major facility programs and recipients. NSF will need to continue its work to identify current risk areas, implement mitigation strategies, and assess any remaining financial impacts as the pandemic continues in the United States and abroad.

Since 2015, NSF has implemented enhanced controls and strengthened agency governance to fully address our recommendations, the recommendations of the 2015 National Academy of Public Administration report; the requirements of the *American Innovation and Competitiveness Act of 2017* (AICA); and FY 2018 and FY 2019 GAO reports. NSF's major facilities program has continued to evolve and improve each year, cementing its place as a model program. Its work to identify risk areas, develop mitigation strategies, and assess financial impacts of COVID-19 will help position it to best address this challenge.

Completed Actions

- ☑ Revised Major Facilities Cooperative Agreement Modified & Supplemental Terms and Conditions to require participation in NSF's Knowledge Management Program.
- ☑ Re-programmed funds appropriated in FY 2020 to the Major Research Equipment and Facilities Construction account, from AIMS to Rubin Observatory and the Daniel K. Inouye Solar Telescope, for use as management reserve to cover documented, COVID-19- related costs.
- ☑ Completed major facilities portfolio workforce gap analysis per *Program Management Improvement Accountability Act* (PMIAA) requirements.
- ☑ Conducted a vehicle allocation methodology and updated optimal fleet profile.

Ongoing Actions

- ➢ Finalizing the Major Facilities Oversight Reviews standard operating guidance.
- ➢ Continuing to develop and implement training plan for the major facilities oversight workforce as part of PMIAA implementation.
- ➢ Evaluating all active major facility awards to identify federally owned property and develop property transition plans as necessary.

CHALLENGE 6 Mitigating Threats Posed by Foreign Government Talent Recruitment Programs

Why is this a serious management challenge?

The issue is related to key initiatives of the President. There is also risk of fraud, waste, or abuse of NSF or other government assets.

Safeguarding the U.S. research enterprise from threats of inappropriate foreign influence is of critical importance. Recent reports by GAO and others have noted challenges faced by the research community to combat undue foreign influence, while maintaining an open research environment that fosters collaboration, transparency, and the free exchange of ideas.

NSF, and other agencies that fund research, continue to face challenges from foreign talent recruitment programs. According to the Office of Science and Technology Policy, a foreign government sponsored talent program is an effort directly or indirectly organized, managed, or funded by a foreign government to recruit science and technology professionals in targeted fields. Some countries sponsor such programs for legitimate purposes. However, some programs encourage or direct unethical and criminal behaviors. Contracts for participation in some programs include language that creates conflicts of commitment and/or conflicts of interest for researchers, such as requirements to attribute U.S.-funded work to a foreign institution; recruit or train other talent recruitment plan members, circumventing merit-based processes; and replicate or transfer U.S.-funded work in another country.

Over the past 3 years, NSF has taken action to mitigate threats posed by such programs. In particular, it strengthened disclosure requirements and processes and released guidelines for strengthening research security. It also created research security strategy positions, expanded research security training, and educated the research community. NSF should continue to assess and refine its controls in this area and should work to ensure that it has sufficient staff and resources to address this challenge.

Completed Actions

- ☑ Released guidelines for strengthening research security.
- ☑ Implemented independent report's recommendations.
- ☑ Created and filled Chief of Research Security Strategy and Policy and Chief Data Officer positions.
- ☑ Launched Research Security Strategy and Policy Group.
- ☑ Expanded research security training for staff in direct communication with recipient organizations.
- ☑ Educated research community about risks and compliance with NSF's policies and procedures.
- ☑ Strengthened disclosure requirements and processes, including implementing two new vehicles for submitting post-award information.
- ☑ Revised term and condition for foreign collaboration considerations in major facilities.
- ☑ Increased collaboration with our office and the FBI.
- ☑ Used Enterprise Risk Management framework.

Ongoing Actions

- ➢ Developing policy across the enterprise.
- ➢ Pursuing a Systems of Record Notice to use data analytics tool.
- ➢ Revising terms and conditions to require Principal Investigator certifications
- ➢ Coordinating with the FBI to prepare a compendium of anonymized research security actions available to inform stakeholders.
- ➢ Continuing outreach and education.

CHALLENGE 7 Mitigating Threats Posed by the Risk of Cyberattacks

Why is this a serious management challenge? The issue is related to key initiatives of the President.

The prevention, detection, assessment, and remediation of cybersecurity incidents is a top priority of the Administration and essential to national and economic security. The recent SolarWinds and Microsoft Exchange incidents demonstrate the significant risk to federal information. In both incidents, foreign governments exploited vulnerabilities in commercial software programs that are used by federal agencies, and gained privileged access to federal systems, allowing them to extract data and personally identifiable information (PII). Additionally, the recent Colonial Pipeline ransomware attack is one example of an issue on the GAO high-risk list that illustrates the pressing need to strengthen federal cybersecurity and IT management. Although these incidents did not directly affect NSF or USAP networks, they highlight the need for increasingly effective measures to ensure the availability, integrity, and confidentiality of data used to achieve NSF's mission.

EO 14028[4] directs agencies to focus on meeting key baseline security measures, including universal logging, multi-factor authentication, reliable asset inventories, and ubiquitous use of encryption, and to adopt a zero-trust architecture. Zero-trust assumes there is no implicit trust granted to assets or user accounts based solely on their physical or network location (i.e., local area networks versus the internet) or based on asset ownership (enterprise or personally owned). It assumes that networks and other components will be compromised and requires authentication and authorization as separate functions before a connection to an enterprise resource is established. Zero-trust protects against both external and internal threat factors. The Department of Homeland Security Cybersecurity Infrastructure Security Agency has established a zero-trust maturity model that focuses on five pillars: Identity, Device, Network/Environment, Application Workload, and Data. The maturity of all five pillars must be optimized to fully protect federal systems and data.

Our FISMA[5] audits have found that NSF has an effective information security program under current standards. NSF, however, could enhance its cybersecurity by implementing zero-trust measures such as: multi-factor authentication for access to all networks; a phishing-resistant authentication option for NSF's public-facing website and systems; encryption and authentication of all traffic within the NSF.gov and USAP.gov environments; regular third-party identification and evaluation of vulnerabilities; automated patch management and software update tools; advanced tools that address zero-day threats; and segmenting networks around their applications.

Completed Actions

- ☑ Requires multi-factor authentication for access to NSF internal network and applications.
- ☑ Encrypted all NSF data at rest and in-transit.
- ☑ Regularly conducts internal vulnerability assessments of the NSF and USAP networks.
- ☑ Strengthened controls over access to sensitive PII, including Social Security Numbers.
- ☑ Improved Endpoint Detection and Response capabilities.

Ongoing Actions

- ➢ Identifying critical software used by NSF.
- ➢ Ensuring storage and retention of logging data complies with requirements.
- ➢ Conducting additional supply chain risk management authenticity/anti-counterfeit training.

[4] *Improving the Nation's Cybersecurity*, May 12, 2021
[5] *Federal Information System Modernization Act of 2014*, Pub. L. No. 113-283

CHALLENGE 8 Managing Transformational Change

Why is this a serious management challenge?

This challenge involves an operation that is critical to an NSF core mission. There is also a risk of fraud, waste, or abuse of NSF or other government assets.

NSF may be facing rapid and transformational change. The *U.S. Innovation and Competition Act*, passed by the Senate on June 8, 2021, and the *NSF for the Future Act*, passed by the House of Representatives on June 28, 2021, both support significant growth for the agency. If pending legislation — which is also consistent with the Administration's outlined vision — were to become law, it would demand NSF manage increased funding, the establishment of a new directorate, and several other significant programmatic changes.

Effectively managing growth is critical to both NSF's near and long-term success. NSF will need to sustain existing programs while developing and implementing new programs. This growth is likely to happen in an environment where existing staff are working at maximum capacity; the nation is facing a labor shortage; and a key onboarding mechanism, the *Intergovernmental Personnel Act*, has a need for more robust controls.

In addition, NSF plans to transition to a hybrid work model upon reopening its physical office environment. In response to the COVID-19 pandemic, NSF shifted its workforce to a fully virtual environment in March 2020. After more than a year, NSF has shown it can achieve its mission while staff work remotely. Staff have also expressed interest in teleworking more permanently, with 89 percent of respondents to NSF's November 2020 Remote Work Survey supporting a hybrid workforce model. Although remote work and flexible hours are proven tools for retaining and recruiting staff, increased telework comes with challenges. NSF staff have also reported experiencing virtual meeting and email fatigue, feelings of isolation due to the physical separation, and the need for help in ensuring work-life balance. As NSF develops and implements its new remote work policy, it will need to address challenges with adapting its cyberinfrastructure, managing a remote workforce, and maintaining its current culture long term.

Finally, as previously discussed, as NSF takes further steps to increase diversity and inclusivity in S&E, it must continue to strengthen its own commitment to those values. Ensuring NSF continues to provide resources and opportunities to strengthen and advance diversity, equity, inclusion, and accessibility is paramount as NSF faces possible large-scale growth and the transition to a hybrid workforce model.

Completed Actions

- ☑ Implemented robust telework capabilities.
- ☑ Provided virtual access to the Employee Assistance Program.
- ☑ Obtained employee feedback related to remote work via an organization-wide survey.
- ☑ Established the NSF Racial Equity Task Force.
- ☑ Established a Remote Work Tiger Team to inform policy creation and implementation.
- ☑ Established the Agency Equity Team to lead NSF's Equity Assessment and to address the goals of EO 13985.

Ongoing Actions

- ➢ Developing a draft remote work policy.
- ➢ Conducting a Diversity, Equity, Inclusion, and Accessibility Assessment.

Appendix A 2021 Executive Orders on Diversity, Equity, Inclusion, and Accessibility

EO	Date	Title	Requirements
13985	Jan. 2021	Advancing Racial Equity and Support for Underserved Communities Through the Federal Government	Identify methods to assess equity and to further opportunities for underrepresented groups.
13988	Jan. 2021	Preventing and Combating Discrimination on the Basis of Gender Identity or Sexual Orientation	Ensure equal treatment under the law irrespective of gender identity or sexual orientation.
14020	March 2021	Establishment of the White House Gender Policy Council	Submit input to the Government-wide Gender Strategy; when final, will be sent to the President.
14035	June 2021	Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce	

Source: NSF OIG-generated from whitehouse.gov

Appendix B Additional Resources

Please visit https://www.oig.nsf.gov for additional reports and publications.

Introduction/All Challenges

- NSF OIG, Management Challenges for the National Science Foundation in FY 2021, October 2020
- NSF, FY 2020 Agency Financial Report, November 2020

Increasing Diversity in Science & Engineering Education and Employment

- Bates, Jason, Researchers apply COVID-19 lessons to prevent future pandemics, Science Matters, May 2021
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- GAO, Colonial Pipeline Cyberattack Highlights Need for Better Federal and Private-Sector Preparedness, May 2021
- Executive Order 14028, Improving the Nation's Cybersecurity, May 2021
- GAO, SolarWinds Cyberattack Demands Significant Federal and Private-Sector Response, April 2021

Managing Transformational Change

- S.1260 - United States Innovation and Competition Act of 2021
- H.R. 2225 - National Science Foundation for the Future Act

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We promote effectiveness, efficiency, and economy in administering the Foundation's programs; detect and prevent fraud, waste, and abuse within NSF or by individuals who receive NSF funding; and investigate allegations of research misconduct. NSF OIG was established in 1989, in compliance with the *Inspector General Act of 1978*, as amended. Because the Inspector General reports directly to the National Science Board and Congress, the Office is organizationally independent from the National Science Foundation.

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National Science Foundation
Office of the Director

October 18, 2021

MEMORANDUM

TO: Ms. Allison C. Lerner
Inspector General, National Science Foundation

FROM: Dr. Sethuraman Panchanathan
Director, National Science Foundation

SUBJECT: Acknowledgment of the Inspector General's Fiscal Year (FY) 2022 Management Challenges Report and Transmittal of NSF's Progress Report for the FY 2021 Management Challenges

As Director of the National Science Foundation (NSF), I recognize the importance of acknowledging, understanding, and mitigating risk to the execution of our mission, while ensuring proper stewardship of taxpayer dollars. The Office of Inspector General's (OIG) yearly Management Challenges, which are required by statute, are an important part of NSF's risk management processes. To that end, this memorandum provides you with NSF's Progress Report for the OIG Management Challenges for FY 2021 and acknowledges my receipt of the OIG's Management Challenges for NSF for FY 2022, dated October 13, 2021. Below are several considerations as you review our Progress Report and the new challenges.

Over the past year and a half, NSF has demonstrated that our established risk management processes well-position the agency to address both ongoing and unforeseeable risks. Throughout the COVID-19 pandemic, NSF has steadfastly maintained its advanced monitoring and oversight of awards through virtual site visits, desk reviews, targeted assessments, audit resolution, and new analytic approaches. Our annual testing of grant award expenditures for the April 2020 through March 2021 period found a low risk level for improper payments, similar to prior year test results.

We appreciate OIG's recognition of our progress addressing challenges identified with managing the Intergovernmental Personnel Act (IPA) Program and our major multi-user research facilities, and agree with the characterization of the latter as a "model program." We will continue our strong performance in oversight and management of these areas as we expand to focus on the two new challenges identified for FY 2022 related to cybersecurity and change management. Although OIG has previously found NSF's information security program to be effective, we recognize that we operate within a broader environment of increased cyber threats to federal agencies. NSF is committed to protecting the data and systems critical to the agency's mission. Similarly, we stand ready to lead the organization through anticipated

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changes in the coming years by leveraging and expanding our existing controls and enterprise risk management framework to new programs and new ways of conducting our work.

Going forward, I will engage the Chief Operating Officer, Assistant Directors and Office Heads, and the Chief Financial Officer to identify owners and paths forward for each of the eight management challenges identified for FY 2022, as noted below:

- Increasing Diversity in Science & Engineering Education and Employment
- Overseeing the United States Antarctic Program (USAP)
- Overseeing Grants in a Changing Environment
- Managing the Intergovernmental Personnel Act Program
- Overseeing Major Multi-User Research Facilities
- Mitigating Threats Posed by Foreign Government Talent Recruitment Programs
- Mitigating Threats Posed by the Risk of Cyberattacks
- Managing Transformational Change

As always, NSF remains committed to serving the research community effectively, to continually improving stewardship across the agency, and to safeguarding Federal funds awarded by NSF in support of the agency's mission. We look forward to continuing to work with your office to achieve those goals.

Sethuraman Panchanathan

Attachments

cc: Chair, National Science Board
Chair, National Science Board, Committee on Oversight
Chief Financial Officer

National Science Foundation (NSF)
FY 2021 Progress Report on OIG Management Challenges

MANAGEMENT CHALLENGE 1: Providing Oversight of Major Multi-User Research Facilities

NSF Leads: Teresa Grancorvitz, Chief Financial Officer and Jim Ulvestad, Chief Officer for Research Facilities

Summary of OIG Identified Challenge

a) *Manage the inherent risk associated with the major facility portfolio and continue to address recommendations from recent audits.*
b) *The advent of COVID-19 added an unprecedented degree of complexity and uncertainty for NSF's major facilities. Facility closures and safety precautions taken due to COVID-19 delayed construction and research, as well as increased costs. This resulted in NSF authorizing total project costs increases and the reprogramming of funds to cover these increases. In response to COVID-19, many existing facilities were closed or required to operate with minimal staff. This led to disruptions in data gathering and routine maintenance, as well as the postponement or cancellation of some planned scientific activities. The pandemic response also halted or delayed the construction of new facilities. NSF will need to continue its work to identify current risk areas, implement mitigation strategies, and assess any remaining financial impacts as the pandemic comes under control in the United States, but continues abroad.*

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF understands the importance of its role in overseeing recipients' on-going management of major facilities. The agency also recognizes the importance of assessing prospective recipients' capabilities for managing major facilities prior to award. Over the past several years, NSF has greatly strengthened its oversight policies and procedures. This includes an annual Major Facilities Portfolio Risk Assessment to determine the necessary business-related reviews and audits to be conducted by the Large Facilities Office (LFO) and the Cooperative Support Branch (CSB) within the Office of Budget, Finance, and Award Management (BFA). In close cooperation with NSF program offices, LFO and CSB conduct these reviews to safeguard NSF's significant, long-term investments in supporting the scientific endeavor.

NSF leadership continues to show its commitment to major facilities oversight through appointment of the Chief Officer for Research Facilities (CORF) and periodic use of the Office of the Director's Watch List. The governance structure currently in place, which includes the Accountable Directorate Representatives (ADRs), Facilities Governance Board, Facilities Readiness Panel, and the Director's Review Board, continues to help ensure consistent implementation of NSF's expanded controls for major facilities oversight. Furthermore, NSF is ensuring adequate human capacity through implementation of the Program Management Improvement Accountability Act (PMIAA) on the major facility/acquisition portfolio and the associated NSF staff overseeing major facility awards, and by establishing guidance on the necessary core competencies for recipient staff managing major facilities.

Since 2017, NSF has been through four Government Accountability Office (GAO) reviews related to its oversight of projects funded from the Major Research Equipment and Facilities Construction (MREFC) account. The June 2018 report, *National Science Foundation: Revised Policies on Developing Costs and Schedules Could Improve Estimates for Large Facilities* (GAO-18-370), recommended that NSF revise its policies for estimating and reviewing the costs and schedules of major facility projects to better incorporate the best practices in GAO's guides.[1] The March 2019 report, *National Science Foundation: Cost and Schedule Performance of Large Facilities Construction Projects and Opportunities to Improve Project Management* (GAO-19-227), recommended that NSF conduct a workforce gap analysis for project management competencies, ensure recipients provide lessons learned and best practices to NSF, and establish criteria for recipient project management competencies to be incorporated into NSF's review process.[2] The April 2020 report, *National Science Foundation: Cost and Schedule Performance of Major Facilities Construction Projects and Progress on Prior GAO Recommendations (GAO-20-268),* and the June 2021 report *National Science Foundation: COVID-19 Affected Ongoing Construction of Major Facilities Projects* (GAO-21-417), had no new recommendations.[3] NSF has Corrective Action Plans (CAPs) in place as described below, and four of the six previous GAO recommendations are now considered fully implemented.

The COVID-19 pandemic presented unique challenges for major facilities, including protecting the safety of personnel and property, construction delays, and unanticipated additional costs given that it is considered an "unforeseen event." The greatest risk is the inadvertent misuse of funds when re-budgeting (Operations Stage awards) and the proper use of budget contingency funds (Construction Stage awards). Following the flexibilities granted through the Office of Management and Budget (OMB) guidance under the pandemic, NSF took action to address these risks by developing internal and external guidance for major facility programs and recipients. These efforts included the following: (1) developing and updating a set of frequently asked questions (FAQs) specific to major facility recipients as a complement to NSF's implementation of OMB Guidance; (2) issuing guidance jointly from the CORF and LFO to NSF Program Offices in response to the COVID-19 pandemic to ensure recipients segregate and track related cost increases; (3) issuing guidance from the Division Director for the Division of Acquisition and Cooperative Support (DACS) directly to recipients on the OMB and NSF flexibilities, the documentation required for tracking cost impacts, and the submission of prior approvals for COVID-19 related requests; and (4) providing guidance for addressing re-baselining of construction projects, incorporation of impacts into Earned Value Management, and the application of management reserve. NSF followed its current policies and controls with only minor clarifications. No additional controls were deemed necessary.

The Regional Class Research Vessel (RCRV) project also experienced a different unforeseen event when the shipyard constructing the vessels experienced a direct hit from Hurricane Ida on August 29, 2021. Although hurricanes are a known phenomenon in the Gulf of Mexico and reasonable preparations can be made, a direct hit from a major hurricane is not manageable by the project. NSF's current controls that are in use for COVID-19 are considered sufficient to deal effectively with this event and any other future unforeseen event.

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[1] GAO-18-370 is available at: https://www.gao.gov/products/gao-18-370.
[2] GAO-19-227 is available at: https://www.gao.gov/products/gao-19-227.
[3] GAO-20-268 is available at: https://www.gao.gov/products/gao-20-268 and GAO-21-417 is available at https://www.gao.gov/products/gao-21-417.

Based on NSF's evaluation of this Management Challenge under Enterprise Risk Management (ERM), coupled with activities already completed and those planned for FY 2022, NSF has determined that the residual risk impact for fraud, waste and abuse (Risk 1) is "low", the likelihood is "very low", and that the residual risk impact for scientific performance (Risk 2) is "moderate" and the likelihood is "very low." Risk 2 impact and likelihood assume sufficient additional funding is made available when needed to sustain ongoing activities. As of September 2021, sufficient additional funding has been available. Additional funding needs for both Operations Stage and Construction Stage awards were addressed by reprogramming of funds, modifications of budget requests to Congress, and application of American Rescue Plan (ARP) funds as described below. NSF is confident that its current and planned controls related to major facility oversight adequately consider and balance risk, resources, benefit to the science community, and stewardship of federal funds.

Regarding removal criteria described in OIG Bulletin 18-02, Attachment 2, NSF believes it has demonstrated senior-level leadership commitment through the appointment of the CORF, has CAPs in place that implement solutions that are tied to root causes, and has established appropriate performance measures to monitor construction progress. Capacity is demonstrated though rigorous reporting and accountability, and workforce capacity will continue to be enhanced as NSF completes implementation of PMIAA for the major facilities portfolio. In addition, NSF has implemented planned corrective actions, demonstrated progress, and monitored on-going activities as described below.

NSF's Completed Actions to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years

Since 2015, NSF has implemented enhanced controls and strengthened agency governance to fully address the recommendations of the 2015 National Academy of Public Administration report; the requirements of the American Innovation and Competitiveness Act of 2017 (AICA); the FY 2018 and FY 2019 GAO Review Reports; and numerous OIG report recommendations. Examples of recent (FY 2020) agency actions include the following:

- Revised Major Facilities Cooperative Agreement Modified & Supplemental Terms and Conditions (and any major facility contract terms and conditions) to require recipients to participate in NSF's Knowledge Management Program as part of the CAP for GAO-19-227.
- Required recipients to develop Segregation of Funding Plans for the following NSF projects: Daniel K. Inouye Solar Telescope (DKIST), Vera C. Rubin Observatory (formerly Large Synoptic Survey Telescope, or LSST), Antarctic Infrastructure Modernization for Science (AIMS), RCRV, and Large Hadron Collider Hi-Luminosity Upgrade (HL-LHC) Program (the Compact Muon Solenoid, or CMS, and A Toroidal LHC ApparatuS, or ATLAS, projects).
- Converted the "Director's Watch List" to the "Office of the Director's Watch List" under cognizance of the CORF, formalizing the process of tracking open action items on a monthly to bimonthly interval.
- Ensured that the AIMS project has Federal Acquisition Regulations-compliant procedures in place, including requirements for expending funds for established purposes, tracking and billing of costs incurred, and record-keeping for audit comparable to Segregation of Funding Plans under cooperative agreements.
- Re-programmed funds appropriated in FY 2020 in the MREFC account, from AIMS to Rubin Observatory and DKIST, for use as management reserve to cover documented costs incurred due to COVID-19 (approved by NSF Acting Director under authority delegated by the National Science Board).

- Implemented corrective actions in response to all OIG recommendations under OIG Report 18-2-005 *Audit of NSF's Oversight of Subrecipient Monitoring,* which included updating various NSF policies, procedures and terms to: (1) align with the Uniform Guidance, (2) provide a specific mechanism to verify that passthrough entities (PTEs) of large and complex awards complete subrecipient risk assessments, and (3) to require that PTEs clearly identify entities that will receive a subaward.

Demonstrated Progress Through Agency Actions Taken in FY 2021

- Continued to monitor allocation of funds between awards as part of required cost incurred audits using Segregation of Funding Plans as reference.
- Completed the major facilities portfolio workforce gap analysis and began development of a Training Plan tied specifically to the major facility oversight competency model as part of PMIAA implementation and the CAP for GAO-19-227.
- Finalized revisions to the 2021 *Major Facilities Guide* (MFG), including:
  a. Content in the new MFG Section 4.3, Schedule Development, Estimating, and Analysis.
  b. More detailed guidance on Segregation of Funding Plans. Provided to the OIG for consideration in closing resolved recommendations in OIG Report 19-2-006, *Audit of NSF's Controls to Prevent Misallocation of Major Facility Expenses.*[4]
  c. New sections on Key Personnel and Recipient Core Competencies.
- Revised and published the *Business Systems Review Guide* to better align with the Uniform Guidance and address implementation of Segregation of Funding Plans and the allocation of expenses during the Construction and Operations Stages (if identified as a risk).
- Revised Standard Operating Guidance for DACS/CSB Grants and Agreements Officers on the Pre-Award Review Process, which includes business and financial review, incorporates requirements on reviewing the costs and schedules of major facility projects to align with GAO's guides.
- Revised and published *Obligation and Allocation of Management Reserve* Standard Operating Guidance (SOG) (NSF-LFO-FY19-02-00) to clarify the relation to the NSB delegation order and eliminate the $10 million applicability limit for use on construction projects impacted by the COVID-19 pandemic.
- Authorized management reserve for RCRV (December 2020) through the Director's delegated authority and additional management reserve for DKIST (February 2021) and Rubin Observatory (August 2021), with National Science Board approval, to account for continuing impacts of the COVID-19 pandemic.
- Allocated FY 2021 funds from the ARP to cover realized and potential COVID-caused cost increases for DKIST, Rubin Observatory, and RCRV construction projects, as well as for operations of the Academic Research Fleet.
- Produced a regular report on COVID-19 impacts on major facilities in both Operations and Construction Stages,[5] which was used to keep leadership aware of the current state of COVID-19 impacts and to retain awareness of impacts for which NSF action or enhanced oversight might be necessary.

[4] OIG Report 19-2-006 is available at https://oig.nsf.gov/reports/audit/audit-nsfs-controls-prevent-misallocation-major-facility-expenses.

[5] The regular COVID-19 impacts report was produced weekly by the CORF, working closely with the ADRs, from early March 2020 through mid-June 2020, then biweekly through the beginning of March 2021, and now is produced once per month.

NSF's Ongoing and Planned Actions

NSF management established the following milestones in consideration of NSF's strategic and operational objectives and the previous actions NSF has already taken as described above:

- Finalize the *Major Facilities Oversight Reviews* SOG and provide to the OIG and GAO for consideration in closing remaining recommendations in OIG Report 19-2-006 on NSF's controls to prevent misallocation of expenses, OIG report 20-2-004 related to Ocean Observatories Initiative operations and maintenance, and a recommendation on recipient project management expertise from GAO-19-227 [FY 2022, Q1].
- Complete development and implementation of the Training Plan for the major facilities oversight workforce as part of PMIAA implementation and the CAP for GAO-19-227. Monitor progress through periodic self-assessment surveys or other means [FY 2022, Q4].

MANAGEMENT CHALLENGE 2: Providing Oversight of Grants During a Pandemic

NSF Lead: Teresa Grancorvitz, Chief Financial Officer

Summary of OIG Identified Challenge

The Coronavirus Aid, Relief, and Economic Security Act (CARES Act) provided $76 million to NSF, including $75 million to support NSF's grant response to COVID-19 and $1 million to assist in the administration of those grants. NSF used funding mechanisms with established policies, procedures, and controls to disperse the funds provided by the CARES Act.

COVID-19 has added complexity to the grant management process due to the need to expend additional federal funds to address its impacts, as well as the health, economic, and societal impacts on NSF's recipient environment.

Similarly, COVID-19 has introduced new and unique factors to which NSF must adapt to maintain effective grant accountability. NSF has begun planning how to address some of these risks, but uncertainty remains, especially as the pandemic continues. NSF may need to make difficult decisions about which grants to terminate, which to continue supporting at established funding levels, and which to support with supplemental funding — and it must consider how these decisions will impact the funding levels of future awards.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

Throughout the COVID-19 pandemic, the research community faced unprecedented challenges that have tested the people and infrastructure that make up the U.S. scientific research enterprise. Throughout these difficulties, NSF and the research community continued doing the work that creates opportunities, spurs innovation, and improves quality of life for individuals, families, and communities across the U.S. NSF plays a unique role in supporting the future of science, technology, engineering, and math (STEM) education in the U.S. This support has remained a top priority for NSF throughout the pandemic and recovery. NSF's response to the pandemic was based on its ERM process, which generated robust dialogue, informed decisions, and coordinated actions for providing oversight during the pandemic. NSF recognized that a destabilizing event in the operating environment (e.g., COVID-19 pandemic) required continuous diligence to minimize the risk of negative outcomes to NSF's monitoring and oversight activities. NSF also recognized that its existing oversight mechanisms and activities may not align with challenges presented by the pandemic. In response, NSF approached its oversight activities with the understanding that there may be heightened risk in the grants program compared to prior years.

NSF's monitoring and oversight efforts spanned the award lifecycle (proposal submission, merit review, pre-award financial review, post-award monitoring, award closeout, and audit follow-up) to ensure financial capability, non-financial administrative and programmatic compliance, and research performance. The foundation of NSF's monitoring and oversight efforts is its suite of policy and procedural documents that incorporate federal regulations, legislative mandates, and agency-specific requirements; the translation of policies and procedures into business rules that are enforced through NSF's business systems; and a risk-based approach to financial and administrative monitoring. Baseline

monitoring activities, which are conducted on most awards through standard, recurring, and automated processes, focused on post-award administration and financial transactions to identify exceptions and potential issues that may require additional scrutiny through advanced monitoring. NSF steadfastly maintained its advanced monitoring and oversight activities through virtual site visits, desk reviews, targeted assessments, audit resolution, and new analytic approaches focused on the grant and cooperative agreement award portfolio.

Over the past year, in addition to monitoring and oversight activities, NSF has taken significant steps to mitigate risks. NSF has:

- Demonstrated strong commitment and top leadership support to ensure continued operations and maintenance of standard business processes and management functions;
- Ensured that NSF has the people and resources to effectively operate in the pandemic environment;
- Executed an action plan that included numerous working groups and committees, such as the Recovery Planning Task Force, the Major Facilities Working Group, and several facility-specific working groups;
- Established processes to monitor the spending of pandemic related funding; and
- Incorporated pandemic relief flexibilities into policy and process documentation.

In 2020, NSF developed a CARES Act Spending Plan, which used existing funding mechanisms with established policies, procedures, and controls to disperse the supplemental funds, to reduce the risk of misuse, and help ensure accountability. NSF also established a process to ensure appropriate financial controls over CARES Act funds by using unique fund codes. The OIG conducted a review of NSF's *CARES Act Spending Plan and Review Team* documents, related policies and procedures, and additional information provided directly by NSF's senior leadership. In its final report (OIG 20-6-001), the OIG concluded that NSF's plan for expending CARES Act funds was "reasonable, prudent, and met the intent of the funding objectives."[6]

In FY 2021, NSF developed a similar approach for the supplemental funds provided under the American Rescue Plan Act (ARP). NSF established unique fund codes for ARP to facilitate quick and transparent tracking of proposal and award actions. NSF developed its ARP spending plan in keeping with the same expectations for reasonableness, prudence, and consistency with the intent of the funds that the OIG noted in its review of NSF's CARES Act spending plan.

To facilitate tracking and reporting on COVID-19 related awards funded from NSF's base appropriation, NSF established new financial coding mechanisms. Specifically, NSF tracks awards issued for COVID-19 research, awards impacted by COVID-19, and institutional or individual recipients disproportionately affected by COVID-19.

Finally, as of September 13, 2021, NSF noted in its review and analysis of grantee single audit reporting packages published in the Federal Audit Clearinghouse that independent public accountants had reported low risks for NSF grant recipients in areas including going concern, financial statement or major

[6] OIG 20-6-001, *Review of the National Science Foundation CARES Act Spending Plan* https://oig.nsf.gov/reports/other/review-national-science-foundation-cares-act-spending-plan.

program audits, and questioned costs. NSF continues to monitor this data for potential changes in its grantee external risk landscape.

NSF's Completed Actions to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years

Policy and Outreach

- Developed and distributed several rounds of policy updates to codify NSF's implementation of OMB Memoranda (M-20-17, M-20-20, and M-20-26) related to COVID-19 grant flexibilities and temporary policies.
- Distributed reminders of monitoring responsibilities across NSF (e.g., Program Officers, Grants Officers, and Operations staff) through targeted outreach (BFA Update).
- Conducted targeted grants management outreach to the awardee community most impacted by the pandemic.
- Conducted a June 2020 Webinar and Question & Answer session with over 1,000 NSF grantees to remind them of important financial management responsibilities under the pandemic environment.

Grants Oversight

- Established the Recovery Planning Task Force to evaluate the pandemic's impact on grantees and NSF.
- Implemented OMB Memorandum M-20-21 to address mandated improvements to NSF's Digital Accountability and Transparency Act (DATA Act) reporting, including monthly reporting of grant awards obligated using CARES Act funding, and employed enhanced monthly reconciliations over CARES Act awards reported to USASpending.gov.
- Developed an enterprise dashboard to assist with oversight and reporting around award obligations and outlays for COVID-19 research funded under the CARES Act and NSF base appropriations.
- Monitored use of program reference code 102Z "COVID Disproportionate Impacts to Institutions/Individuals" to track assistance for vulnerable populations.
- Initiated development of data products using grantee single audits, NSF financial data, and historical monitoring results to monitor risks in NSF's external enterprise.

Risk Management and Internal Controls

- Conducted current fiscal year testing of grant award expenditures for potential unallowable costs to develop a pre-pandemic baseline of NSF grant improper payment risk.
- Briefed OIG on proposed FY 2021 approach to align its implementation of OMB A-123 Appendix A, ERM, and Appendix C to holistically assess whether there is an increased risk of improper payments under the pandemic environment.
- Continued development of the Awardee Internal Control / Financial Solvency Dashboard.
- Conducted targeted ERM Science Directorate workshops.
- Continued development of an Enterprise Project Report Scorecard.

Demonstrated Progress Through Agency Actions Taken in FY 2021

Policy and Outreach

- Published new guidance on the NSF Coronavirus webpage for awardees, programs, and panelists to address emerging government-wide and NSF-specific policies surrounding COVID-19.
- Closely monitored the COVID-19 status and recovery for Major Facilities.

- Distributed enhanced financial coding guidance through BFA Updates to track awards with disproportionate impact to individuals and institutions.
- Published NSF implementation guidance for OMB M-21-20, Promoting Public Trust in the Federal Government through Effective Implementation of the American Rescue Plan Act and Stewardship of the Taxpayer Resources.
- Developed and put into action the NSF ARP spending plan and implementation guidance.

Grants Oversight

- Conducted FY 2021 advanced monitoring site visits and desk reviews, which involved adapting protocols where required to maintain effectiveness.
- Conducted baseline monitoring activities and implemented incremental monitoring enhancements using data and analytics to better identify potential risk areas.
- Identified opportunities to use data analytics to improve oversight and monitoring, including re-evaluation of the approach to improper payments risk assessment, development of an Awardee Internal Control / Financial Solvency Dashboard, and development of an Enterprise Project Report Scorecard.
- Implemented internal NSF dashboards to monitor potential grant risk factors around grant award expenditure patterns and post-award adjustments.
- Updated DATA Act reporting to encompass M-21-20 requirements for tracking financial assistance awards obligated with supplemental ARP funding.

Risk Management and Internal Controls

- Conducted risk and control checkpoints, walkthroughs, and tests of design and operating effectiveness to validate existing grants monitoring and oversight controls.
- Conducted qualitative and quantitative risk assessment for compliance with the Payment Integrity Information Act of 2019 (PIIA) and completed and planned interviews across the Foundation, including BFA, Office of Information and Resource Management (OIRM), OPP, and other Program Office Directorate representatives.
- Conducted annual testing of grant award expenditures covering April 2020 through March 2021 to update baseline of improper payment risk under the peak pandemic period. Results indicated a similarly low risk level as prior year testing results.
- Engaged regularly with NSF ERM Risk Captains to monitor this enterprise-level risk and identify ways to support increased effectiveness across Offices and Programs.
- Facilitated breakout sessions with NSF Directorates and other key stakeholders to further integrate oversight activities across the agency and maximize the value of targeted outreach opportunities.
- Conducted interactive listening sessions with Program Offices on potential risk areas and oversight responsibilities, and engaged with other NSF key stakeholders (e.g., Program Officers and Grants Officers) on monitoring and oversight responsibilities via BFA Pulse and other targeted communications.

NSF's Ongoing and Planned Actions

NSF management established the following milestones in consideration of NSF's strategic and operational objectives and the previous actions NSF has already taken as described above:

- Continue advanced monitoring site visits and desk reviews. [On-going]
- Continue to update ongoing supplemental fund government-wide policy and subsequent ARP spending requirements and guidance as needed. [On-going]

- Continue to update and enhance internal financial reporting over ARP obligations and outlays. [On-going]
- Issue final PIIA risk assessment report. [FY 2022, Q1]
- Continue to evaluate extended enterprise risks in the post-pandemic environment through advanced monitoring, baseline monitoring, and routine grantee communications. [On-going]

MANAGEMENT CHALLENGE 3: Managing the Intergovernmental Personnel Act (IPA) Program

NSF Leads: Wonzie Gardner, Office Head, Office of Information & Resource Management and Joanne Tornow, Assistant Director, Directorate for Biological Sciences

Summary of OIG Identified Challenge

a) *Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.*
b) *IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).*
c) *IPAs are not subject to federal pay and benefits limits.*
d) *COVID-19 has brought new and unique challenges to this program, including recruiting, onboarding, and managing IPAs in a remote work environment. It is unclear if institutions will be reluctant to allow staff to participate in the IPA program — and, if the number of IPAs decreases, whether NSF will be able to recruit qualified staff to fill any resulting openings. Fiscal concerns at institutions could also undermine the progress NSF has made in increasing cost-sharing for IPAs.*

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF provides the opportunity for scientists, engineers, and educators to rotate into the Foundation as temporary Program Directors, advisors, and leaders. Rotators bring fresh perspectives from across the country and across all fields of science and engineering supported by the Foundation, helping influence new directions for research in science, engineering, and education, including emerging interdisciplinary areas. Many of these rotators remain involved in their professional research and development activities while working at NSF through participation in the IR/D Program, which is overseen by the NSF IR/D Council.

NSF takes a proactive approach in the management of the IPA Program to appropriately consider and mitigate inherent risks associated with its execution.

Demonstrated Top Leadership Commitment:
The IPA Steering Committee reports directly to the NSF Director and Chief Operating Officer (COO) and has been in place since April 2016. The IPA Steering Committee is comprised of senior-level leaders across the agency, namely a Chair and Vice-Chair who are part of the agency's Senior Executive Service (SES), the Chairs of the NSF Executive Resources Board (ERB) and IR/D Council, Head of the Office of Equity and Civil Rights, and four at large members, including two Senior Executive Service (SES) and two executive-level IPAs.

The IPA Steering Committee is charged with ensuring NSF is best utilizing the IPA hiring authority. It advises the Foundation's senior leadership on matters that directly concern policy on the use of the IPA Program, and on common approaches to budgeting and implementation of the program. It also regularly reports on its oversight and stewardship of the IPA Program, including costs associated with the program, to the NSF Director and Chief Operating Officer, OMB, and Congress, pursuant to the AICA.

Capacity:
The IPA Steering Committee is supported in the execution of its responsibilities by various NSF units with key expertise for risk management, reporting, and accountability, including BFA, OIRM's Division of Human Resource Management (HRM), the Office of General Counsel (OGC), the Office of Legislative and Public Affairs (OLPA), and the Office of Integrative Activities (OIA).

Monitoring:
NSF continues to monitor the use of IPA assignments on an ongoing basis, providing a data-driven summary to NSF senior leadership via an annual review of metrics related to participation, demographic characteristics, annual costs, and cost share value. Analyses of these data have demonstrated positive trends in increasing demographic diversity and reductions in annual costs. NSF has recently integrated program and executive level IPAs into the USA Performance Management System to enhance its ability to monitor supervisory oversight of IPA performance.

Demonstrated Progress:
NSF engages in continuous improvement of its management of the IPA Program, addressing the management challenges identified by OIG as well as other agency-identified risks and challenges. In this way, NSF is ensuring the program fully supports the mission of the agency and the Nation's interests. Indeed, NSF believes that the steps taken to date have reduced the inherent risk substantially, such that the residual risk is acceptable to the agency.

NSF worked to resolve, and close, the recommendations from OIG report 17-2-008, *NSF Controls to Mitigate IPA Conflicts of Interest*.[7] The last of the four recommendations from this report was closed by the OIG in October 2018. This result demonstrates that NSF has effectively minimized the inherent risk of IPA conflicts of interest while working at NSF (since most IPAs come from institutions receiving NSF grants). NSF is confident that the actions taken in response to prior OIG recommendations and ongoing monitoring and controls have mitigated the potential risks associated with the IPA program.

In FY 2017, NSF initiated a pilot to require a cost share of 10 percent from the IPA's home institution. Historically, NSF requested institutions provide up to 15 percent cost share of IPAs' salaries and fringe benefits, with mixed success. After a successful pilot period, in FY 2020, NSF implemented required cost share as policy, requiring that institutions provide a minimum of 10 percent cost share for every full-time IPA agreement. Exceptions to the mandatory cost share policy are limited and include federally funded research centers or extremely resource-constrained institutions. NSF's reimbursement of the IPAs' base salary is now reduced by 10 percent in a standardized manner. Total cost share increased by over $1 million between FY 2019 and FY 2020, with the percent of assignments that cost share near 90 percent. Since IPAs continue to be full-time employees of their home institutions, those institutions continue to provide coverage for fringe benefits upon their return and into retirement. NSF does not take on the long-term responsibility for health/life insurance, retirement, or other benefits typically conferred upon federal employees. The cost share mechanism continues to maximize taxpayer value and eliminate the differential in the average cost of an IPA vs. a Federal employee.

[7] OIG Report 17-2-008 can be accessed at: https://oig.nsf.gov/reports/audit/nsf-controls-mitigate-ipa-conflicts-interest.

In FY 2012, the OIG issued an audit of NSF's IR/D Program (OIG Report 12-2-008).[8] The report suggested several recommendations including tracking planned and actual IR/D time and expenses for each IR/D participant, clarifying the scope of the program and providing clear guidance to IR/D participants and supervisors, automation of the IR/D plan and creation of an IR/D Council and IR/D experts across NSF to review IR/D requests in each directorate. Actions taken by NSF included implementation of electronic plans and workflow approval in SharePoint, an IPA time tracker, a comprehensive IR/D Guide, an automated quarterly tracking report showing planned versus actual IR/D time and expenses by participant and annual training for IR/D experts. All recommendations from the report were closed by the OIG in March 2013.

NSF's Completed Actions to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years

a) Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.

- Ensured there is a "bench" of staff ready to fill developmental detail assignments to vacant executive positions who have been trained at the Federal Executive Institute (FEI), American University Executive Leadership Program, Harvard Business School Leadership Training, Individual Development Plans, and NSF Academy Leadership Development Program.
- Implemented the New Executive Transition Program (NeXT) in 2009 to onboard employees and IPAs transitioning into executive-level positions to help new executives reach full performance as quickly as possible by developing executive knowledge about NSF mission, culture, organization, people, and business processes.
- Instituted mandatory training for Program Officers, including IPAs, on NSF's Merit Review process which teaches how research proposals are evaluated and how to execute the Program Officer role.
- Created a parallel performance management system in 2014 for IPAs to ensure clarity in setting expectations and providing feedback on performance.
- Established a knowledge transfer process in 2015 that exiting IPA executives can use to transfer knowledge and information to incoming executives.
- Implemented a required three-day supervisory training and development course in 2015 called Federal Supervision at NSF designed to assist new federal supervisors (including IPAs) in understanding their roles and all the requirements pertaining to federal human capital management.
- Established a Steering Committee for Policy and Oversight of the IPA Program (IPA Steering Committee) in April 2016 to serve as the primary body for considering policy on NSF's use of IPAs, and to oversee common approaches to budgeting and implementation of the IPA program.
- Produced IPA Program Annual Reports for the Director of NSF, beginning in 2018. This report provides annual data and trend analyses on various aspects related to the use of IPAs at NSF for use by the Director and NSF senior managers in assessing and overseeing the program.
- Developed the Corrective Action Plan (CAP) response to the GAO report, *A Workforce Strategy and Evaluation of Results Could Improve Use of Rotating Scientists, Engineers, and Educators* (GAO-18-533*)*.

[8] OIG Report 12-2-008 may be accessed at: https://oig.nsf.gov/reports/audit/nsfs-independent-research-and-development-program.

- Integrated activities associated with the CAP in response to GAO-18-533 into Renewing NSF goal 1 Adapting the Workforce to the Work.
- Engaged in IPA Program Enterprise Risk Management to clearly identify IPA Program objectives and associated risks as they pertain to the mission of NSF.
- Established implementation plan to Integrate Program level and Executive level IPAs into the USA Performance Management System in FY 2021.

b) *IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).*

- Established the IR/D Council in October 2011 to develop and monitor internal controls related to the IR/D Program, including tracking the time spent on IR/D activities. Data from these internal controls are disseminated to NSF senior management quarterly for use in managing the IR/D Program within each organization.
- Developed an IR/D Guide in 2012 to clearly communicate NSF policies on the use of IR/D, including the possibility that participation in the IR/D Program could be curtailed if it compromised the completion of NSF duties.
- Designated IR/D experts in each Directorate/Office who receive annual training to ensure that NSF IR/D policies are implemented appropriately.
- Delivered a "Benefits of the NSF IR/D Program" report to the NSF Deputy Assistant Directors (DADs) in March 2018 highlighting the value of IR/D in recruitment, research currency, and ethics protection.
- Instituted a requirement that all IR/D plans provide an explanation of how the IR/D activities enhance the requestor's ability to perform NSF duties.
- Published a revised IR/D Guide in January 2017 that includes guidance limiting NSF payment of IPAs' IR/D travel to their home institutions to 12 trips per year. The guidance encourages IPAs to combine other NSF official business and/or telework with these trips to more efficiently use travel dollars.
- Monitored time spent on IR/D by both permanent and rotating staff, and provided quarterly data to NSF senior managers to ensure appropriate oversight of IR/D.
- Performed yearly data checks to assure that no IPA IR/D participant home travel was paid by NSF in excess of 12 trips per year.

c) *IPAs are not subject to federal pay and benefits limits.*

- NSF initiated a pilot requiring 10 percent cost sharing by IPAs' home institutions of their academic-year salaries and fringe benefits (per NSF Bulletin 16-11). This pilot applied to all new IPA agreements initiated in FY 2017 and beyond, including those for executive and program level staff. Additionally, NSF eliminated reimbursement for lost consulting. An assessment of the pilot indicated that the cost-share percentage increased 33.3 percent between FY 2017 – FY 2020.
- After a successful pilot period, NSF implemented the required cost share as policy, effective January 31, 2020, requiring that institutions provide a minimum of 10 percent cost share for every full-time IPA agreement. Total cost share increased by over $1 million between FY 2019 and FY 2020, with the percent of assignments that cost share near 90 percent (note that strongly justified waiver requests may be considered). The cost share mechanism continues to maximize taxpayer value.
- Engaged with the GAO on the salary reimbursements associated with IPAs. As noted in the 2018 GAO report (GAO-18-533), IPAs remain employees of their home institutions, with NSF reimbursing the institutions for most of their salaries and benefits. NSF does not set the salaries for rotators who are detailed to NSF using the IPA authority because their salaries are set by their home institutions.

- Submitted to Congress annual responses to the AICA (P.L. 114-329 Section 111 on Personnel Oversight) on the Justifications for Rotator Pay Exceeding the SES Pay Max.

Demonstrated Progress Through Agency Actions Taken in FY 2021

a) *Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.*
   - Migrated Program Director and Executive IPAs to the USA Performance system for managing performance plans.
   - Submitted the IPA Program Annual Report covering the prior fiscal year to the Director of NSF.
   - Continued to provide ongoing training/onboarding activities and mandatory supervisor training for new IPAs.
   - Continued to engage in IPA Program Enterprise Risk Management to clearly identify IPA Program objectives and associated risks as they pertain to the mission of NSF.
   - Continued to integrate activities associated with the CAP in response to GAO-18-533 into Renewing NSF goal 1 Adapting the Workforce to the Work.

b) *IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).*
   - Continued the IR/D Program, which permits employees and individuals performing temporary service with NSF to maintain their involvement with their professional research and research-related activities. Prior to creating an IR/D plan, participants must receive approval from their supervisor for the time and expense related to the submitted activities. Additionally, the plan needs to be approved by the Division Director and designated IR/D Expert from the organization. IR/D activities may not interfere with other assigned NSF duties and may be curtailed at management's or the participant's discretion.
   - NSF continued to maintain robust oversight, training, and internal controls to monitor use of the IR/D program.
   - Submitted the IR/D Annual Report to the NSF Deputy Assistant Directors, covering program participation statistics, average days and dollars requested and used and status of IR/D training and outreach.
   - Provided annual training for IR/D experts, including updates to the IR/D Guide and the online electronic IR/D plan.
   - Provided quarterly data to NSF senior managers to ensure appropriate oversight of IR/D time and travel by both permanent and rotating staff.
   - Continued to perform yearly data check to assure that there are no IPA IR/D participants where NSF payment of travel to their home institutions exceeds 12 trips per year.

c) *IPAs are not subject to federal pay and benefits limits.*
   - NSF is preparing a brief report to GAO that will highlight the efforts of the agency surrounding the IPA Cost Share Policy and address concerns surrounding IPA costs at NSF.
   - Submitted the FY 2020 IPA Program Annual Report to the Office of the Director, which demonstrated that the 10 percent cost-share policy continued to reduce or eliminate the gap between IPA reimbursements and federal salaries, and thus this is not a major risk to the agency.
   - Submitted to Congress the FY 2020 annual response to the AICA on the Justifications for Rotator Pay Exceeding the SES Pay Maximum. With the implementation of the cost-sharing policy, the overall cost of IPAs to the agency, and to the taxpayer, is comparable to federal staff.

d) *COVID-19 Challenges.*
   - Actively engaged with the NSF Remote Workforce Working Group to discuss the Agency's action plan for remote IPA positions, post the pandemic.

- Facilitated a focus group of IPAs who onboarded during COVID, to help identify new and unique challenges associated with onboarding in a remote work environment. The results of that study determined that the onboarding experience for the IPA was different depending on the individual. Many felt completely assimilated to the NSF culture and mission. There were opportunities identified to enhance the onboarding experience as NSF develops personnel policies based on our experience with the pandemic.
- Established implementation plan to collect and analyze FY 2021 data on IPA recruiting, onboarding, and costs attributed to the COVID-19 pandemic. Findings will be included in the FY 2021 IPA Annual Report.

NSF's Ongoing and Planned Actions

NSF management developed the anticipated milestones and responses to the findings in the OIG Management Challenge FY 2021 Report below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken in response to those risks.

a) *Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.*
   - NSF conducted an analysis (January 2018) on IPA years of service and found that, on average, IPA executives serve 3.1 years at NSF and are 3 times more likely to stay for 3-4 years compared to staff level IPAs. Non-executives serve, on average, 2.3 years at NSF. Per the Office of Personnel Management, the average time a career SES spends in a position is 3.4 years and non-career SES is 1.7 years.[9] Thus, the turnover risk for IPAs is not any greater than for employees. NSF will continue to use the robust onboarding, training, knowledge transfer, and performance management systems that are in place, to ensure that turnover of all employees and IPAs have minimal impact on operations.
   - Migrated Program Director and Executive IPAs to the USA Performance system for managing performance plans and will continue using this platform.

b) *IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).*
   - Determine how the IR/D program will operate in a long-term remote work environment and adjust policies in the IR/D Guide, if necessary, in FY 2022.
   - Continue to submit the IR/D Annual Report to the DADs, covering program participation statistics, average days and dollars requested and used, and status of IR/D training and outreach.
   - Continue to provide annual training for IR/D experts, including updates to the IR/D Guide and the online electronic IR/D plan.
   - Continue to provide quarterly data to NSF senior managers to ensure appropriate oversight of IR/D time and travel by both permanent and rotating staff.
   - Continue to perform yearly data checks to assure that there are no IPA IR/D participants where NSF payment of travel to their home institutions exceeds 12 trips per year.

c) *IPAs are not subject to federal pay and benefits limits.*
   - As of FY 2020, the gap in pay between IPAs and federal employees has been reduced or eliminated by implementing the required 10 percent cost-share as policy. Thus, this does not

[9] Office of Personnel Management data on SES demographics https://www.opm.gov/policy-data-oversight/senior-executive-service/facts-figures/#url=Demographics.

constitute a significant risk to the agency. NSF will continue to monitor costs of the program, and provide annual reports to the Director, Chief Operating Officer, and NSF senior management.

d) *COVID-19 Challenges.*
   - Continue IPA engagement activities using the Federal Employee Viewpoint Survey and other surveys or mechanisms to help identify new and unique challenges to the program, including recruiting, onboarding, and managing IPAs in a remote work environment.
   - Continue to engage with the NSF Remote Workforce Working Group to discuss the agency's action plan for remote IPA positions, post the pandemic.
   - The IPA Steering Committee will continue to collect and analyze data on recruiting, onboarding, and IPA costs to identify if there are changes or challenges that may be attributed to the pandemic.

MANAGEMENT CHALLENGE 4: Providing Oversight of the Antarctic Infrastructure Modernization for Science (AIMS) Project

NSF Lead: Alexandra Isern, Assistant Director, Directorate for Geosciences

Summary of OIG Identified Challenge

a) *Providing oversight of the Antarctic Infrastructure Modernization for Science (AIMS) Project, which will stretch agency resources and may present additional challenges for NSF to overcome, and doing so with minimal impact on scientific research.*

b) *Providing oversight of the separate Antarctic Support Contractor (ASC) contract modification with Leidos to build an Information Technology & Communications (IT&C) Primary Addition — a key precursor to AIMS' success.*

c) *The advent of COVID-19 has added an unprecedented degree of complexity and uncertainty to the AIMS project. For example, while design and domestic fabrication of materials are continuing, AIMS construction on ice at McMurdo has been put on hold and will require a complete rebaselining in FY 2021; the IT&C Primary Addition construction was also halted and will need rebaselining. Additionally, actions taken to keep Antarctica free of COVID-19, particularly those associated with rotating staff and contractors to and from the Antarctic continent, will have significant impacts on program operations and construction progress.*

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF—through the Office of Polar Programs (OPP) in the Directorate for Geosciences (GEO)—funds and manages the U.S. Antarctic Program (USAP) which supports the United States' research and national policy goals in the Antarctic. USAP has two major construction projects ongoing at McMurdo Station – the IT&C Primary Addition, which involves building onto an existing facility for the consolidation of IT&C functions, and the AIMS Project, the scope of which currently includes six new facilities as well as utilities to support them. All are being built to replace multiple outdated structures and consolidate key functions for more streamlined and efficient operations. Both projects are being implemented through NSF's ASC under a Federal Acquisition Regulation-based contract with NSF. This management challenge

addresses AIMS only, but IT&C Primary Addition is identified here since its completion is on the critical path for construction for AIMS.

Antarctica's remote location, extreme environment, and the short period of time each year during which the continent is accessible present challenges above and beyond those typically encountered for domestic construction projects.

The ASC (Leidos, Inc.) has a well-developed risk identification and mitigation process overseen by NSF as captured in the project execution plan. The initial risk register for AIMS contained 120 entries which were used to develop the project's budget contingency – key among them were delays in long-lead procurement items, inadequate quantities of fill material on-site, and work stoppages due to weather. Leidos continues to mitigate the likelihood and impacts of these key risks through extensive planning and coordination and has already identified the key long-lead material and equipment purchases to support delivery dates, meeting the logistics supply chain requirements. These procurements for equipment and construction material are captured and tracked in the project's integrated master schedule and reviewed regularly by project and program leadership.

The global pandemic associated with COVID-19, which is considered an unforeseen event not addressed by the budget contingency for AIMS construction, impacted all USAP operations. As a result of the significant health risk to the deployed population as well as global travel restrictions, it was necessary to make significant changes to program and construction project plans. The global pandemic resulted in "excusable delays" for the contractor, as well as additional government-directed delays in performance of work under the AIMS project. This included placing the construction sites in a safe and stable configuration in March 2020 and bringing home deployed construction crews earlier than anticipated. In accordance with NSF policy, the magnitude of these impacts will require re-baselining of the AIMS project and OPP is actively engaged with Leidos, BFA, and the Office of the Director for that purpose.

NSF's Completed Actions to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years

- Completed design and began construction on the IT&C Primary Addition Project. The IT&C Primary Addition Project is a prerequisite to the AIMS project but is not part of the funded AIMS project. As of March 2020, the facility construction was 74 percent complete and is poised to be continued as conditions allow. Significant delays to schedule due to the COVID-19 pandemic will now require a re-baselining effort.
- AIMS received authorization for the total project cost and duration from the National Science Board in February 2019 following extensive internal reviews and an independent cost estimate, with the first two construction packages awarded for the Vehicle Equipment and Operations Center (VEOC) and the Lodging Building exterior in April 2019.
- OPP augmented internal staffing for program/project management and oversight by assigning the management of capital projects to a newly created staff position.
- Shortly following AIMS authorization, weekly meetings of the core integrated project team – including OPP, DACS, and LFO – were initiated.
- On-site work began on AIMS with aggregate production and demolition of facilities in the footprint of VEOC and Lodging. Significant delays to schedule due to the COVID-19 pandemic will now require a re-baselining effort.
- Continued to engage the research community to ensure they remained aware of potential disruptions that construction and the pandemic might have on Antarctic science.

- Partnered with BFA/DACS and LFO to: (1) identify areas that the contractor needed to strengthen, which resulted in the contractor hiring additional staff, (2) restructure the office supporting the contract, and (3) obtain interagency support for engineering and cost analysis from the U.S. Army Corps of Engineers (USACE).
- Restructured USACE support being provided to the AIMS project by moving from cost reasonableness reviews to full independent cost estimates for proposal packages.
- Completed verification and acceptance of the AIMS Earned Value Management System (EVMS) in accordance with NSF policy.
- Enlisted formal Value Engineering sessions with NSF participation.
- Increased financial oversight of Construction in Progress reporting and construction invoicing by requiring Program Officer review of every invoice, and augmenting the accounting support to OPP.
- Completed AIMS EVMS surveillance and identified corrective action requirements to ensure that an appropriate EVMS is developed.
- Completed the first annual construction review carried out by an independent external review team in accordance with NSF policy to evaluate contractor performance.
- Required the contractor to clearly distinguish COVID-19-driven impacts to cost and schedule from non-COVID-driven impacts to facilitate reconciliation of funding responsibilities.
- Conducted a "Logistics Summit" to ensure adequate and timely throughput of material into and out of the domestic departure point to McMurdo Station.

Demonstrated Progress Through Agency Actions Taken in FY 2021

- Acquired no-cost access to a long-term storage area to accommodate increased backlog of material resulting from COVID-19 resupply impacts.
- Provided ASC with planning parameters for re-baselining.
- The Chief Officer for Research Facilities convened an AIMS "Tiger Team," consisting of representatives from GEO Office of the Assistant Director, OPP, and BFA, in order to evaluate options for the future re-baselining of AIMS and develop a new path forward that transitions AIMS to a long-term Antarctic Infrastructure Recapitalization program.

NSF's Ongoing and Planned Actions

NSF management developed the following anticipated actions in consideration of NSF's strategic and operational objectives and the previous actions NSF has already taken as described above:

- Continue monitoring and oversight of the AIMS and IT&C Primary Addition Projects in accordance with established internal management and project execution plans, including external panel reviews and EVMS surveillance reviews for AIMS. Significant delays to schedule due to the COVID-19 pandemic will now require a re-baselining effort for both projects.
- Working closely with BFA, re-baseline AIMS, subject the revised cost and schedule to external panel review, Facilities Readiness Panel Review, Director's Review Board Review and if required, notification to National Science Board.
- Leverage the expertise within the USACE to provide quality assurance through design and constructability technical reviews, on-ice construction observation, cost estimating services, and schedule and cost review.
- Conduct quarterly NSF Integrated Project Team Meetings to ensure status of AIMS developments is known and to solicit expert feedback/advice.

MANAGEMENT CHALLENGE 5: Increasing Diversity in Science & Engineering (S&E) Education and Employment

NSF Leads: Karen Marrongelle, NSF Chief Operating Officer and Rhonda Davis, Office Head, Office of Equity and Civil Rights (OECR)

Summary of OIG Identified Challenge

a) *Continue efforts to develop strategies and programs to increase diversity in S&E education and employment and to measure their effectiveness.*
b) *Take action to help alleviate the impact of COVID-19 on efforts to increase diversity in STEM research and education.*

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

The importance of this challenge was imprinted on the Foundation at the earliest points of its origins. Chapter 4 of the NSF blueprint, *Science: The Endless Frontier,* identifies "The Renewal of Our Scientific Talent" as a priority for the then-nascent Foundation, with a specific focus on removing the barriers that prevent major segments of society from participating in the scientific enterprise. This aspect of NSF's mission and purpose was established more formally in 1980 with the enactment of the Science and Engineering Equal Opportunities Act. This Act specifically authorized NSF to undertake a comprehensive program to increase the participation of women and minorities in science and engineering and established what would become the Committee on Equal Opportunities in Science and Engineering[10] (CEOSE) to advise the Foundation. For decades NSF has maintained a robust portfolio of programs that aim to broaden participation in science and engineering, with $1.4 billion requested for FY 2022.

As is noted in the OIG's framing of this challenge, NSF and 16 other agencies were directed by OMB in August 2020 to prioritize investments that increase diversity, equity, and inclusion in STEM. More recently, Executive Order 13985 has directed that all agencies "pursue a comprehensive approach to advancing equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality." NSF will continue to strengthen its investments and policies but addressing this challenge will require a more holistic approach, which involves institutional partners to also make changes in addressing systemic barriers to inclusion in STEM.

NSF leadership recognizes both the importance of this issue and also the fact that barriers in STEM in many ways reflect and are perhaps rooted in the systemic, stubborn, and destructive barriers to participation more generally that have existed throughout our nation's history. In fact, top NSF leadership recently identified this issue as an "exceedingly important priority." At the 2021 Annual Meeting of the American Association for the Advancement of Science, NSF Director Dr. Sethuraman Panchanathan defined ensuring accessibility and inclusivity in STEM as the second of three major pillars of the NSF vision, saying "There is so much untapped talent across the nation that can strengthen the science and engineering community. Every demographic and socioeconomic group and geographical area in the nation has diverse people who are capable of succeeding in STEM and contributing to the

[10] CEOSE was originally named the Committee on Equal Opportunities in Science and Technology.

research enterprise. We need to scale up existing pathways into STEM fields for them and create new ways into science and engineering. And we need to do it quickly. This is critical to making progress and being competitive."

It is also undeniable that despite NSF's efforts, data confirm the persistence of this challenge. There have been noteworthy areas of progress, such as increases in the shares of individuals in S&E occupations from racial and ethnic groups historically underrepresented in STEM.[11] But the overall picture is summed up in the opening sentences of the recently issued report on Women, Minorities, and Persons with Disabilities in Science and Engineering:[12]

> Women, persons with disabilities, and some minority groups—Blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives—are underrepresented in science and engineering (S&E). That is, their representation in S&E education and S&E employment is smaller than their representation in the U.S. population.

The risk of inadequate action is significant, as the opportunity costs of this exclusion are substantial. Recent economic literature on the cost of lack of diversity finds that if key racial gaps had been closed 20 years ago, the result would be an additional $16 trillion in gross domestic product (Peterson & Mann, 2020). Similarly, gender equality in earnings would increase total global wealth by 14 percent (Wodon & Briere, 2018). The size and scale of this issue and the NSF mission require the agency to elevate its action to address this challenge within the S&E enterprise.

Indeed, the need for NSF to escalate its efforts was captured in the 2011-2012 report to Congress by CEOSE, which noted both the progress to date and the insufficiency of that progress in redressing historic patterns of underrepresentation. That report called for a "bold new initiative focused on broadening participation of underrepresented groups in STEM, similar in concept and scale to NSF's centers." This motivated the establishment of the NSF INCLUDES (Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science) national network.

In the context of this management challenge, NSF INCLUDES is of special significance because of its emphasis on building on the best practices and lessons learned from previous investments by NSF and other organizations. Even though its budget of $46 million (proposed for FY 2022) is only 3 percent of NSF's Broadening Participation Portfolio,[13] it is providing a unifying framework and a set of expectations for the larger portfolio grounded in research and implementation. Through NSF INCLUDES, the agency is building a national network to connect individuals, institutions, alliances, and other entities to catalyze the STEM enterprise to work collaboratively toward building a STEM workforce that reflects the population of the Nation. NSF INCLUDES is building the infrastructure for sustained broadening participation efforts across the Nation.

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[11] Figure of underrepresented minorities in S&E occupations, by broad occupational category: 2003 and 2017 https://ncses.nsf.gov/pubs/nsb20201/figure/8.

[12] Women, Minorities, and Persons with Disabilities in Science and Engineering report issued in April 2021 https://ncses.nsf.gov/pubs/nsf21321/

[13] NSF's Broadening Participation Portfolio is set forth in its annual budget request to Congress and can be divided into three categories: (1) Focused Programs have broadening participation as an explicit goal of the program, (2) Emphases Programs have broadening participation as one of several emphases, but broadening participation is not an explicit goal of the program, and (3) NSF's Geographic Diversity program, EPSCoR, has geographic diversity as an explicit goal.

Also of special note in this context is the Science of Broadening Participation program. This program draws upon the theories, methods, and analytic techniques of the social, behavioral, economic, and learning sciences to better understand the factors that enhance as well as the barriers that hinder our ability to expand participation in education, the workforce, and major social institutions in society. This is intended to enable educators, employers, and policy makers to make evidence-based decisions, design effective interventions, and create programs that successfully engage diverse groups.

The agency has taken a variety of program and policy approaches to increasing diversity in S&E. While broadening participation is the focus or emphasis of some programs, it is included through the broader impacts criteria, in the review criteria of all NSF proposals for funding. Additionally, some program announcements and solicitations go beyond the standard criteria. They range from encouraging language to specific requirements. Investments range from capacity building, research centers, institutional transformation, partnerships, and alliances to the use of co-funding or supplements to existing awards in the core research programs.

Efforts to increase diversity in science and engineering education and employment have been a hallmark of NSF since its founding. NSF fully recognizes that today these efforts warrant unprecedented urgency given the national and economic security concerns and the global S&E trends set forth by the NSB in the Vision 2030 report. Today's efforts to address this challenge span across every NSF Directorate and Office. NSF also recognizes that the COVID-19 pandemic exacerbated this situation in 2020, having a disproportionate impact on the careers of scientists and trainees from underrepresented groups. NSF appreciates the grand scale of these issues and the pressing need to define all pieces of the challenge within the agency's broad sphere of influence and to address them with speed using all available strategies and programs. To achieve this, NSF's commitment to ensuring accessibility and inclusivity has been embedded as a pillar in the agency's strategic planning process, which will facilitate determining the appropriate focus, scope, and monitoring for NSF's next steps in addressing this challenge.

NSF's Completed Measures to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years

- Embedded Broadening Participation in the NSF Strategic Plan, FY 2018 – 2022, through a variety of investment priorities related to the Learning and Stewardship strategic outcome goals.
- Provided robust funding for Programs to Broaden Participation, with over $1.0 billion provided annually since FY 2018.
- Emphasized the importance of efforts to broaden participation in the guidance and FAQs issued in response to the impact of COVID-19.[14]
- Developed and provided annually to Congress the Report on Funding to Minority-Serving Institutions, as required by the NSF Authorization Act of 2002 (P.L. 107-368).[15]
- Included information on the participation of women, individuals from racial and ethnic groups historically underrepresented in STEM, and persons with disabilities in the annual Report to the National Science Board on the NSF's Merit Review Process.[16]

[14] NSF's Coronavirus Information website can be found at https://www.nsf.gov/news/special_reports/coronavirus/
[15] Annual reports to Congress on Funding to Minority-Serving Institutions may be accessed at https://www.nsf.gov/od/broadeningparticipation/bp_investments.jsp.
[16] Reports on NSF's merit review process may be accessed at https://www.nsf.gov/nsb/publications/pubmeritreview.jsp.

- Established NSF INCLUDES as one of the NSF Big Ideas, with the goal of developing a talented, innovative, and capable STEM workforce that reflects the diversity of the Nation.
- Conducted competitions for NSF INCLUDES funding, which led to:
  a. 70 awards for Design and Development Launch Pilots in FY 2016 and FY 2017
  b. 8 awards for Alliances in FY 2018 and FY 2019
  c. 1 award for the NSF INCLUDES Coordination Hub in FY 2018
  d. 29 awards for Planning Grants in FY 2020
  e. Published two Reports to the Nation on the INCLUDES program and its accomplishments:
     i. The 2018 Report to the Nation: NSF INCLUDES which explored the initial program statistics for the NSF INCLUDES design (NSF 18-040).[17]
     ii. The 2020 Special Report to the Nation II: Building Connections, which highlights the progress of this collective effort to achieve greater diversity in STEM (NSF 20-099).[18]
  f. Issued call for new NSF INCLUDES Alliances (NSF 20-629).
- Convened CEOSE meetings three times per year; receipt of key biennial reports and recommendations.
- Implemented a new award term and condition in October 2018 entitled, "Notification Requirements Regarding Sexual Harassment, Other Forms of Harassment, or Sexual Assault." This term and condition applies to NSF awardee organizations.

Demonstrated Progress Through Agency Actions Taken in FY 2021

- Initiated the agency's response to EO 13985 with the establishment by the NSF Director of the Agency Equity Team (AET), which is leading the agency's Equity Assessment and engaging internal and external stakeholders to address the goals of the EO.
- Released the NCSES 2021 Women, Minorities, and Persons with Disabilities in Science and Engineering report (NSF 21-321).
- Initiated a comprehensive outreach strategy for the 2021 Women, Minorities, and Persons with Disability in Science and Engineering report that is engaging major stakeholders and building awareness within the university and employer communities of the underrepresentation reflected by the data in the report.
- Renamed the Office of Diversity and Inclusion to the Office of Equity and Civil Rights (OECR), which
  supports the agency's goal to advance diversity, equity, inclusion, and accessibility and is responsible for the Diversity and Inclusion (D&I) Program, Equal Employment Opportunity (EEO) Program, Reasonable Accommodations (RA) Program, Alternative Dispute Resolution (ADR) Program, Awardee Civil Rights Compliance Program, and Harassment Notification Term and Condition.
- Reorganized OECR and established three branches: the Equity and Operations Branch (EOB) which is responsible for the D&I Program, ADR Program, civil rights policy and OECR administrative functions; the Awardee Compliance Branch (ACB) which is responsible for the Equal Opportunity (EO) Program, including awardee compliance; and Equal Employment and Accessibility Branch (EEAB) which is responsible for the EEO Program and RA Program. The

[17] The 2018 Report to the Nation: NSF Includes may be accessed at https://www.nsf.gov/news/special_reports/nsfincludes/pdfs/INCLUDES_report_to_the_Nation.pdf.
[18] The 2020 Report to the Nation II: Building Connections may be accessed at https://www.nsf.gov/pubs/2020/nsf20099/nsf20099.pdf.

changes will provide greater focus and separation of functions and responsibilities enabling more effective, efficient, and streamlined processes and procedures.

- Established the NSF Racial Equity Task Force (RETF) to review employment and program delivery policies and practices, determine if there are potential barriers that may hinder racial equity, and identify ways to incorporate recommended initiatives and practices into NSF policies and procedures. The efforts of the task force also serve to operationalize Dr. Panchanathan's vision that discrimination and bias have no place at NSF, in the research community, or any corner of science and engineering. Task force leadership is primarily comprised of NSF executives at the Leadership Team level. The working groups were comprised of a diverse cross-section of 28 NSF employees, representing the full spectrum of employees, to include: permanent, temporary and IPA Staff; all GS levels; supervisory and non-supervisory staff; SES staff and staff from each scientific directorate.
- Expanded the Broadening Participation Portfolio with new funding opportunities: Dear Colleague Letter: Broadening Participation in STEM Entrepreneurship and Innovation (BPINNOVATE – DCL 21-023), Build and Broaden 2.0 (21-542); Launching Early-Career Academic Pathways in the Mathematical and Physical Sciences (LEAP-MPS – 21-570); and NSF Boosting Research Ideas for Transformative and Equitable Advances in Engineering (21-568); DCL (21-110) Persons with Disabilities – STEM Engagement and Access (PWD-SEA); and others.
- Funded several rapid response research grants related to impacts of COVID-19, some of which were directed to Historically Black Colleges and Universities (HBCUs) and Hispanic Serving Institutions (HSIs), or that focused on COVID-19 impacts on students from groups historically underrepresented in STEM.
- Issued new funding opportunities targeted toward populations and institutions disproportionately impacted by the global pandemic, including Racial Equity in STEM Education (EHR Racial Equity) Program Description, Advancing Innovation and Impact in Undergraduate STEM Education at Two-year Institutions of Higher Education Program Description, Dear Colleague Letter: Supplemental Funding for Postdoctoral Researchers to Mitigate COVID-19 Impacts on Research Career Progression, and Dear Colleague: Tribal Colleges and Universities Program STEM Innovative Faculty Support (DCL – 21-096).[19,20,21,22]

[19] More information on the Racial Equity in STEM Education (EHR Racial Equity) Program may be accessed at https://beta.nsf.gov/funding/opportunities/racial-equity-stem-education-ehr-racial-equity.

[20] More information on the Advancing Innovation and Impact in Undergraduate STEM at Two-year Institutions of Higher Education may be accessed at https://beta.nsf.gov/funding/opportunities/advancing-innovation-and-impact-undergraduate-stem-education-two-year.

[21] The Dear Colleague Letter: Supplemental Funding for Postdoctoral Researchers to Mitigate COVID-19 Impacts on Research Career Progression may be accessed at https://www.nsf.gov/pubs/2021/nsf21066/nsf21066.jsp?org=NSF.

[22] The Dear Colleague Letter: Tribal Colleges and Universities Program STEM Innovative Faculty Support may be accessed at https://www.nsf.gov/pubs/2021/nsf21066/nsf21066.jsp?org=NSF.

- Continued long-term strategic investment in NSF broadening participation-focused programs as these programs have broadening participation as an explicit goal. This includes not only our longer-standing programs,[23] but also several new programs such as the Social, Behavioral, and Economic Science Directorate's Build and Broaden program, the Computer and Information Science and Engineering-MSI Research Expansion Program, and Mathematical and Physical Sciences Ascending Post-Doctoral Research Fellowships.
- Convened the Fall 2020 and Spring 2021 meetings of the STEM Education Advisory Panel to assess the progress of the Committee on Science, Technology, Engineering, and Mathematics Education (CoSTEM) in carrying out responsibilities related to the America COMPETES Reauthorization Act and help identify the need or opportunity to update the Federal STEM Education 5-Year Strategic Plan.
- Convened FY 2021 CEOSE meetings (October 2020, February 2021, and June 2021), and received the summer 2021 report, *Making Visible the Invisible*, recommending that NSF demonstrate, support, and reward bold leadership actions to create, integrate, and make visible efforts, promising practices, and impacts within and across its programs to broaden participation of underrepresented groups in STEM.
- Continued strengthening NSF's sexual harassment policies by convening the NSF Sexual Harassment Working Group (SHWG), comprised of OECR, OGC, and Policy Office staff.
- Assessed selected NSF programs to determine the necessity for harassment policies and expanded the harassment notification term and condition to postdoctoral fellowship awards and Small Business Innovation Research (or SBIR) awards.
- Initiated the first phase of an evaluation of the sexual harassment term and condition and conference proposal policy to determine the extent to which these policies are creating positive and lasting change.
- Developed a harassment term and condition FAQ page on the website of OECR, clarifying that the term & condition also applies to other forms of unlawful harassment.
- Initiated action to revise all postdoctoral fellowship solicitations that make awards directly to the individual to stipulate that the fellow must agree to abide by the affiliated institution's policies or codes of conduct and to notify NSF if the fellow is subjected to any "administrative leave/administrative action," or is the subject of any "finding/determination" relating to sexual harassment, other forms of harassment or sexual assault.
- Modified the Small Business Innovation Research and Small Business Technology Transfer solicitation to include language to stipulate that all personnel supported by an NSF award must remain in full compliance with policies and/or codes of conduct, statutes, regulations, or executive orders relating to sexual harassment, other forms of harassment, or sexual assault.
- Completed the review of proposals for additional NSF INCLUDES planning grants and Alliances. Eighteen new planning grants and five new Alliances were funded in FY 2021. The biennial NSF INCLUDES National Network Convening took place, engaging individuals from NSF-funded projects, other federal agencies and allied efforts in interactive presentations and discussions. In addition, the agency is awarding a contract for NSF INCLUDES program-level evaluation services. Conducted an analysis, led by BFA and the OIRM, into participation in NSF programs by HBCUs, which entailed hosting listening sessions with HBCU Office of Sponsored Program staff and

[23] For example, the Historically Black Colleges and Universities – Undergraduate Program (HBCU-UP), including the Excellence in Research Track; the Improving Undergraduate STEM Education – HSI program; the Louis Stokes Alliances for Minority Participation (LSAMP) program; Tribal Colleges and Universities Program (TCUP); Alliances for Graduate Education and the Professoriate; Centers of Research Excellence in Science and Technology (CREST); and the ADVANCE program.

professors. Leveraged available data sources to do quantitative analysis of NSF award data about the state of NSF investment in HBCUs to supplement the qualitative data gathered. Shared findings and recommendations broadly across NSF with senior leadership in program, performance, and agency operations. Evaluated cross-agency input on next steps.

NSF's Ongoing and Planned Actions

NSF management developed the following anticipated milestones in consideration of NSF's strategic and operational objectives and the previous actions NSF has already taken as described above:

- Finalize the strategic framing of efforts to ensure accessibility and inclusivity, in keeping with the agency's response to Executive Order 13985, in the NSF Strategic Plan for FY 2022-2026 and its associated performance activities, with public release scheduled for February 2022.
- Continue action to strengthen the Broadening Participation component of the Broader Impacts criterion, for example, by working externally with the NSF INCLUDES Network and the ARIS (Advancing Research Impact in Society) Center to identify new incentives to encourage current and prospective PIs to visit their websites and utilize available broadening participation resources to strengthen proposals and enhance inclusive implementation/communication strategies.
- Continue the work of the NSF RETF, including planning implementation of the recommendations made. Efforts will also include further barrier analysis to include data challenges.
- Identify, in collaboration with the National Science Board and CEOSE, potential approaches for more consistent reporting of Broadening Participation outcomes by NSF awardees.
- Proceed with the multi-year framework for investments through NSF INCLUDES, as presented in the FY 2022 budget request, with emphasis on supporting research on broadening participation in STEM, developing shared goals and objectives, and continuing to build the NSF INCLUDES National Network.
- Continue comprehensive outreach strategy for the 2021 Women, Minorities, and Persons with Disability in Science and Engineering report that is engaging major stakeholders and building awareness within the university and employer communities of the underrepresentation reflected by the data in the report.
- Continue to examine the challenges of limited data in terms of studying small groups of people who we know are underrepresented in STEM, as well as less studied groups, e.g., sexual orientation/gender identification, who may be underrepresented and would enhance diversity in the S&E workforce.
- Continue to implement post-COVID-19 initiatives, policies, and programs designed to address the lasting and unequal impact of the pandemic on groups and institutions such as minority-serving institutions, two-year institutions and community colleges, and people from groups historically underrepresented in the S&E enterprise.
- Continue implementation work, in alignment with Executive Order 14041 of September 3, 2021, of the BFA/OIRM initiative to strengthen the engagement of HBCUs in NSF's programs, including potentially enabling new research avenues/program offerings for HBCUs, setting aggressive HBCU-focused goals for equity and inclusion, and systematically investing in outreach, training, and post-award compliance support for HBCUs.
- Continue to expand the harassment notification term and condition by updating the upcoming PPAPG to include a term and condition for travel funding proposals.

MANAGEMENT CHALLENGE 6: Mitigating Threats Posed by Foreign Government Talent Recruitment Programs

NSF Lead: Rebecca Keiser, Chief of Research Security Strategy and Policy

Summary of OIG Identified Challenge

NSF, and other agencies that fund basic and advanced research, are facing challenges from foreign government-sponsored talent recruitment programs. These programs — designed to benefit the foreign state's economic development, industry, and national security by obtaining information and technology from abroad — have the potential to exploit the openness of American universities and threaten the integrity of U.S. research initiatives. Talent recruitment programs target individuals with access to, influence over, or expertise in cutting-edge science, including NSF-funded researchers, merit review panelists, and career federal employees or rotators who manage NSF's scientific programs. Some plans have required members to provide information that is proprietary. Failure to properly disclose membership in such programs can also have criminal or civil ramifications. In addition, institutions funded by NSF could be affected by financial constraints driven by the pandemic, which could undermine their ability to identify and manage conflicts of interests, commitment, and affiliation created by researchers' involvement with such programs.

NSF has begun to take action to confront the challenges presented by foreign talent recruitment programs. NSF should continue to assess and refine its controls in this area and should work to ensure that it has sufficient staff and resources to respond to this challenge.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

The National Science Foundation seeks to maintain a vibrant science and engineering community for the benefit of the Nation. Participation in this community relies on individuals to uphold core principles and values such as openness, transparency, reciprocity, collaboration, and integrity. However, open scientific exchange and research face a challenge from some foreign governments through the use of talent recruitment programs. Some of these programs deliberately disregard these core principles and incentivize participants to misappropriate U.S.-funded scientific research prior to its open publication. These programs target scientists, engineers, and educators of all nationalities working or educated in the United States.

Over the past three years, NSF has taken steps to mitigate threats posed by foreign government talent recruitment programs. NSF focuses on the following risks to its funded research from foreign government interference:

- Conflicts of interest that need to be recognized and mitigated by the U.S. employers of the research community;
- Undisclosed research duplication and researcher commitments to research entities outside their U.S. employer;
- Compromises to the merit review system; and
- Unauthorized use of pre-publication data and information.

In recognition of the importance of working closely with the rest of the U.S. government, NSF serves as co-chair of the National Science and Technology Council Subcommittee on Research Security. The

Subcommittee on Research Security brought together science agencies and law enforcement to develop the recommendations that served as the foundation for National Security Presidential Memorandum 33 (NSPM-33).[24] NSPM-33, the Recommended Practices for Strengthening the Security and Integrity of America's Science and Technology Research Enterprise, and the associated fact sheet were released by the White House in January 2021 to direct a national response to safeguard the security and integrity of federally funded research and development (R&D) in the United States.[25] The Subcommittee on Research Security also convened a new Interagency Working Group (IWG) on Disclosure Policies (DP). The objective of the IWG-DP is to provide clarity regarding disclosure requirements (e.g., who discloses what, relevant limitations and exclusions), disclosure process (e.g., updates, corrections, certification, and provision of supporting documentation), and expected degree of uniformity across agencies. NSF also co-chairs this IWG.

On August 10, 2021, Dr. Eric Lander announced that the Biden Administration "is working on how to implement NSPM-33 effectively, rigorously, and uniformly across the federal government in a way that protects the nation's interests in both security and openness."[26]

NSF's Completed Actions to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years

In July 2019, NSF released a Dear Colleague Letter on Research Protection to the research community from then-Director Córdova. The letter alerted the community to existing and emerging risks to the global research ecosystem, inspired conversations about balancing science and security, and warned of the risks of participation in foreign government talent recruitment programs. At the same time, NSF issued a policy prohibiting NSF personnel and rotators such as IPAs detailed to NSF from participating in foreign government talent recruitment programs.[27] This policy helps prevent inappropriate foreign influence on NSF personnel.

In 2019, NSF commissioned a report from the independent JASON advisory group to assess risks to fundamental research. NSF also asked what good practices could be put into place by academic researchers and funding agencies such as NSF to balance the open environment of fundamental research with the needs for national and economic security. In the report – which was made public in December 2019 – JASON provided NSF and awardees with many helpful findings and recommendations to maintain balance between openness and security of science. NSF responded to the report in early

[24] The National Security Presidential Memorandum 33 may be accessed at https://trumpwhitehouse.archives.gov/presidential-actions/presidential-memorandum-united-states-government-supported-research-development-national-security-policy/

[25] Recommended Practices for Strengthening the Security and Integrity of America's Science and Technology Research Enterprise may be accessed at https://trumpwhitehouse.archives.gov/wp-content/uploads/2021/01/NSTC-Research-Security-Best-Practices-Jan2021.pdf. The associated fact sheet is available at https://trumpwhitehouse.archives.gov/wp-content/uploads/2021/01/NSC-OSTP-NSPM33-Fact-Sheet-Jan2021.pdf.

[26] Dr. Eric Lander, President's Science Advisor and Director of the Office of Science and Technology Policy: Clear Rules for Research Security and Researcher Responsibility https://www.whitehouse.gov/ostp/news-updates/2021/08/10/clear-rules-for-research-security-and-researcher-responsibility/.

[27] NSF's Personnel Policy on Foreign Government Talent Recruitment Programs may be accessed at https://www.nsf.gov/bfa/dias/policy/researchprotection/PersonnelPolicyForeignGovTalentRecruitment%20Programs07_11_2019.pdf.

2020, taking actions to mitigate risks, noting where the agency has already taken action, and agreeing with the report's recommendations.[28]

The additional actions that NSF took to ensure the integrity of federally-funded research included demonstrating organizational leadership and oversight. NSF has reprogrammed existing resources to mitigate risks to research security. Specifically, NSF created and filled the first-in-government position of Chief of Research Security Strategy and Policy (CRSSP) in March 2020 – a leadership position which reports to the NSF Director – and the position of CRSSP Chief Data Officer in September 2020. In June 2020, CRSSP launched the Research Security Strategy and Policy Group (RSSPG) which comprises the Chief Officer for Research Facilities, the Director's Chief of Staff, the Head of the Office of Legislative and Public Affairs, the General Counsel, and the Executive Secretary. The RSSPG meets quarterly and as situations arise to advise the Director and the CRSSP on all aspects of research security strategy and policy. In May 2020, CRSSP created the International Collaboration in Large Facilities (ICLF) Team which comprises the Chief Officer for Research Facilities and representatives from the OGC, BFA, and the Office of International Science and Engineering, and reviews potential international collaboration information from major facility managing organizations. CRSSP also meets regularly with the Assistant General Counsel (Ethics) and the Head of the Policy Office in the Division of Institution and Award Support, within BFA to develop policy and training and resolve other issues related to science and security.

NSF coordinated with U.S. government interagency partners, including through the National Science and Technology Council (NSTC) Subcommittee on Research Security, on the development of NSPM-33 which established national security policy for U.S. government-supported R&D, including by outlining specific actions the federal government – including NSF – will take to enhance research security and integrity in the following areas:

- Enhance awareness of research security risks and protections,
- Strengthen disclosure requirements and processes,
- Information sharing,
- Research security training,
- Risk identification and analysis, and
- Promote and protect international R&D cooperation.

Demonstrated Progress Through Agency Actions Taken in FY 2021

Pursuant to NSPM-33 and the recommendations of JASON, NSF took multiple actions in FY 2021, which are summarized here:

- **Chief of Research Security Strategy and Policy (CRSSP):** Teams of experts were assembled in 2020 and 2021 to ensure that NSF has the necessary staff and resources to continue to respond to this challenge. CRSSP has taken on new roles and developed new capabilities to mitigate risks associated with foreign government talent recruitment programs. Importantly, CRSSP also regularly coordinates science and security-related actions with relevant offices across NSF, especially the Office of the Director, the Policy Office in the Division of Institution and Award Support, within BFA, OGC, the Office of International Science and Engineering, and OIG, including through the RSSPG and ICLF Team. CRSSP and relevant offices have set up an "NSF

[28] The report on Fundamental Research Security may be accessed at https://www.nsf.gov/news/special_reports/jasonsecurity/JSR-19-2IFundamentalResearchSecurity_12062019FINAL.pdf. NSF's Response is available at https://nsf.gov/news/special_reports/jasonsecurity/NSF_response_JASON.pdf.

Research Protection Group" email alias to receive and respond to questions from within NSF on issues such as post-award information disclosure and other issues such as how to respond to a PI's request for extended leave to work for a foreign company submitted.

- Enhance awareness of research security risks and protections:
  a. Research security training for NSF staff: In March 2020, NSF released mandatory training for all NSF personnel on science and security. It includes modules on the importance of international collaborations, undue foreign government interference, NSF's policies on disclosure, and NSF's policies on staff participation in foreign government talent recruitment programs. In August 2021, NSF released a second phase of training aimed at staff in positions such as program directors and relevant staff in BFA, that directly communicate with proposer and awardee organizations and principal investigators. This training focuses on new requirements in the proposal process related to submission of "Current and Pending Support" and "Biographical Sketch" by senior personnel. More specifically, the training covers:
     i. The information that is required to be disclosed in the Biographical sketch and Current and Pending Support sections of the proposal;
     ii. How NSF uses the information disclosed in these sections in the merit review process; and
     iii. Assessing information disclosed in the Biographical Sketch and Current and Pending Support sections of the proposal and Post Award Information disclosures.
  b. Research security training for the external community: Beginning in 2020, NSF and the National Institutes of Health (NIH) co-chaired the Research Security Education and Training working under the National Counter-Intelligence Task Force. Together with interagency partners, the co-chairs are coordinating research security training for the external community.
  c. Outreach to the academic community: To increase awareness of the risks and compliance with NSF's policies and procedures, NSF participated in numerous meetings and conferences for the research community, including to the National Academies of Sciences, Engineering, and Medicine (NASEM), National Council of University Research Administrators (NCURA), Council on Governmental Relations, Society of Research Administrators International, National Association of College and University Attorneys (NACUA), Federal Demonstration Partnership, Global Research Council Conference on Responsible Research Assessment, American Association for the Advancement of Science (AAAS) Science Diplomacy Affinity Group, U.S.-China Business Council, as well as to institutions of higher education and Statewide Systems Offices such as the University of Texas, University of California, and University of Virginia systems. NSF also utilizes the NSF Grants Conference to relay this important information to the proposer and awardee community.
  d. Recommended Practices for research organizations: The NSTC released Recommended Practices for Strengthening the Security and Integrity of America's Science and Technology Research Enterprise in January 2021. The 21 recommended practices for enhancing research and security and integrity span five broad categories:
     i. Demonstrate organizational leadership and oversight.
     ii. Establish an expectation of openness and transparency.
     iii. Provide and share training, support, and information.
     iv. Ensure effective mechanisms for compliance with organizational policies.
     v. Manage potential risks associated with collaborations and data.
- Strengthen disclosure requirements and processes:

a. Standardized format and streamlined processes for disclosure: As part of its revision to the Proposal & Award Policies & Procedures Guide (PAPPG), NSF announced that use of an NSF-approved format will be required to be used by senior personnel in preparation of both the biographical sketch and current and pending support sections of the proposal.[29] To streamline the process, NSF worked with the NIH to use SciENcv:Science Experts Network Curriculum Vitae as an NSF-approved format for both sections of the proposal.[30] A separate fillable format also is available for use. A set of Frequently Asked Questions regarding the NSF-approved formats also has been developed to assist users in completion of these electronic formats. The community was required to use an NSF-approved format to prepare these sections of any proposal submitted or due on or after October 5, 2020. In addition, a new table entitled, *NSF Pre-award and Post-award Disclosures Relating to the Biographical Sketch and Current and Pending Support*, has been developed and disseminated to assist users in completion of these sections of the proposal.[31]

b. Submission of Post-award Information: Effective October 2020, NSF has implemented the two new electronic vehicles for submission of post-award updates to current and pending support information:
   i. Issuance of a new award term and condition regarding previously undisclosed information. If an organization discovers that a Principal Investigator (PI) or co-PI on an active NSF award failed to disclose current support or in-kind contribution information as part of the proposal submission process, the Authorized Organizational Representative of the awardee organization must submit the requisite information outlined in the article within 30 calendar days of the identification of the undisclosed current support or in-kind contribution.
   ii. Update of NSF's Annual Project Reporting Format. Effective October 5, 2020, PIs and co-PIs on NSF awards must notify NSF when active other support has changed since the award was made or since the last reporting period. They must include a revised current and pending support document as part of this notification.

- Information sharing:
  a. NSF partners with OIG on incidents.
     i. In FY 2021, NSF greatly increased its collaboration with OIG and Federal Bureau of Investigation to exchange information and take action to address offenses, where appropriate. NSF worked collaboratively with the OIG, where appropriate, to address threats posed by foreign government talent recruitment programs. In 2021, consistent with our OIG Cooperation Directive, NSF continued to support the OIG's investigations, including those involving allegations related to foreign talent programs.
     ii. Following referrals by the OIG, NSF has recouped, or prevented the loss of, millions of taxpayer dollars through actions on awards given to institutions of higher education, and small businesses through NSF award suspension, government-wide suspension, and NSF award termination.

[29] NSF's Proposal & Award Policies & Procedures Guide (PAPPG) may be accessed at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf22001&org=NSF. Additional information on the biographical sketch is available at https://www.nsf.gov/bfa/dias/policy/biosketch.jsp and on the current and pending support is available at https://www.nsf.gov/bfa/dias/policy/cps.jsp.
[30] The SciENcv: Science Experts Network Curriculum Vitae is available at https://www.ncbi.nlm.nih.gov/sciencv/
[31] The NSF Pre-award and Post-award Disclosures table may be accessed at https://www.nsf.gov/bfa/dias/policy/disclosures_table/august2021.pdf.

iii. Following referrals by the OIG, NSF has taken additional actions such as removal of PI from NSF award and NSF debarment from serving as reviewer, panelist, or consultant.

b. Pursuant to Section 115 of the AICA and implementing regulations, NSF reports findings of research misconduct made under its research misconduct regulation (45 C.F.R Part 689) to other "Federal science agencies" as defined in the AICA and consistent with privacy laws and other legal restrictions.

- Risk identification and analysis:
  a. NSF has used an Enterprise Risk Management framework to identity and mitigate risks.
  b. Revised term and condition for foreign collaboration considerations in major facilities: As of October 5, 2020, NSF-funded major facilities must provide NSF with advance notification of potential collaboration with non-U.S. organizations or governments in connection with its NSF-funded award and must await guidance from NSF prior to negotiating terms of any potential agreement.
  c. NSF International Collaboration in Large Facilities (ICLF) Team: This team, which was created in May 2020, is chaired by the CRSSP and includes the Chief Officer for Research Facilities and representatives from OGC, the Office of International Science and Engineering, and BFA. The team reviews the potential international collaboration information from major facility managing organizations in compliance with the new award term and condition and provides the necessary guidance back to the NSF Program Officer based on strategic agency considerations.

NSF has taken a range of actions against individuals and entities associated with foreign talent programs or organizations receiving foreign funding, based on recommendations by the OIG. In many cases, actions were taken based on grant fraud or other wrongful conduct (or allegations thereof) before any foreign affiliation was surfaced to NSF. The types of actions taken include award suspension, award termination, cancellation of final payment, government-wide suspension, debarment, and a ban on serving as a proposal reviewer.

NSF's Ongoing and Planned Actions

NSF will continue to work diligently to address the risks of foreign government interference in NSF-funded research so that our research community can continue to contribute to the U.S. economy and to U.S. security. Ongoing and future actions include:

- Develop a comprehensive action plan to outline next steps the agency will take to further action to address the threats from foreign government interference.
- Continue to serve as co-chair with the NIH of the NSTC Subcommittee on Research Security and work closely with the White House, other federal science funding agencies, and intelligence and law enforcement communities to share information, promote outreach to institutions of higher education and other research organizations, coordinate policy and practices, and implement the NSPM-33 guidance for federal departments and agencies. This includes serving as co-chair of the interagency working group established in May 2021 on disclosure policy under the Subcommittee on Research Security.
- Evaluate recommendations and consider implementing additional policy steps or outreach related to research security at both the agency level and the Subcommittee on Research Security level. Additional activities could include, but are not limited to, those listed below.
- Enhance awareness of research security risks and protections:
  a. Issue a notice from Director Panchanathan to the U.S. research community communicating the continuing threat from foreign government interference and the need for researchers to

disclose all sources of funding and all affiliations to their home organizations and to U.S. federal science agencies. The notice will also communicate the risks of foreign government talent recruitment plans that present the great potential for conflicts of interest and commitment and the research community's responsibility to manage these.

b. Develop a Cooperative Agreement between agencies to support the development of online training (curriculum and technical solutions) to increase the security and integrity of federally funded research by providing a wider knowledge base on the application of new research security measures in the proposal and award process. The goal of the training is to better protect U.S. research interests from both domestic and foreign threats.

c. Continue to provide up-to-date research security training for all staff.

d. Continue to enforce NSF's policy prohibiting NSF personnel and rotators from participating in foreign government talent recruitment programs.

- Strengthen disclosure requirements and processes:
  a. Implement NSF's enhanced pre-award and post-award disclosure requirements regarding preparation of the biographical sketch, and current and pending support information in the FY 2022 PAPPG. NSF's disclosure requirements have been summarized in a new table entitled, *Pre-award and Post-award Disclosures Relating to Biographical Sketch and Current and Pending Support*, originally issued on June 16, and as modified on August 24, 2021.
  b. Evaluate NIH's requirement that key personnel individually certify that the information in current and pending support is accurate and complete; consider whether this model is consistent with NSF's existing authorities and an effective way to comply with the National Defense Authorization Act Section 223: Disclosure of Funding Sources in Applications for Federal Research and Development Awards.
- Information sharing:
  a. Facilitate NSF's access to classified information and ability to engage in classified discussions with other U.S. government agencies more easily, including through the addition of a Sensitive Compartmented Information Facility in NSF's headquarters.
  b. Continue to partner with OIG on incidents.
- Risk identification and analysis:
  a. Continue to ensure adherence to the term and condition for foreign collaboration considerations in major facilities.
  b. Continue with ongoing efforts to enhance threat awareness in the research community, which includes outreach and dialogue with researchers and grants management staff—sharing information and providing resources necessary to protect federally funded research, and referring incidents that cause concern of potential waste, fraud, and abuse to the NSF OIG.

PAYMENT INTEGRITY INFORMATION ACT REPORTING

The Improper Payments Information Act of 2002 (IPIA; Pub. L. 107-300), as amended by the Improper Payments Elimination and Recovery Act of 2010 (IPERA; Pub. L. 111-204), the Improper Payments Elimination and Recovery Improvement Act of 2012 (IPERIA; Pub. L. 112-248), and the Payment Integrity Information Act of 2019 (PIIA; Pub. L. 116-117) require agencies to annually report information on improper payments to the President and Congress. More detailed information on NSF's payment integrity program can be found at https://paymentaccuracy.gov/.

Actions Taken to Address Auditor Recovery Recommendations

Using OMB Circular A-123, Appendix C, Part V.B.2 guidance, NSF determined that it would not be cost effective to conduct recapture audits of its single grants program and other activities (contracts, charge cards, and payments to employees). OMB agreed with NSF's analysis. As such, NSF does not conduct payment recapture audits.

NSF has leveraged the results of the work performed under PIIA, audits, grant monitoring programs, and internal control reviews. All activities consistently demonstrated that there is not a significant risk of unallowable costs or improper payments within NSF's single grant program and other mission support activities. No circumstances have changed within NSF's grant program or its mission support activities requiring NSF to reassess its payment recapture cost-effectiveness analysis.

CIVIL MONETARY PENALTY ADJUSTMENT FOR INFLATION

The Federal Civil Penalties Inflation Adjustment Act Improvements Act of 2015 (the 2015 Act; Sec. 701 of Public Law [P.L.] 114–74) further amended the Federal Civil Penalties Inflation Adjustment Act of 1990 (P.L. 104–410) to improve the effectiveness of civil monetary penalties and to maintain their deterrent effect. The 2015 Act requires agencies to (1) adjust the level of civil monetary penalties with an initial "catch-up" adjustment through an interim final rulemaking and (2) make subsequent annual adjustments for inflation. Inflation adjustments are to be based on the percent change in the Consumer Price Index for all Urban Consumers (CPI-U) for the month of October preceding the date of the adjustment, relative to the October CPI-U in the year of the previous adjustment.

The only civil monetary penalties within NSF's jurisdiction are those authorized by the Antarctic Conservation Act of 1978, 16 U.S.C. 2401, et seq., and the Program Fraud Civil Remedies Act of 1986, 31 U.S.C. 3801, et seq.

The following table identifies NSF's FY 2021 inflation adjustments to civil monetary penalties.

Table 3.3 – FY 2021 Civil Monetary Penalty Adjustment for Inflation

Statutory Authority	Penalty (Name and Description)	Year Enacted	Latest Year of Adjustment (via Statute or Regulation)	Current Penalty Level ($ Amount or Range)	Location for Penalty Update Details
Antarctic Conservation Act of 1978, 16 U.S.C., 2401 *et seq.*, as amended	Antarctic Conservation Act, Knowing violations	1978	2021	$30,107	85 FR 86968 Thursday, December 31, 2020
Antarctic Conservation Act of 1978, 16 U.S.C., 2401 *et seq.*, as amended	Antarctic Conservation Act, Not knowing violations	1978	2021	$17,791	85 FR 86968 Thursday, December 31, 2020
Program Fraud Civil Remedies Act of 1986, 31 U.S.C., 3801, *et seq.*	Program Fraud violations	1986	2021	$11,803	85 FR 86968 Thursday, December 31, 2020

GRANTS PROGRAM REPORTING

OMB's Circular A-136, Financial Reporting Requirements requires agencies with Federal grants programs to submit a high-level summary of expired, but not closed, Federal grants and cooperative agreements (awards). Table 3.4, below, shows the total number of awards and balances for which closeout has not yet occurred, but for which the period of performance has elapsed by two years or more prior to September 30, 2021.

Table 3.4 – Age and Balances for Expired Awards not Closed

CATEGORY	2 – 3 Years	>3-5 years	>5 years
Number of Grants/ Cooperative Agreements With Zero Dollar Balances	424	239	130
Number of Grants/ Cooperative Agreements With Undisbursed Balances	0	0	0
Total Amount of Undisbursed Balances	$0	$0	$0

Information shown above is as of 9/30/2021.

As indicated in the table above, NSF's 793 financial assistance awards (grants, cooperative agreements, and fellowships) that are expired but not closed have zero-dollar balances in NSF's financial accounting system. The majority of these awards that are still not fully closed have overdue final project reports and/or project outcome reports.

In the FY 2020 AFR appendix '*Grants Program Reporting*', NSF reported 61 awards with undisbursed funds. To address this, NSF reviewed operating policies and implemented accounting practices to close all awards on the same schedule, thereby, reducing this number to zero in the above reporting for FY 2021.

NSF works to close out all awards as quickly as possible. Typically, awards are financially closed 120-days after the end-date of the award and are administratively closed automatically once the awards are financially closed. NSF has made progress in decreasing the number of overdue final project reports and/or project outcome reports by implementing policies and procedures to track and enforce the submission of required project reports. Further, in FY 2021, NSF convened a working group to review our current process and make recommendations to tighten our controls. Changes are still being reviewed and assessed.

Overdue report information will be provided by NSF to the Federal Awardee Performance and Integrity Information System, as prescribed in the revised 2 CFR § 200 published in the Federal Register on August 13, 2020,[1] among other possible changes.

[1] https://www.federalregister.gov/documents/2020/08/13/2020-17468/guidance-for-grants-and-agreements

UNDISBURSED BALANCES IN EXPIRED GRANT ACCOUNTS

In FY 2021, NSF funded research and education in science and engineering through grants and cooperative agreements to 1,900 colleges, universities, and other institutions. NSF grants are funded in one of two ways: (1) the grant may be funded fully at the time of award, called a standard grant, or (2) the grant may be funded incrementally (one year at a time), called a continuing grant. In both cases, all costs on the grant must be incurred by the grantee during the term of the grant period. At NSF, grantees typically have 120 days after the grant expires to complete final drawdowns and expenditures.

The information provided here pertains to the agency's two grant making appropriation accounts: Research and Related Activities and Education and Human Resources. The data reported are based on the following definitions:

- An **expired grant** is a grant award that has reached the grant end date and is eligible for closeout. For NSF, this means grants with an expired period of performance.
- **Undisbursed balances** on expired grants are amounts that remain available for expenditure before it is closed out.

Once a grant has expired, NSF takes actions to close out the grant both administratively and financially. The financial closeout action takes place 120 days after the award expiration date when the undisbursed balances are de-obligated from the award. Administrative closeout is initiated after financial closeout is completed.

The methodology used to develop undisbursed balances on expired grant awards is consistent with the U.S. Government Accountability Office (GAO) conclusions documented in their April 2012 report, GAO-12-360, *Grants Management: Action Needed to Improve the Timeliness of Grant Closeouts by Federal Agencies,* along with discussion and clarifying information from GAO. The data reported here reflects the amount of undisbursed balances in grant accounts that have reached their end date and are eligible for closeout and is provided in accordance with OMB M-16-18, *Financial and Performance Reporting on Undisbursed Balances in Expired Grant Accounts*.

1. **In the preceding three fiscal years, the total number of expired grant accounts with undisbursed balances (on the first day for each fiscal year) and the total amount that has not been obligated to specific grant or project remaining in the accounts**
   The number of expired grants with undisbursed balances for the preceding three fiscal years is provided in Table 3.5. The numbers and balances reflect a point in time before expired awards are closed out during normal processes described above. For FY 2021, there were 4,616 expired grants with undisbursed balances of $99,486,778.

Table 3.5 – Status of Undisbursed Balances in Expired Grants

	FY 2021 (as of 9/30/21)	FY 2020 (as of 9/30/20)	FY 2019 (as of 9/30/19)
Number of expired grants	4,616	4,478	5,204
Undisbursed balances prior to closeout	$99,486,778	$84,615,563	$97,666,016

2. **Details on future action NSF will take to resolve undisbursed balances in expired grant accounts**
   NSF continually monitors its grant awards throughout their lifecycle following a comprehensive post-award monitoring process. NSF grants are closed based on their period of performance end date. All unliquidated (or undisbursed) award balances are de-obligated 120 days after the grant period has expired. Having small undisbursed balances at the end of the grant period is a routine occurrence, as not all grantees fully spend the funds obligated during the course of their research.

3. **The method that NSF uses to track undisbursed balances in expired grant accounts**
   NSF completes financial closeout of expired grant awards on a daily basis using a set of automated and manual activities. Eligibility for closeout for all NSF awards begins 120 days after the award expiration date. The NSF closeout process automatically de-obligates any unliquidated award balance, produces an award closeout transaction to flag the award as financially closed, and sends the financial closeout date to NSF's award management system. This initiates final administrative closeout procedures in the award management system.

   The expected award closeout date is made available to awardees and staff through the Award Cash Management Service (ACM$). ACM$ requires the submission of award level payment amounts and expenditures each time funds are requested by awardees and allows NSF to complete post-award monitoring at the individual award level throughout the lifecycle of the award.

4. **Process for identification of undisbursed balances in expired grant accounts that may be returned to the Treasury of the United States**
   When a grant is closed out, the unliquidated balances are de-obligated. The de-obligated grant balances are treated one of three ways:
   - If the source appropriation is still active, the balances are recovered by NSF and remain available for valid new obligations until the source appropriation's expiration date.
   - If the source appropriation has expired but funds have not yet been canceled, the grant balances are recovered by NSF and remain available for upward adjustments on other existing obligations within the source appropriation.
   - If the source appropriation has been canceled, the grant balances are returned to the Treasury.

   Prior to September 30 of each year, all undisbursed grant balances in canceling appropriations are de-obligated and subsequently returned to Treasury.

AWARDS TO AFFILIATED INSTITUTIONS

The following table lists institutions affiliated with members of the National Science Board (NSB) in FY 2021.[1]

Affiliated Institution	Awards Obligated in FY 2021 (Dollars in thousands)
Arizona State University	$74,735
Auburn University	21,487
California Institute of Technology	79,924
Catholic University of America	2,772
Michigan State University	67,294
Southwest Research Institute	418
Stanford University	68,871
University of California, Los Angeles	65,937
University of Colorado	125,345
University of Florida	50,191
University of Massachusetts	51,853
University of Oregon	23,940
University of Tennessee	26,816
University of Texas at El Paso	16,193
University of the District of Columbia	2,357
University of Utah	47,715
University of Vermont	8,164
Washington University	19,837
TOTAL	***$ 753,849***

[1] This information is provided solely in the interest of openness and transparency. The table lists the dollar value of the awards made to institutions affiliated with NSB members during their time on the NSB in fiscal year ended September 30, 2021. NSB establishes the policies of NSF within the framework of applicable national policies set forth by the President and Congress. Federal conflict of interest rules prohibit NSB members from participating in matters where they have a conflict of interest or there is an impartiality concern without prior authorization from the designated agency Ethics Official. Individual NSF grant awards are made pursuant to a peer-review based process and most are not reviewed by the NSB. With regard to matters that are brought to the Board, NSB members are not involved in the review or approval of grant awards to their affiliated institutions. The table displaying Awards to Affiliated Institutions applicable to the previous fiscal year is available in the Appendices at https://www.nsf.gov/pubs/2021/nsf21002/pdf/08-chap3-appendices.pdf. Because of the regular turnover among NSB membership, the information in these tables is not directly comparable across years.

Awards to Assistant Director IPAs' Home Institutions by NSF Directorates

The following tables identify the awards made by directorates to the home institutions of Assistant Directors serving under the Intergovernmental Personnel Act (AD IPAs) during their time at NSF for the fiscal years ended September 30, 2021 and 2020. AD IPAs led five of the seven directorates during the fiscal year ended on September 30, 2021 and September 30, 2020. NSF executive staff formulate directorate or office scientific goals, objectives, and priorities. Federal conflict of interest rules prohibit executives, including IPA detailees who serve in AD positions, from participating in matters where they have a conflict of interest or an impartiality concern. NSF grant awards are made pursuant to a merit-review based process and are not routinely reviewed by IPAs serving in executive positions. If matters are brought to such IPAs, they do not participate in the review or approval of awards to their home institutions. The following tables are provided in the interest of openness and transparency.

Table 3.6 – FY 2021 Awards to AD IPAs' Home Institutions
(Dollars in Thousands)

Directorate	Total Dollars and Awards Made by Directorate in FY 2021[1]	Home Institution of IPA Assistant Director	Total Dollars and Awards to Home Institution by Directorate in FY 2021	Total Dollars and Awards to Home Institution by NSF in FY 2021
Computer & Information Science & Engineering	$1,064,516 (3,188 awards)			
		Princeton University	$12,689 (33 awards)	$70,187 (149 awards)
Engineering	$1,068,240 (3,670 awards)			
		University of Michigan	$4,761 (30 awards)	$93,971 (285 awards)
		Emory University	$715 (4 awards)	$13,681 (38 awards)
Geosciences	$1,573,387 (2,861 awards)			
		Pennsylvania State University	$2,083 (17 awards)	$28,858 (95 awards)
Social, Behavioral, & Economic Sciences	$259,359 (1,240 awards)			
		University of Michigan	$14,122 (26 awards)	$93,971 (285 awards)
Education & Human Resources	$1,115,229 (1,906 awards)			
		Portland State University	$1,546 (5 awards)	$4,268 (20 awards)
Total	$5,080,731 (12,865 awards)		$35,916 (115 awards)	$210,965[2] (587 awards)

[1] Some NSF awards are split funded, meaning an award is funded by two or more directorates. For a split-funded award in this column: the award is counted for each directorate; the award funding is only the split-funded amount.

[2] Two IPAs from the University of Michigan served as ADs during FY 2021. Award dollars and count have been reduced by $93,971 thousand and 285 awards, respectively, in this total box to avoid double counting.

Table 3.7 – FY 2020 Awards to AD IPAs' Home Institutions
(Dollars in Thousands)

Directorate	Total Dollars and Awards Made by Directorate in FY 2020[3]	Home Institution of IPA Assistant Director	Total Dollars and Awards to Home Institution by Directorate in FY 2020	Total Dollars and Awards to Home Institution by NSF in FY 2020
Computer & Information Science & Engineering	$1,018,016 (3,666 awards)	Princeton University	$7,539 (36 awards)	$64,010 (149 awards)
Engineering	$1,022,730 (3,751 awards)	University of Michigan	$20,961 (69 awards)	$120,997 (329 awards)
Geosciences	$1,524,571 (2,569 awards)	Pennsylvania State University	$8,552 (33 awards)	$81,686 (267 awards)
Social, Behavioral, & Economic Sciences	$260,831 (1,387 awards)	University of Michigan	$10,468 (31 awards)	$120,997 (329 awards)
Education & Human Resources	$1,036,508 (1,993 awards)	Portland State University	$497 (2 awards)	$5,779 (28 awards)
Total	$4,862,656 (13,366 awards)		$48,017 (171 awards)	$272,472[4] (773 awards)

[3] Some NSF awards are split funded, meaning an award is funded by two or more directorates. For a split-funded award in this column: the award is counted for each directorate; the award funding is only the split-funded amount.

[4] Two IPAs from the University of Michigan served as ADs during the entire FY 2020. Award dollars and count have been reduced by $120,997 thousand and 329 awards, respectively, in this total box to avoid double counting.

NSF SENIOR MANAGEMENT AND NATIONAL SCIENCE BOARD

NSF Senior Management

(as of September 30, 2021)

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Sethuraman Panchanathan, *Director*
Vacant, *Deputy Director*
Karen Marrongelle, *Chief Operating Officer*
Brian Stone, *Chief of Staff*

O/D Offices

Office of Equity and Civil Rights
Rhonda Davis, *Head*
Affirmative Action Officer

Office of the General Counsel
Peggy Hoyle, *General Counsel*

Office of Integrative Activities
Alicia Knoedler, *Head*

Office of International Science & Engineering
Kendra Sharp, *Head*

Office of Legislative & Public Affairs
Amanda Greenwell, *Head*

Directorate for Biological Sciences
Joanne S. Tornow, *Assistant Director*

Directorate for Computer & Information Science & Engineering
Margaret Martonosi, *Assistant Director*

Directorate for Education & Human Resources
Sylvia Butterfield, *Assistant Director (Acting)*

Directorate for Engineering
Susan Margulies, *Assistant Director*

Directorate for Geosciences
Alexandra R. Isern, *Assistant Director*

Directorate for Mathematical & Physical Sciences
Sean L. Jones, *Assistant Director*

Directorate for Social, Behavioral, & Economic Sciences
Arthur W. Lupia, *Assistant Director*

Office of Budget, Finance, & Award Management
Teresa Grancorvitz, *Head*
Chief Financial Officer
Performance Improvement Officer

Office of Information & Resource Management
Wonzie L. Gardner, Jr., *Head*
Chief Human Capital Officer

Other Designated Senior Officials

Chief Information Officer
Dorothy Aronson (O/D)

Chief Officer for Research Facilities
James S. Ulvestad (O/D)

Chief of Research Security Strategy and Policy
Rebecca S. Keiser (O/D)

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Terms expire May 10, 2022

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Stanford University

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University of Florida

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University of Colorado

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Emilio F. Moran
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Suresh V. Garimella
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Alan Stern
Southwest Research Institute

Stephen H. Willard
Cellphire, Inc.

Maria T. Zuber[1]
Massachusetts Institute of Technology

Terms expire May 10, 2026

Sudarsanam Suresh Babu
Oak Ridge National Laboratory/University of Tennessee, Knoxville

Roger N. Beachy
Washington University, St. Louis

Aaron Dominguez
Catholic University of America, Washington, D.C.

Dario Gil
IBM

Melvyn E. Huff
University of Massachusetts, Dartmouth

Matthew Malkan
University of California, Los Angeles

Scott Stanley
Techno Planet

Heather A. Wilson
University of Texas, El Paso

Vicki L. Chandler[2]
Minerva Schools at KGI

Robert Groves[2]
Georgetown University

Member ex officio

Sethuraman Panchanathan, *NSF Director*

National Science Board Office

John J. Veysey, II, *Executive Officer*

Office of Inspector General

Allison C. Lerner, *Inspector General*

[1] Resigned February 2021
[2] NSB Member whose term expired, but temporarily served as a consultant to the Board until November 2020.

PATENTS AND INVENTIONS RESULTING FROM NSF SUPPORT

The following information about inventions is being reported in compliance with Section 3(f) of the National Science Foundation Act of 1950, as amended [42 U.S.C. 1862(f)]. There were 1,366 NSF invention disclosures reported to NSF either directly or through the National Institutes of Health's iEdison database during FY 2021. Rights to these inventions were allocated in accordance with Chapter 18 of Title 35 of the United States Code, commonly called the "Bayh-Dole Act."

ACRONYMS

ACM$	NSF Award Cash Management Service
AFR	Agency Financial Report
AI	Artificial Intelligence
AICA	American Innovation and Competitiveness Act of 2017
AIMS	Antarctic Infrastructure Modernization for Science
AOAM	Agency Operations and Award Management
APG	Agency Priority Goal
APR	Annual Performance Report
ARP Act	American Rescue Plan Act
ASC	Antarctic Support Contractor
BFA	Office of Budget, Finance and Award Management
CAP	Cross-Agency Priority or Corrective Action Plan
CARES Act	Coronavirus Aid, Relief, and Economic Security Act
CFO	Chief Financial Officers
COVID	Coronavirus
DATA Act	Digital Accountability and Transparency Act of 2014
EHR	Directorate for Education and Human Resources
ERM	Enterprise Risk Management
FBWT	Fund Balance with Treasury
FECA	Federal Employees' Compensation Act
FFMIA	Federal Financial Management Improvement Act of 1996
FFRDC	Federally Funded Research and Development Center
FISMA	Federal Information Security Modernization Act
FMFIA	Federal Managers' Financial Integrity Act of 1982
FPPS	Federal Personnel/Payroll System
FTE	Full-time Equivalents
FY	Fiscal Year
GAAP	Generally Accepted Accounting Principles
GAO	Government Accountability Office
GEO	Directorate for Geosciences
GPRA	Government Performance and Results Modernization Act of 2010
GRFP	Graduate Research Fellowship Program
GSA	General Services Administration
H-1B	H-1B Nonimmigrant Petitioner Account
HBCU	Historically Black Colleges and Universities
IBC	Interior Business Center
IG	Inspector General
INCLUDES	Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science
IPA	Intergovernmental Personnel Act
IR/D	Independent Research/Development
IT	Information Technology
iTRAK	NSF's financial management system
K-12	Kindergarten to Grade 12
LFO	Large Facilities Office
MFG	Major Facilities Guide

MREFC	Major Research Equipment and Facilities Construction
NCSES	National Center for Science and Engineering Statistics
NSB	National Science Board
NSF	National Science Foundation
O/D	Office of the Director
OIG	Office of Inspector General
OMB	Office of Management and Budget
OPM	Office of Personnel Management
OPP	Office of Polar Programs
PAPPG	Proposal and Award Policies and Procedures Guide
PL	Public Law
PP&E	General Property, Plant, and Equipment
R&D	Research and Development
R&RA	Research and Related Activities
RECR	Responsible and Ethical Conduct of Research
RCRV	Regional Class Research Vessels
SAM	System for Award Management
SBIR	Small Business Innovation Research
SBR	Statement of Budgetary Resources
SES	Senior Executive Service
SFFAS	Statement of Federal Financial Accounting Standards
SOG	Standard Operating Guidance
SSAE	Statement of Standards for Attestation Engagements
STEM	Science, Technology, Engineering, and Mathematics
STTR	Small Business Technology Transfer
USAP	U.S. Antarctic Program
USSGL	United States Standard General Ledger