Management Challenges for the National Science Foundation in Fiscal Year 2022

October 13, 2021

NSF

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

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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.

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[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."

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.

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 its action plan to address inequitable barriers in agency policies and programs by January 19, 2022. In response to EO 14020, NSF participates in the White House Gender Policy Council and has submitted input to the Government-wide Gender Strategy. As for EO 14035, required agency deliverables start in FY 2022.

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.

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

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.

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."

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

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.

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.

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.

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

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.

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	Submit self-assessments of Diversity, Equity, Inclusion, and Accessibility (DEIA) practices; agency-specific strategic plans that align with an upcoming Government-wide Strategic Plan; and annual progress reports; create DEIA implementation teams to ensure compliance.

Source: NSF OIG-generated from whitehouse.gov

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

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- 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
- Special Report NSF 21-321, National Center for Science and Engineering Statistics, Women, Minorities, and Persons with Disabilities: 2021, April 2021
- NSB, NSF, The STEM Labor Force of Today: Scientists, Engineers, and Skilled Technical Workers, August 2021
- NSF, An Update on Diversity, Equity, Inclusion, and Accessibility Progress at NSF, August 2021
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- NSB-2020-15, Vision 2030, May 2020

Overseeing the United States Antarctic Program (USAP)
- NSF OIG Report No. 21-2-002, Performance Audit of the National Science Foundation's Information Security Program for FY 2020, November 2020

Overseeing Grants in a Changing Environment
- NSF OIG Report No. 21-6-003, Capstone Report: Observations on the OMB COVID-19 Flexibilities, August 2021
- NSF OIG Report No. 20-6-001, Review of the National Science Foundation CARES Act Spending Plan, May 2020

Overseeing Major Multi-User Research Facilities
- NSF, FY 2022 Budget Request to Congress, May 2021
- NSF OIG Report No. 20-2-007, Audit of NSF's Monitoring of Government-Owned Equipment Purchased on NSF Awards, August 2020
- NSF OIG Report No. 20-2-006, NSF Could Improve Accountability for Its Vehicle Fleet and Recipient-titled Vehicles at Major Facilities, May 2020
- NSF OIG Report No. 19-2-006, Audit of NSF's Controls to Prevent Misallocation of Major Facility Expenses, June 2019

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- GAO, Protecting Federal Research from Foreign Influence, January 2021
- GAO-21-130, Federal Research: Agencies Need to Enhance Policies to Address Foreign Influence, December 2020
- The White House Office of Science and Technology Policy, Enhancing the Security and Integrity of America's Research Enterprise, June 2020

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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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