

A large, stylized gear graphic in shades of blue and grey. The letters 'NSE' are prominently displayed in a bold, serif font across the center of the gear.

NSE

**Management's Discussion
and Analysis**

Chapter 1



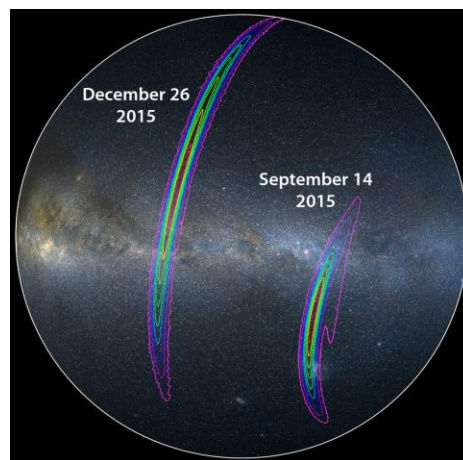
Agency Overview

Mission and Vision

The National Science Foundation was established in 1950 “to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense; and for other purposes.”¹ NSF is the only federal agency responsible for funding nonmedical research in all fields of science, engineering, education, and technology.

For almost seven decades, NSF investments in discovery and learning have helped strengthen our Nation’s security, grow our economy, and maintain our world leadership in innovation. NSF has embraced the challenge of ensuring that scientific discovery and technological breakthroughs continue to expand the boundaries of human knowledge, and its investments have enabled innovations and technologies that address important societal challenges. These discoveries have led us to the internet and solar panels, three-dimensional (3-D) printing, and life-saving drugs. Through research awards approved in FY 2016, NSF-supported scientists are learning how to turn specific chemicals in the brain on and off. This understanding could lead to new methods for diagnosing and treating chronic pain, drug addiction, and neurological diseases. Scientists at the NSF-funded Harvard Materials Research Science and Engineering Center are designing fabrics to improve bullet-proof vests for U.S. troops, while others work to create fibers that can support new nerve tissue as it grows. Engineering researchers funded by NSF have used advances in nanotechnology and imaging techniques to develop a sensor system that detects damage to bridges, dams, and roadways before it is visible. Other researchers were involved in developing computer models to address the complexity, competing objectives, and uncertainty facing municipal government planners who are trying to meet increasing water demand in the southwest, while using less energy and improving water quality. Through the Small Business Innovation Research (SBIR) program, NSF supports research and early-stage development of innovative, high-risk products, processes, and services, such as development of a retinal implant to restore vision to people with age-related macular degeneration. Not all scientific discoveries have an obvious, near-term technological application. Sustained NSF investment in

Gravitational waves detected from a second pair of colliding black holes. In December 2015, almost 3 months after the initial confirmation of the existence of gravitational waves in the universe, the NSF-funded Laser Interferometer Gravitational-Wave Observatory (LIGO) captured a second set of waves from another black hole merger 1.4 billion light years away. For the first time, researchers confirmed that one of the black holes was spinning, indicating that the black hole experienced some dynamic process before the merger. NSF was the initial funder of the LIGO project 40 years ago, and its continued commitment to LIGO’s high-risk, high-reward research now makes possible an entirely new way to observe some of the most energetic events in our universe. This new astrophysical information is changing the way we understand the universe.



Mapping the approximate locations of LIGO detections on a sky map of the southern hemisphere. Credit: Axel Mellinger, LIGO.

¹ National Science Foundation Act of 1950 (P.L. 81–507)

basic research, however, provides a steady pipeline of new ideas and techniques that, together with a highly trained science and engineering (S&E) workforce,² contribute to the health of the Nation's innovation ecosystem. NSF's mission affirms its commitment, through investment in these discoveries, to advancing the frontiers of S&E, ensuring the sustained vigor of both fundamental research and leveraging the Nation's innovation ecosystem to maintain global leadership in the 21st century.

NSF's vision is of a Nation that capitalizes on new concepts in science and engineering and provides global leadership in advancing research and education. NSF's core values articulate the essential qualities that staff are encouraged to embody in support of the agency's mission. Among these core values are a dedication to scientific excellence, learning, stewardship, inclusiveness, and accountability. NSF strives to excel as a federal agency by investing in priorities that address important national challenges while promoting economic growth, innovation, and new scientific advancements. NSF's Strategic Plan, *Investing in Science, Engineering, and Education for the Nation's Future*,³ identifies three interrelated strategic goals to achieving the agency's mission: (1) transform the frontiers of science and engineering, (2) stimulate innovation and address societal needs through research and education, and (3) excel as a federal science agency. These strategic goals represent a roadmap for NSF's success. A detailed discussion of NSF's Strategic Plan can be found in the Performance section, beginning on page MD&A-11.

NSF is the funding source for 24 percent of all the federally supported basic scientific research conducted by America's colleges and universities, and this share increases to nearly 60 percent when medical research supported by the National Institutes of Health is excluded.⁴ NSF promotes scientific progress and advances scientific frontiers by making awards and managing award portfolios of the highest quality. NSF awards reflect national priorities, keep U.S. researchers and research institutions at the forefront of innovation, and distinguish the United States as a leader in the rapidly changing global landscape of scientific research and discovery. In doing so, NSF pursues transformational work, new fields of scientific inquiry, and new theoretical paradigms. Increasingly, NSF awards are made where scientific disciplines converge, which reflects the increasingly interdisciplinary nature of modern science and engineering.

Foldable robots for the clinic. Retrieving a tiny button battery from a child's stomach is challenging, yet every year 3,500 button batteries are swallowed in the U.S. If left in the body, ingested batteries can burn the digestive track. To give doctors an option other than surgery, NSF-funded researchers at the Massachusetts Institute of Technology (MIT) have developed a tiny foldable robot the size of a small pill. Once swallowed, the robot unfolds and moves toward its target via external magnetic field. Besides foreign object retrieval, similar devices can patch wounds and deliver medicine. After completing their mission, the robots dissolve. The researchers plan to redesign the robot, adding sensors so that it can control itself rather than relying on external manipulation.



NSF-funded researchers have developed an origami robot that folds into an ingestible capsule. Credit: Melanie Gonick, MIT.

² For more information on the state of the Nation's S&E workforce, see *Revisiting the STEM Workforce: A Companion to Science and Engineering Indicators 2014*: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsb201510

³ NSF's Strategic Plan: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf14043

⁴ NSF, National Center for Science and Engineering Statistics. *Survey of Federal Funds for Research and Development Fiscal Years 2014–16*. <https://ncesdata.nsf.gov/fedfunds/2014/>

A cornerstone of NSF investment in the development of a world-class workforce is the Graduate Research Fellowship Program, which has funded nearly 53,800 Graduate Research Fellows since 1952. The ranks of NSF fellows include numerous individuals who have made transformative breakthroughs in science and engineering research. Many of them have become leaders in their chosen careers—over 450 have become members of the National Academies of Sciences or Engineering, and 40⁵ have been honored as Nobel laureates. 223 Nobel Prize winners have received NSF support at some point in their careers. These investments are a critical means by which NSF identifies, nurtures, and invests in scientific potential.

For nearly seven decades, NSF has supported basic research and education across all fields of science and engineering. NSF's investments seamlessly connect research and education to support the development of a world-class scientific workforce that can engage fully and contribute imaginatively in the 21st century, as leaders increasingly rely on technology to meet challenges, identify possibilities, and leverage opportunities. NSF's sustained support cultivates scientists and engineers who are able to transcend the laboratory and contribute to the 21st century S&E enterprise at the leading edge of scientific discovery. The scientific discoveries of today, in turn, become the foundation of our Nation's future—contributing to the Nation's health, prosperity, and well-being while inspiring new and more diverse generations of Americans to explore the scientific frontiers of tomorrow.

Following the Money

NSF is funded primarily through congressional appropriations to six accounts: Research and Related Activities (R&RA), Education and Human Resources (EHR), Major Research Equipment and Facilities Construction (MREFC), Agency Operations and Award Management (AOAM), National Science Board (NSB), and Office of Inspector General (OIG). Appropriations in these six accounts in FY 2016 totaled \$7,463 million,⁶ an increase of \$119 million, or almost 2 percent, over the FY 2015 appropriations level of \$7,344 million. R&RA, EHR, and MREFC appropriations fund the agency's programmatic activities and accounted for 95 percent of NSF's total appropriations in FY 2016. Figure 1.1 provides details on NSF's FY 2016 appropriations.

Early detection of dyslexia. Between 10 percent and 17 percent of the U.S. population suffers from dyslexia. With early detection and quick intervention, however, researchers can more effectively help and treat dyslexic children. In studying the brain activity of children as they read, an NSF-funded researcher at New York's Binghamton University has discovered a way to predict early on which children will have reading disabilities such as dyslexia. This earlier detection allows caregivers to intervene at a crucial stage and design treatment plans to help children become successful readers. The researcher is currently developing a screening test able to identify a reading problem a full 2 years before it emerges, leaving time for effective intervention.

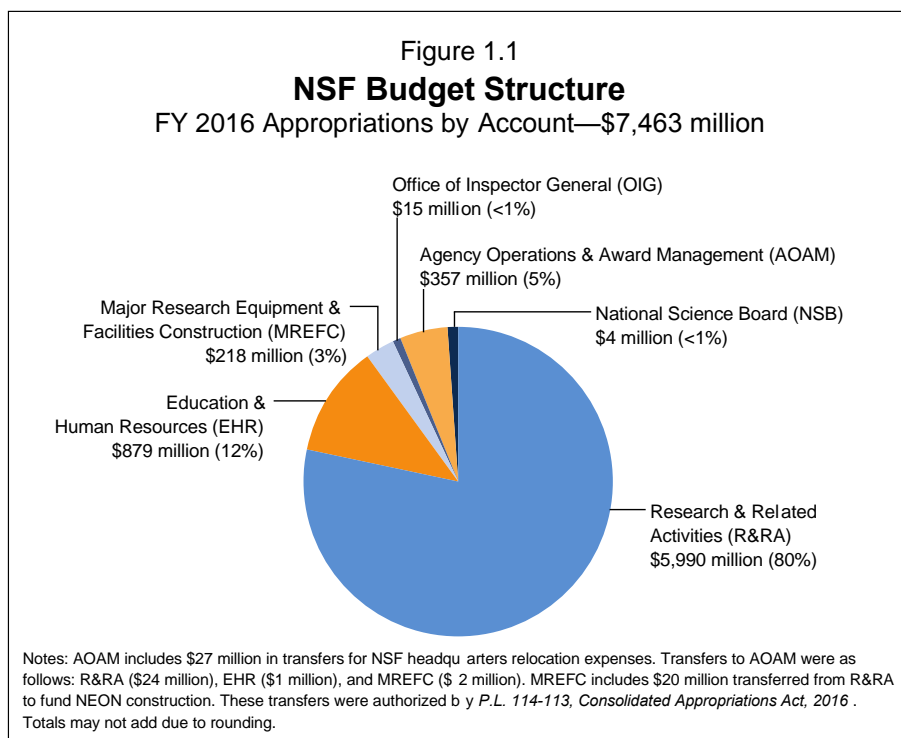
The same brain research may also have applications in security and identification verification, as researchers study whether brain signatures can act as a brain-based biometric.



Credit: Sarah Laszlo, Binghamton University.

⁵ 43 Nobel laureates were awarded the NSF Graduate Research Fellowship; 40 were fellows.

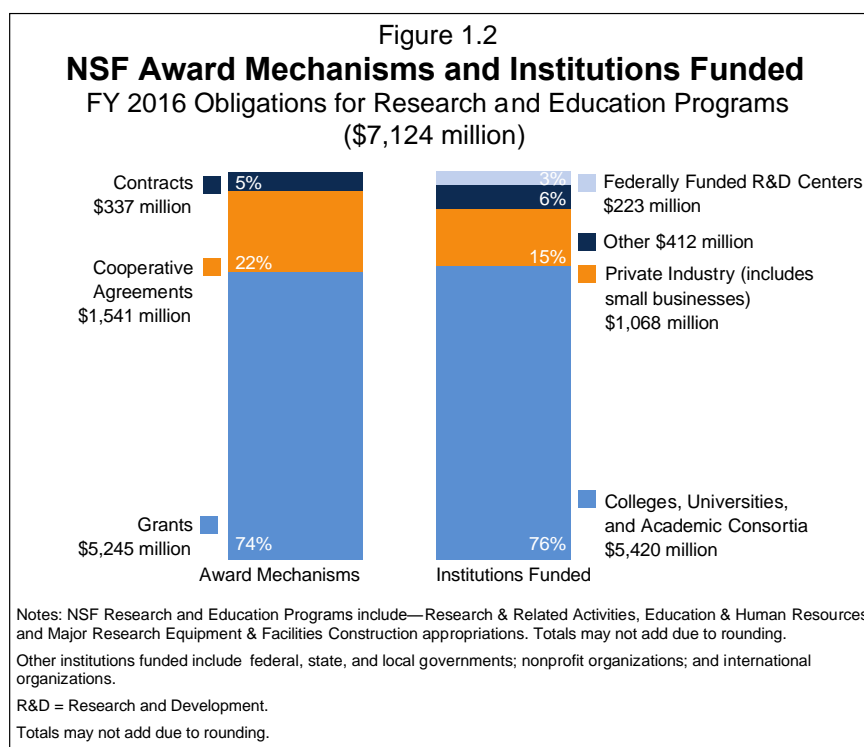
⁶ FY 2016 appropriations of \$7,463 million plus Donations (\$24.4 million) plus H1-B Nonimmigrant Petitioner Receipts (\$139.3 million) equal Appropriations (Discretionary and Mandatory) of \$7,627 million, as shown in the Statement of Budgetary Resources.



- R&RA, which supports basic research and education activities at the frontiers of science and engineering, including high-risk and transformative research, accounted for 80 percent of FY 2016 funding. The FY 2016 R&RA funding level of \$5,990 million was \$56 million, approximately 1 percent, above the FY 2015 appropriation of \$5,934 million.
- EHR, which supports activities that ensure a diverse, competitive, and globally engaged U.S. science, technology, engineering, and mathematics (STEM) workforce and a scientifically literate citizenry is NSF's second largest appropriation, accounting for about 12 percent of the agency's budget. EHR's FY 2016 funding level of \$879 million was \$13 million, approximately 2 percent, above the FY 2015 EHR appropriation of \$866 million.
- The MREFC appropriation supports the construction of unique national research platforms and major research equipment that enable cutting-edge research. This account was 3 percent of the agency's total appropriations in FY 2016. The FY 2016 MREFC funding level of \$218 million increased almost \$18 million, or 9 percent, over the prior year appropriation of \$201 million. This increase reflects the transfer of \$20 million in R&RA funds to provide additional support for the National Ecological Observatory Network (NEON) construction project.
- FY 2016 AOAM funding, \$357 million, supports NSF's administrative and management activities. AOAM was approximately 5 percent of NSF's total FY 2016 appropriations. AOAM increased \$32 million, 10 percent, from the FY 2015 level of \$325 million. This includes \$27 million from the R&RA, EHR, and MREFC accounts to support the upcoming relocation of NSF's headquarters to Alexandria, Virginia.
- Separate appropriations support the activities of the OIG and the NSB; each accounted for less than 1 percent of NSF's total FY 2016 appropriations. The FY 2016 OIG appropriation of \$15.1 million increased \$730,000, 5 percent, over the prior year appropriation of \$14.4 million. NSB received an appropriation of \$4.4 million in FY 2016, equal to the previous year's funding level.

- In FY 2016, 90 percent of research funding was allocated based on competitive merit review.⁷ Over 34,000 members of the science and engineering community participated in the merit review process as panelists and proposal reviewers.⁸ Awards were made to 1,883 institutions in 50 states, the District of Columbia, and 3 U.S. territories. These institutions employ America's leading scientists, engineers, and educators; and they train the leading innovators of tomorrow. In FY 2016, over 362,000 people were directly involved in NSF programs and activities, receiving salaries, stipends, participant support, and other types of direct involvement. Beyond these figures, NSF programs indirectly impact millions of people, reaching K-12 students and teachers, the general public, and researchers through activities including workshops; informal science activities such as museums, television, videos, and journals; outreach efforts; and dissemination of innovative curricula and teaching methods.

In FY 2016, NSF funded 11,893 new awards, mostly to academic institutions. As shown in Figure 1.2, 76 percent of support for research and education programs (\$5,420 million) was to colleges, universities, and academic consortia. Private industry, including small businesses, accounted for 15 percent (\$1,068 million), and support to Federally Funded Research and Development Centers (FFRDCs) accounted for 3 percent (\$223 million). Other recipients (\$412 million) included federal, state, and local governments; nonprofit organizations; and international organizations. A small number of awards fund research in collaboration with other countries, which adds value to the U.S. scientific enterprise and maintains U.S. leadership in the global scientific enterprise.



As shown in Figure 1.2, NSF's award funding was primarily through the use of grants and cooperative agreements. Grants can be funded either as standard awards, in which funding for the full duration of the

⁷ NSF does not require external merit review for certain kinds of proposals, including contracts and awards to FFRDCs, proposals for international travel grants and some conferences, symposia, and workshops.

⁸ For more information about NSF's merit review process, see https://www.nsf.gov/bfa/dias/policy/merit_review/ and *Report to the National Science Board on the National Science Foundation's Merit Review Process, FY 2015* (NSB-2016-41) at <https://www.nsf.gov/publications/ods/results.jsp?TextQuery=nsb201641>.

project is provided in a single fiscal year, or as continuing awards, in which funding for a multiyear project is provided in increments. Cooperative agreements are used when the project requires substantial agency involvement during the project performance period (e.g., research centers, multi-use facilities). Contracts (procurement instruments) are used to acquire products, services, and studies (e.g., program evaluations) required primarily for NSF or other government use.

Organizational Structure

NSF is an independent federal agency headed by a Director who is appointed by the President and confirmed by the U.S. Senate.⁹ The Director and the 24-member National Science Board (NSB) jointly pursue the goals and function of NSF, including the duty to “recommend and encourage the pursuit of national policies for the promotion of research and education in science and engineering.”¹⁰ The NSB identifies issues critical to NSF’s future and helps chart the strategic direction of NSF’s budget and programs. The Board also serves as an independent body of advisors to both the President and the Congress on policy matters related to S&E and education in S&E. NSB members are appointed by the President and are prominent contributors to the S&E research and education community.¹¹ NSF’s Director is a member *ex officio* of the Board. The Director and the other NSB members serve 6-year terms.

The NSF workforce includes nearly 1,400 permanent staff.¹² NSF also regularly recruits visiting scientists, engineers, and educators as rotators who work at NSF for up to 4 years.¹³ Rotators bring fresh perspectives from across the country and across all fields of S&E supported by the Foundation, helping explore new directions for research in science, engineering, and education, including emerging interdisciplinary fields. As shown in Figure 1.3, NSF’s organizational structure aligns with the major fields of S&E.¹⁴

In addition to the agency’s headquarters located in Arlington, Virginia, NSF maintains offices in Brussels, Belgium, Tokyo, Japan, and Beijing, China, to facilitate its international activities and an office in Christchurch, New Zealand, to support the U.S. Antarctic Program (USAP). NSF is scheduled to relocate its headquarters from Arlington to Alexandria, Virginia, in 2017.

⁹ The Director’s biography is available at www.nsf.gov/news/speeches/cordova/cordova_bio.jsp.

¹⁰ 42 U.S. Code 1862(d): <https://www.law.cornell.edu/uscode/text/42/1862>

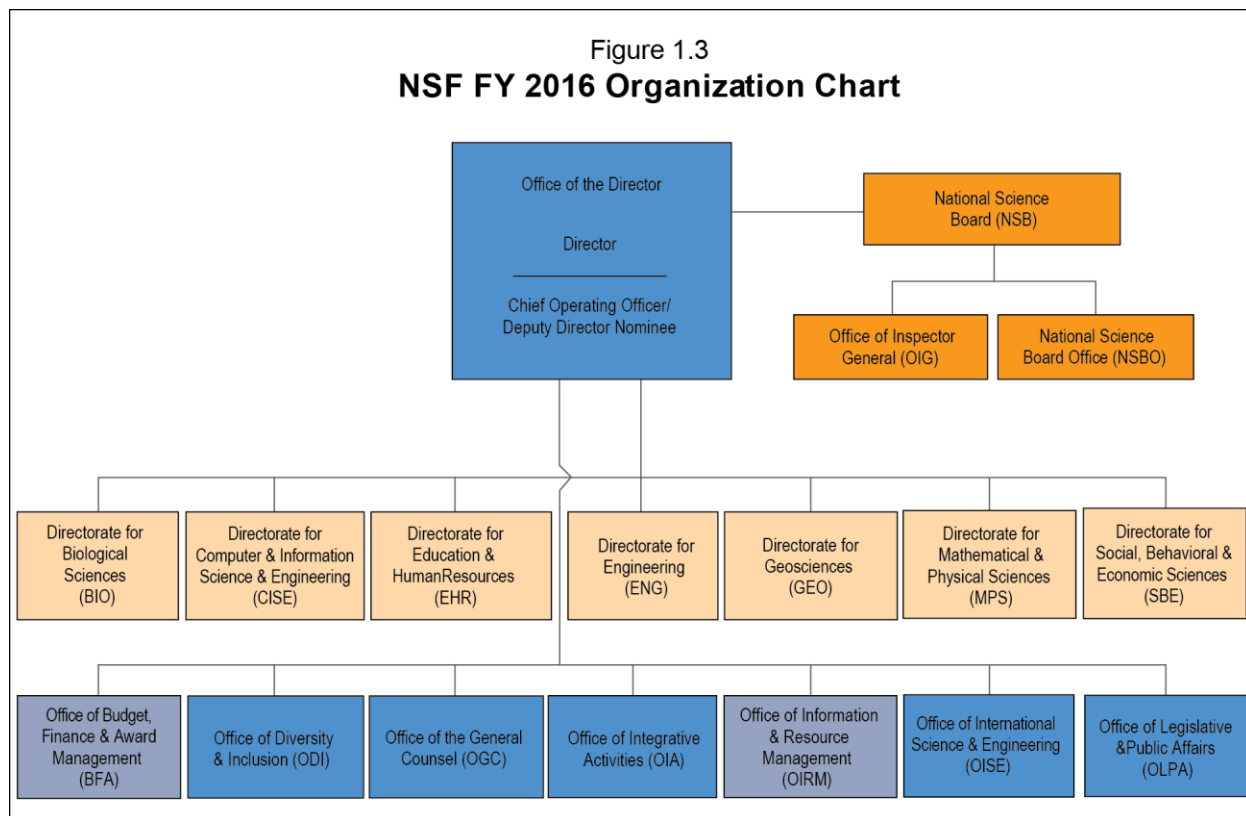
¹¹ A list of NSB members is available at <https://www.nsf.gov/nsb/members/>.

¹² Full-time equivalents (FTE).

¹³ As of September 30, 2016, temporary appointments included 183 under the Intergovernmental Personnel Act (IPA) Mobility Program.

¹⁴ NSF’s organization chart is available at: https://www.nsf.gov/staff/organizational_chart.pdf.

Figure 1.3
NSF FY 2016 Organization Chart



Management Challenges

In October 2015, the OIG identified seven major management and performance challenges for the agency for FY 2016: (1) establishing accountability over large cooperative agreements, (2) management of NSF's business operations, (3) management of the Intergovernmental Personnel Act (IPA) program, (4) moving NSF headquarters to a new building, (5) management of the USAP, (6) improving grant administration, and (7) to encourage the ethical conduct of research.¹⁵

Management's report on the significant activities undertaken in FY 2016 to address these challenges is located in *Appendix 3B: Management Challenges—NSF Response* of this Agency Financial Report (AFR). The report also discusses activities planned for FY 2017 and beyond. Some of these significant actions and planned next steps to address the challenges are highlighted below:

Establishing Accountability over Large Cooperative Agreements

NSF has been continuously enhancing its pre- and post-award oversight of large facilities cooperative agreements since June 2014. These enhancements are included in the latest revision of the Large Facilities Manual (LFM)¹⁶ and internal Standard Operating Guidance. To build on these improvements, in FY 2016, the agency carefully analyzed the December 2015 report and recommendations of the National Academy of Public Administration (NAPA).¹⁷ NSF agrees with the spirit of all the recommendations, has accommodated many of them, and will continue addressing the remainder of the NAPA recommendations in FY 2017. In FY 2016, NSF took actions to bolster research infrastructure oversight, enhance project

¹⁵ The NSF Inspector General's memorandum on Management Challenges for NSF in FY 2016 is in NSF's *FY 2015 Agency Financial Report* Appendix 3A, <https://www.nsf.gov/publications/ods/results.jsp?TextQuery=nsf16002>

¹⁶ Large Facilities Manual: https://www.nsf.gov/bfa/lfo/docs/LargeFacilitiesManual2016Final_Draft_12.23.2016.pdf

¹⁷ *National Science Foundation: Use of Cooperative Agreements to Support Large Scale Investment in Research* http://napawash.org/images/reports/2015/NSF_Phase_2_Comprehensive_Report.pdf.

management expertise, and ensure that NSF's large research infrastructure policy and procedures are followed. For example, the Foundation: (1) hired additional staff in the Large Facilities Office, (2) developed certification and training for NSF staff engaged in large facilities oversight, and (3) drafted internal control testing and other oversight mechanisms. To ensure reasonable costs for large facility projects, NSF rolled out internal NSF operating guidance on the obligation and allocation of budget contingency; further improved management controls by implementing contract mechanisms to support independent cost estimate reviews, per U.S. Government Accountability Office (GAO) practices and procedures; and developed a tool for large facility award recipients that will support awardees in audit readiness. In March 2016, NSF strengthened management of NEON, completing the process for selecting a new managing organization for the NEON project, Battelle Memorial Institute. The turnaround of the NEON project reflects NSF's quick action to restore confidence in the oversight of a major scientific facility and to ensure sound financial and technical oversight in bringing the construction portion of the project to completion. Going forward, NSF plans to develop operating guidance in such areas as: (1) Earned Value Management System verification/validation reviews; and (2) implementing training, certification, and core competency standards for NSF staff engaged in large facilities oversight.

Management of NSF's Business Operations

- *Improper payments*—NSF resolved the FY 2015 audit report finding of noncompliance with the Improper Payments Elimination and Recovery Act (IPERA) reporting requirements. In addition, NSF submitted a corrective action plan (CAP) to address the audit findings. In August 2016, the OIG reviewed the CAP and found it responsive to OIG recommendations. To further assess the agency's risk of improper payments, NSF completed a policy and procedure document for future IPERA risk assessments. NSF will complete future IPERA risk assessments on a 3-year cycle and report results in FY 2018.
- *Information & Information Technology (IT) resources*—NSF has been proactive in reviewing security controls and identifying areas to strengthen the program, including the appropriate allocation of USAP resources for IT security. The agency will continue to address identified IT security weaknesses through program funding.
- *Transparency & accountability*—NSF is well-positioned to successfully implement the Digital Accountability and Transparency (DATA) Act requirements to publish financial management, procurement, and financial assistance data. NSF has successfully submitted test files, revised reporting based on final technical guidance from Treasury. If financial system patches cannot be implemented on time, NSF has developed a contingency plan to still meet the DATA Act deadline by May 2017.
- *Government records*—In November 2015, NSF submitted a CAP to address a GAO report finding that agencies needed to take action to meet the requirements of a National Archives and Records Administration's directive. The directive required agencies to reform policies and practices relating to records management and to provide a framework for the management of electronic records. NSF deployed a permanent, electronic grant records system in February 2016. In the near future, NSF will formalize plans to manage other types of records and ensure execution of a comprehensive plan to manage permanent records electronically.

Management of the IPA Program

Through the IPA program, NSF provides the opportunity for scientists, engineers, and educators to rotate into the agency as temporary Program Directors, advisors, and leaders. NSF's IPA Steering Committee was established in April 2016 to oversee the ongoing implementation of the program. This summer, the steering committee submitted reports to the NSF Director providing recommendations on managing IPA costs and developing an integrated workforce framework. The committee also worked on developing strategic principles for managing the IPA program. In the upcoming year the committee will address IPA

policies, establish a framework for oversight of the program, and coordinate the development of budget guidelines for the IPA program.

Moving NSF Headquarters to a New Building

In FY 2016, the NSF Relocation Office made significant progress in reducing risk related to scheduling delays, union negotiations, and records management. In August 2017, NSF will begin to relocate staff from Arlington to Alexandria, Virginia.

Management of the USAP

NSF continued progress on the 2012 Blue Ribbon Panel (BRP) recommendations.¹⁸ In FY 2016, the agency addressed major infrastructure upgrades for McMurdo Station through continued design effort to: (1) prepare for the Antarctic Infrastructure Modernization for Science (AIMS) project's preliminary design review; (2) upgrade McMurdo lodging, Vehicle/Equipment Operations Center, and Information Technology and Communication Primary Operations Center; and (3) replace the Palmer Pier. In the coming year, NSF expects to complete planning and design efforts for many of these projects, as well as prepare for the next phase in the AIMS project, and continue to take steps to ensure the overall health and safety of USAP participants.

Improving Grant Administration

NSF employs a multi-pronged approach to accountable grants administration: (1) a suite of policy and procedural documents that incorporate federal regulations and agency-specific requirements, (2) IT system business rules to enforce policies and procedures, and (3) a risk-based approach to financial and administrative monitoring. NSF continues to expand and upgrade mechanisms for communicating policies, procedures, and business practices to staff and external stakeholder communities. Activities in FY 2016 focused on ensuring transparency and accountability, streamlining written guidance for administering grants, and enhancing oversight of pre- and post-award activities. In FY 2017, NSF will continue its implementation of monitoring and spending controls; keep refining guidance and leveraging outreach opportunities; and assess and manage risk, as appropriate.

Early-career astronomers detect new worlds. Two early-career researchers added two more exoplanets to the trove of nearly 3,000 exoplanets now known to exist. A first-year graduate student from the University of Arizona supported by NSF's Graduate Research Fellowship Program (GRFP) detected—and directly imaged—a planet in a multi-star system 340 light years from Earth. Estimated to be 16 million years old, the exoplanet is among the youngest discovered. Another GRFP-supported graduate student leading a team at Caltech also detected *the* youngest-known, fully formed exoplanet, aged between 5 million and 10 million years old. Both exoplanet discovery teams included additional members currently and formerly supported by NSF's GRFP. The discoveries of these and other exoplanets help scientists better understand the life cycles of planetary systems, including our own.



Artist's impression of a planet in a triple-star system discovered by a University of Arizona team. Credit: L. Calçada, ESO.

¹⁸ U.S. Antarctic Program Blue Ribbon Panel Report: https://www.nsf.gov/geo/plr/usap_special_review/usap_brp/rpt/index.jsp.

To Encourage the Ethical Conduct of Research

NSF recognizes the importance of ethical conduct of research and requires each institution that submits a proposal to certify it has a plan to provide appropriate training and oversight in the ethical conduct of research to all undergraduates, graduate students, and postdoctoral researchers involved in NSF-supported

Ancient monkey fossil provides insights into biological history of the Americas. In Panama, researchers funded by NSF's Partnerships in International Research and Education program unearthed a 21 million-year-old monkey fossil that upends conventional thinking about when and how species dispersed from South America to North America. Scientists previously thought species used a 4 million-year-old land bridge, called the Isthmus of Panama, to move between continents. The discovery of the ancient fossil (closely related to living South American monkeys) on the North American landmass, however, suggests the species moved northward long before the land bridge formed—nearly 17 million years earlier. The fossil was found during the expansion of the Panama Canal, which exposed fossil-bearing rock strata for the first time.



Photograph of the upper molar of 21 million-year-old *Panamacebus*, the first-ever fossil evidence for monkeys recovered from the North American landmass. Credit: Aldo Rincon, Florida Museum of Natural History.

research. Further, NSF has taken concrete steps, including funding the major relaunch of the Online Ethics Center website in February 2016, to enhance awareness of ethical conduct of research issues by supporting the development of tools and resources that enhance the ability of research institutions to cultivate cultures of academic and research integrity. As in previous years, in FY 2016, NSF's Cultivating Cultures for Ethical STEM (CCE STEM) invested in innovative approaches to foster ethical STEM research in all of the fields of S&E that NSF supports, including within interdisciplinary, inter-institutional, and international contexts. NSF will continue to fund CCE STEM research projects that use basic research to identify what constitutes responsible or irresponsible, just or unjust scientific practices and sociotechnical systems, and how to best instill students with this knowledge. In FY 2017, NSF will issue an NSF Dear Colleague Letter emphasizing the importance of the responsible and ethical conduct of research. The agency will continue to take steps to support and share research that provides answers and best practices for ethical STEM communities.

Performance

This discussion of NSF's FY 2016 performance management activities focuses on the agency's efforts related to the Government Performance and Results Act of 1993 (GPRA) and the GPRA Modernization Act of 2010¹⁹ and on the agency's management metrics.

In FY 2016, NSF took steps toward developing an enterprise risk management (ERM) framework to identify, assess, respond, and report on risks. NSF's ERM process will provide valuable, enterprise-wide information to assist leadership and managers to make sound decisions, alleviate threats, and identify opportunities to accomplish NSF's mission and objectives. NSF plans to implement ERM by taking incremental steps, leveraging existing resources, and building on its current risk management practices. The agency's aim is to integrate ERM within its key organizational processes such as strategic planning, budgeting, and performance management.

FY 2016 Strategic Framework

NSF is subject to GPRA and the GPRA Modernization Act of 2010, as well as related performance reporting guidance issued by the Office of Management and Budget (OMB).²⁰ NSF's Strategic Plan, *Investing in Science, Engineering, and Education for the Nation's Future*,²¹ lays out the following strategic goals:

- The first mission-focused goal, *Transform the Frontiers of Science and Engineering*, derives from the first part of NSF's mission, "to promote the progress of science" in order to expand and explore the frontiers of human knowledge; to enhance the ability of the Nation to meet the challenges it faces; and to create new paradigms and capabilities for scientific, technological, and (consequently) economic leadership in an increasingly fast-paced, competitive world.
- The second mission-focused goal, *Stimulate Innovation and Address Societal Needs through Research and Education*, flows from the latter part of the NSF mission statement—"to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." Through targeted solicitations and core programs, NSF is able to focus the attention of the broader science and engineering community on fundamental aspects of high-priority national challenges.
- The management-focused goal, *Excel as a Federal Science Agency*, directs NSF to integrate its mission, vision, and core values to efficiently and effectively execute its activities, and to provide the flexibility and agility required to meet the quickly evolving challenges associated with the first two strategic goals.

These three strategic goals are addressed through seven specific objectives. Objectives are intended to be comprehensive of agency program activities. Progress toward these objectives is monitored through annual performance goals (seven goals in FY 2016) and Strategic Reviews (see next section).

¹⁹ GPRA: <https://www.whitehouse.gov/omb/mgmt-gpra/index-gpra>.

²⁰ OMB Circular A-11, *Preparation, Submission, and Execution of the Budget*, Part 6: https://www.whitehouse.gov/omb/circulars_a11_current_year_a11_toc.

²¹ NSF Strategic Plan: https://www.nsf.gov/about/performance/strategic_plan.jsp.

NSF 2014–2018 Strategic Goals

Strategic Goals	Strategic Objectives
G1: Transform the Frontiers of Science and Engineering	O1: Invest in fundamental research to ensure significant continuing advances across science, engineering, and education. O2: Integrate education and research to support development of a diverse STEM workforce with cutting-edge capabilities. O3: Provide world-class research infrastructure to enable major scientific advances.
G2: Stimulate Innovation and Address Societal Needs through Research and Education	O1: Strengthen the links between fundamental research and societal needs through investments and partnerships. O2: Build the capacity of the Nation to address societal challenges using a suite of formal, informal, and broadly available STEM educational mechanisms.
G3: Excel as a Federal Science Agency	O1: Build an increasingly diverse, engaged, and high-performing workforce by fostering excellence in recruitment, training, leadership, and management of human capital. O2: Use effective methods and innovative solutions to achieve excellence in accomplishing the agency's mission.

In addition, NSF set two Agency Priority Goals for FY 2016–FY 2017 to monitor progress in specific areas in where near-term focus can impact the Nation. In FY 2016, NSF continued its practice of having agency leaders conduct quarterly data-driven performance reviews for each of the Agency Priority Goals. NSF also participates actively in Cross-Agency Priority Goals relevant to its mission.

NSF FY 2016–FY 2017 Priority Goals

Type of Goal	Goal Header	Goal Statement
Agency Priority Goal	Improve Graduate Student Preparedness	Improve STEM graduate student preparedness for entering the workforce. By September 30, 2017, NSF will fund at least three summer institutes and 75 supplements to existing awards to provide STEM doctoral students with opportunities to expand their knowledge and skills to prepare themselves for a range of careers.
	Invest Strategically in Public Participation in STEM Research	Build the capacity of the Nation to solve research challenges and improve learning by investing strategically in crowdsourcing and other forms of public participation in science, technology, engineering, and mathematics research (PPSR). By September 30, 2017 NSF will implement mechanisms to expand and deepen the engagement of the public in STEM research.
Cross-Agency Priority Goals	STEM Education	Improve science, technology, engineering and mathematics (STEM) education by implementing the federal STEM Education 5-Year Strategic Plan, announced in May 2013, specifically: <ul style="list-style-type: none"> • Improve STEM instruction. • Increase and sustain youth and public engagement in STEM. • Enhance STEM experience of undergraduate students. • Better serve groups historically under-represented in STEM fields. • Design graduate education for tomorrow's STEM workforce. • Build new models for leveraging assets and expertise. • Build and use evidence-based approaches.
	Lab-to-Market	Increase the economic impact of federally funded research and development by accelerating and improving the transfer of new technologies from the laboratory to the commercial marketplace.

Strategic Objectives and Strategic Reviews

In the spring of 2016, NSF conducted its third set of Strategic Reviews to address the requirement of the GPRA Modernization Act of 2010, Section 1116(f). OMB Circular A-11 (Section 270.2) specifies that: “Annually, agency leaders should review progress on each of the agency’s strategic objectives established by the agency Strategic Plans and updated annually in the Annual Performance Plan. These reviews should inform strategic decision-making, budget formulation, and near-term agency actions, as well as preparation of the Annual Performance Plan and Annual Performance Report.” NSF accomplished the Strategic Reviews by conducting a strategic and focused crosscutting analysis using the results of existing assessment processes, evaluations, and reports as well as other sources of evidence. The following provides information on the focus of the Strategic Reviews in FY 2016.

High flyer targets hurricanes. It wasn’t quite Uber, but NSF’s Gulfstream-V (GV) aircraft gave a lift to a crew of hurricane hunters from the National Oceanic and Atmospheric Administration (NOAA) during the peak of hurricane season in September 2016. The ride-share resulted from a partnership between NSF and NOAA and meant that hurricane forecasting continued uninterrupted during this critical time of year. As Hurricane Lester approached Hawaii, the GV flew into the storm three times, its range and climb allowing the crew to stay airborne longer and soar higher than they could have with NOAA’s Gulfstream-IV, which was offline for unscheduled maintenance. On each mission, the GV deployed dropsondes, sensors that float down through the clouds collecting details such as wind speed, temperature, and pressure. This information was processed onboard and transmitted to the World Meteorological Organization’s Global Telecommunications System for immediate inclusion in hurricane forecast models. The GV’s detailed measurements improved the accuracy of real-time forecasts.



The NSF/NCAR Gulfstream V readies for takeoff on a mission to study a tropical storm. Credit: Carlye Calvin, UCAR.

G1/O1: Invest in fundamental research to ensure significant continuing advances across science, engineering, and education. The G1/O1 Strategic Review investigated NSF’s investment in the **science of broadening participation**, which is defined as fundamental social science and education research to identify and understand the factors that foster or hinder participation, retention, and success of members of underrepresented groups in STEM fields.

G1/O2: Integrate education and research to support development of a diverse STEM workforce with cutting-edge capabilities. The G1/O2 Strategic Review examined how NSF can improve measurement of its investments in **graduate education** in light of current trends in the diversity of career pathways of STEM graduate students.

G1/O3: Provide world-class research infrastructure to enable major scientific advances.

G3/O1: Build an increasingly diverse, engaged, and high-performing workforce by fostering excellence in recruitment, training, leadership, and management of human capital.

And, *G3/O2: Use effective methods and innovative solutions to achieve excellence in accomplishing the agency’s mission.* The combined G1/O3, G3/O1, and G3/O2 Strategic Review focused on two recommendations from

the report by the NAPA pertaining to the NSF staff responsible for oversight of major facilities. NSF and NSB commissioned NAPA to assess NSF’s use of cooperative agreements to provide effective financial and other support for large-scale **infrastructure** investment in science and technology.²²

²² National Science Foundation: *Use of Cooperative Agreements to Support Large Scale Investment in Research* http://napawash.org/images/reports/2015/NSF_Phase_2_Comprehensive_Report.pdf.

G2/O1: Strengthen the links between fundamental research and societal needs through investments and partnerships; G2/O2: Build the capacity of the Nation to address societal challenges using a suite of formal, informal, and broadly available STEM educational mechanisms. The combined G2/O1 and G2/O2 Strategic Review investigated the broader impacts criterion of NSF's merit review process. Defined as, "the potential for the proposed activity to benefit society or advance desired societal outcomes," the broader impacts criterion is the mechanism through which the merit review process communicates the importance of societal benefit to its potential awardees.

More information, including information about the specific "Opportunities for Action or Improvement" recommended by the Strategic Reviews, will be published with NSF's *FY 2018 Budget Request to Congress*.

FY 2016 Progress toward Achievement of Goals

NSF's FY 2016 Annual Performance Report (APR)²³ will provide a complete discussion of the Foundation's performance measures, including descriptions of the metrics, methodologies, results, and trends, along with a list of relevant external reviews. The FY 2016 APR will also provide more information about NSF's GPRA verification and validation review.

In FY 2016, NSF tracked progress toward its three strategic goals through seven annual performance goals and three Agency Priority Goals. A description of these goals is below:

Mission-Oriented Goals

Three performance goals supported all objectives under the two mission-oriented strategic goals: (1) *Transform the Frontiers of Science and Engineering* and (2) *Stimulate Innovation and Address Societal Needs through Research and Education*.

The FY 2016 performance goals in this area were:

- Ensure key FY 2016 NSF-wide program investments are implemented and on track.
- Ensure program integrity and responsible stewardship of major research facilities and infrastructure.
- Enable consistent evaluation of the impact of NSF investments with a high degree of rigor and independence.

Management Goals

In FY 2016, NSF had four performance goals to support the management-oriented strategic goal, *Excel as a Federal Science Agency*, focused on customer service and human resources development. The FY 2016 performance goals in this area were:

- Foster a culture of inclusion through change management effort resulting in change leadership and accountability.
- Use evidence-based reviews to guide management investments.
- Inform applicants whether their proposals have been declined or recommended for funding within 182 days, or 6 months, of deadline, target, or receipt date, whichever is later.
- Increase the percentage of proposal review panelists that participate virtually while maintaining the quality of the merit review process.

²³ *FY 2016 Agency Performance Report* will be included in the *FY 2018 Budget Request to Congress*: <https://www.nsf.gov/about/budget/>.

Agency Priority Goals and Cross-Agency Priority Goals

In FY 2016, NSF tracked progress toward two Agency Priority Goals:

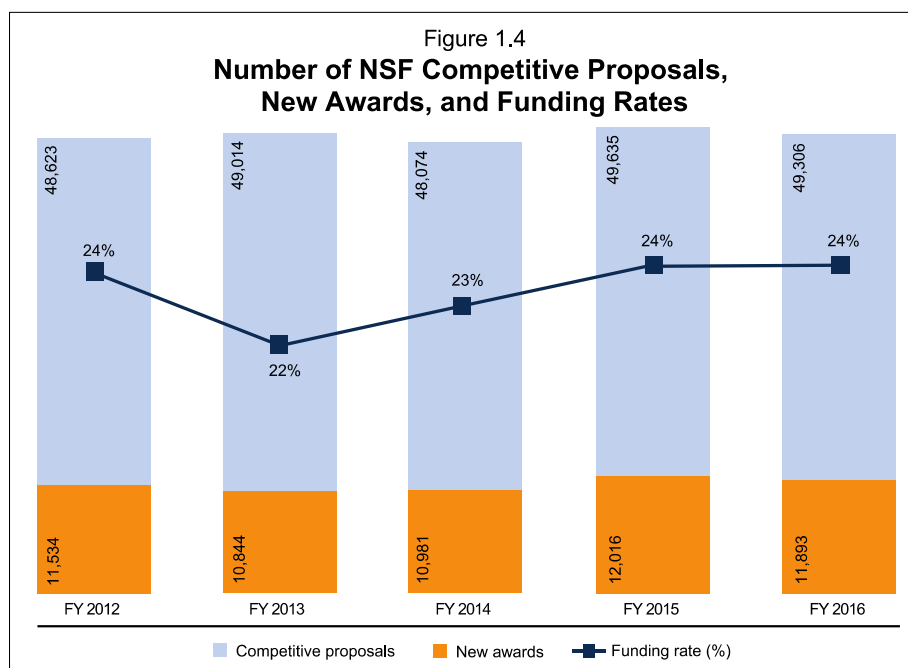
- Improve STEM graduate student preparedness for entering the workforce.
- Build the capacity of the Nation to solve research challenges and improve learning by investing strategically in crowdsourcing and other forms of public participation in STEM research.

For current information about Agency and Cross-Agency Priority Goals, please see the Performance.gov website.²⁴

Proposal Workload and Management Trends

NSF continuously monitors key portfolio, proposal workload, and financial measures to understand short- and long-term trends and to help inform management decisions. For an analysis of the long-term trends in competitive proposals, awards, funding rate, and other portfolio metrics, see the *Report to the National Science Board on the National Science Foundation's Merit Review Process, Fiscal Year 2015*.²⁵

Overall, the FY 2016 portfolio indicators of competitive proposals acted upon, new awards, and funding rates are relatively stable between FY 2015 and FY 2016, as shown in Figure 1.4.



²⁴ Performance.gov website: <https://www.performance.gov/>

²⁵ *Report to the National Science Board on the National Science Foundation's Merit Review Process, Fiscal Year 2015* (NSB-2016-41) at <https://www.nsf.gov/publications/ods/results.jsp?TextQuery=nsb201641>.

Table 1.1 provides 5 years of data on NSF's portfolio, proposal workload, and financial indicators.

Table 1.1—Proposal Workload and Management Trends

Measure		FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Percent Change (FY 2016 FY 2015)	Average (FY 2012 FY 2015)
Portfolio	Competitive proposal actions	48,623	49,014	48,074	49,635	49,306	- 0.7%	48,837
	Competitive award actions	11,534	10,844	10,981	12,016	11,893	- 1.0%	11,344
	Average annual award size (competitive awards)	\$169,217	\$169,107	\$180,507	\$164,526	\$176,243	7.1%	170,839
	Funding rate	24%	22%	23%	24%	24%	no change	23%
Proposal Workload	Number of employees FTE, usage	1,415	1,414	1,390	1,374	1,398	1.7%	1,398
	Number of active awards*	56,432	55,542	53,546	53,967	54,439	0.9%	54,872
	Proposal reviews conducted	235,654	233,116	225,847	231,450	225,017	- 2.8%	231,517
Financial	Number of grant payments	28,016	27,649	27,978	22,860	22,926	0.3%	26,626
	Award expenses incurred but not reported at 9/30 (\$ in millions)**	\$1,769	\$344	\$250	\$398	\$413	3.8%	\$690
Notes: * Active awards include all active awards regardless of whether funds were received during the fiscal year. ** FY 2016 number reflects an accrual, and all other years reflect actuals.								

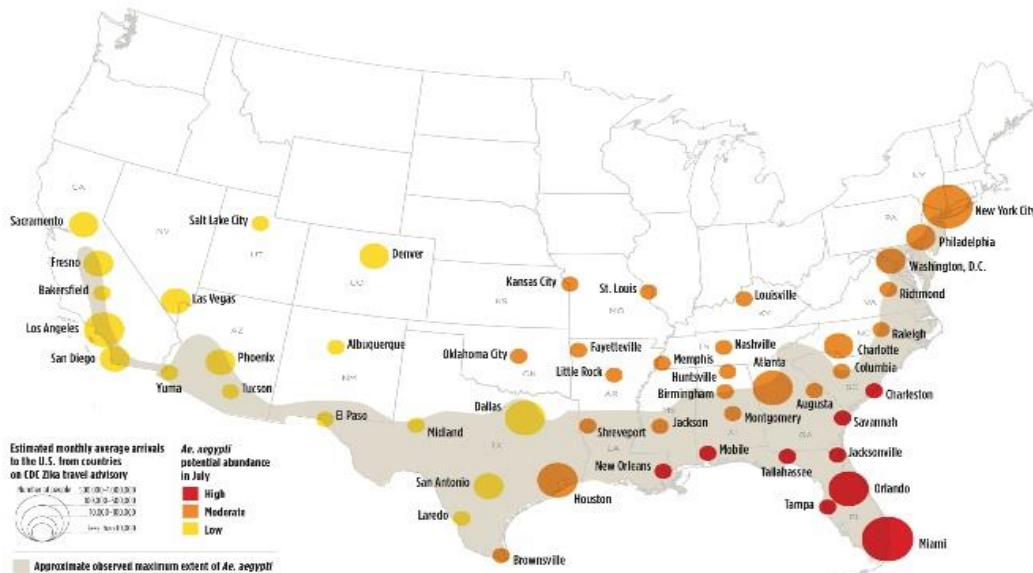
- Between FY 2015 and FY 2016, the number of competitive proposal actions was stable and in excess of 49,000.
- The number of new awards in both FY 2015 and FY 2016 was close to 12,000.
- The overall funding rate in FY 2016 stayed level with FY 2015, 24 percent. Funding rates differ by directorate and are presented in the agency's annual budget request to Congress.
- The average annual award size of competitive awards increased 7 percent—from \$164,526 in FY 2015 to \$176,243 in FY 2016. As shown in Table 1.1, award size varies by year. The FY 2016 average annual award size is higher than all but one of the preceding 4 years, \$170,839.
- There was an almost 2-percent increase in the number of employees between FY 2015 and FY 2016, from 1,374 to 1,398. The FTE level in FY 2016, however, was equal to the 4-year average.
- The number of active awards increased about 1 percent in FY 2016, from 53,967 in FY 2015 to 54,439 in FY 2016. The number of active awards in FY 2016 is close to the average over the preceding 4 years.

During FY 2016, NSF completed its third full year with grantees using the Award Cash Management Service (ACM\$) for all payment activity. In the ACM\$ environment, all NSF awardee institutions are required to submit payment requests at the award level. Award expenses are posted to the NSF financial

system at the time of the payment request. In FY 2016, NSF awardees submitted approximately 583,000 award-level disbursement and expense transactions, an increase of about 27,000 transactions, or 5 percent, from 2015. To further expand payment activity in ACM\$, starting in June 2016, all new SBIR/Small Business Technology Transfer (STTR) awardees began to utilize ACM\$ for their payments. At year-end close, 181 SBIR/STTR companies had gained access to ACM\$. This will significantly reduce the burden of manual invoicing and any potential for error or missed payments by NSF staff.

ACM\$ has significantly improved the timeliness of grant financial data. In prior years, as of September 30, NSF awardee institutions using quarterly expense reporting processes had approximately \$1.7 billion in award expenses that they had incurred but not yet reported to NSF. Under ACM\$, the amount of incurred but not yet reported award expenses has decreased to under \$415 million for each of the last 4 years.

Predicting potential Zika outbreaks in U.S. cities. A study led by the NSF-funded National Center for Atmospheric Research (NCAR) provided data to the scientific and public health communities suggesting which areas in the U.S. were at highest risk for Zika outbreaks during the summer of 2016. After examining multiple factors such as summer weather conditions, travel patterns, socio-economic status, and mosquito biology, the researchers concluded that cities in southern Florida and impoverished areas in southern Texas could be hotspots for local virus transmission. Anticipating the timing and location of outbreaks, public health officials could prepare a response plan, potentially reducing an outbreak's impact. This work lays a foundation for forecasting, handling, and possibly preventing future outbreaks of Zika and other serious diseases.



Researchers determined which cities were most likely to face an increased risk of Zika outbreaks during summer 2016. Credit: NCAR.

Financial Discussion and Analysis

NSF is committed to fostering a strong internal control environment and efficient financial operations that support the agency's mission; provide accurate, transparent, and timely financial information; and comply with applicable laws and regulations. In keeping with its record of achievement in financial management, NSF works to continuously improve financial and business processes. Some areas of focus in FY 2016 are highlighted below:

Digital Accountability and Transparency (DATA) Act

NSF continued preparations for implementing the DATA Act. The DATA Act directs federal agencies to standardize and publish a wide variety of reports and data compilations related to spending: financial management, payments, budget actions, procurement, and assistance. Building on NSF's government-wide leadership in federal financial assistance management, the agency is well-positioned to successfully implement the DATA Act by the government-wide deadline. NSF is actively taking steps to mitigate risks or challenges and is employing multiple implementation approaches to ensure timely compliance.

Grants Oversight and New Efficiency (GONE) Act

In FY 2016, NSF determined that it has ready access to the required data, conducted a preliminary analysis of expired awards meeting reporting requirements of the Act, and reviewed its automated and manual processes for closeout. The agency is on track to fulfill GONE Act reporting requirements next year in the FY 2017 AFR.

IPERA Reporting Requirements

NSF resolved the instance of noncompliance with the IPERA reporting requirements, identified in the FY 2015 audit report. In December 2015, the agency completed a qualitative risk assessment of improper payments. The OIG performed an inspection of NSF's assessment and determined that the agency was in compliance. Further, NSF and the OIG agreed on making significant improvements to the agency's risk assessment process. NSF plans to continually assess its controls over improper payments to evaluate their effectiveness. For more details see *Appendix 2: Improper Payments Elimination and Recovery Act Reporting Details*.

Monitoring of Construction-Type Cooperative Agreements

During FY 2016, NSF implemented strengthened controls and increased collaboration with its OIG on monitoring and oversight of construction type agreements. In addition, the agency completed testing and validation of its enhanced policies and procedures on awarded funds. As noted below, the Independent Auditor's Report for FY 2016 has indicated that monitoring construction-type cooperative agreements is no longer considered a significant deficiency. NSF will continue to evaluate its controls over construction-type agreements as part its on-going internal control program.

In accordance with the Chief Financial Officers Act of 1990 and the Government Management Reform Act of 1994, NSF prepares financial statements in conformity with U.S. generally accepted accounting principles (GAAP) for federal entities. The financial statements present NSF's detailed financial information relative to its mission and the stewardship of those resources entrusted to the agency. It also provides readers with an understanding of the resources that NSF has available, the cost of its programs, and the status of resources at the end of the fiscal year. NSF's financial statements have undergone an independent audit to ensure that they are free from material misstatement and can be used to assess NSF's financial status and related financial activity for the year ending September 30, 2016.

NSF received an unmodified audit opinion on its financial statements, and no material weaknesses were identified in the internal control program for financial reporting. The significant deficiency related to

monitoring of construction-type cooperative agreements that had been identified in previous years' audit reports was resolved. In addition, NSF was found compliant with the Improper Payments Elimination and Recovery Act. A new significant deficiency related to information technology access controls and monitoring processes was identified. The Independent Auditor's Report begins on page Financials-5. Management's response follows the audit report.

Understanding the Financial Statements

The following discussion of our financial condition and results of operations should be read together with the financial statements and the accompanying notes.

NSF's FY 2016 financial statements and notes are presented in accordance with OMB Circular A-136, *Financial Reporting Requirements*. NSF's current year financial statements and notes are presented in a comparative format. The Stewardship Investment schedule presents information over the last 5 years. Table 1.2 summarizes the changes in NSF's financial position in FY 2016.

Table 1.2—Changes in NSF's Financial Position in FY 2016 (Dollars in Thousands)

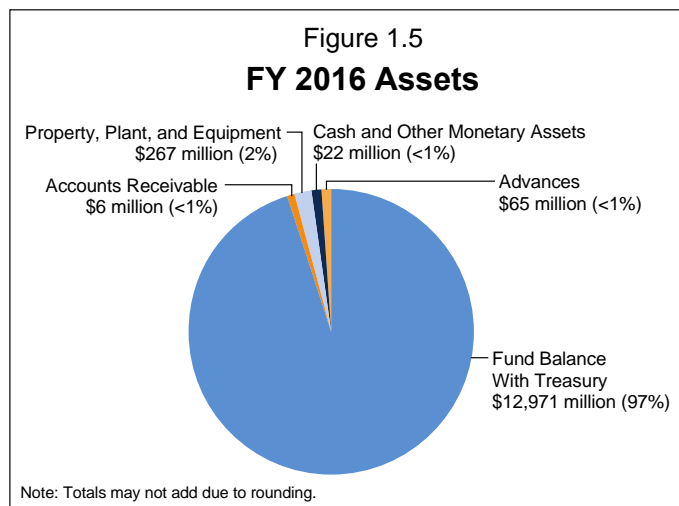
Net Financial Condition	FY 2016	FY 2015	Increase/(Decrease)	% Change
Assets	\$13,330,617	\$12,724,668	\$605,949	4.8%
Liabilities	\$608,725	\$518,809	\$89,916	17.3%
Net Position	\$12,721,892	\$12,205,859	\$516,033	4.2%
Net Cost	\$7,046,347	\$6,980,344	\$66,003	0.9%

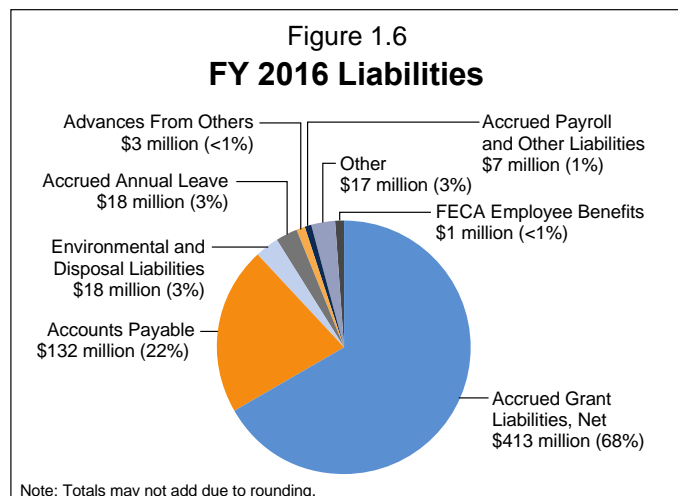
Balance Sheet

The Balance Sheet presents the total amounts available for use by NSF (assets) against the amounts owed (liabilities) and amounts that comprise the difference (net position). NSF's total assets are largely composed of *Fund Balance with Treasury*. A significant balance also exists in the *General Property, Plant, and Equipment* account.

In FY 2016, Total Assets (Figure 1.5) increased 4.8 percent from FY 2015. The bulk of the change occurred in the *Fund Balance with Treasury* account, which increased by \$652.6 million in FY 2016. NSF is authorized to use *Fund Balance with Treasury* to make expenditures and pay amounts due through the disbursement authority of the Department of Treasury. The *Fund Balance with Treasury* is increased through appropriations and collections and decreased by expenditures and rescissions.

In FY 2016, Total Liabilities (Figure 1.6) increased 17.3 percent from FY 2015. This change was primarily related to a \$71.8 million increase in *Accrued Grant Liabilities, Net* in FY 2016. *Accrued Grant Liabilities, Net* is estimated annually by utilizing a linear regression model based on the statistical correlation of NSF grantees' historical unliquidated obligations and expenses incurred but not reported. The majority of the FY 2016 change was due to a decrease of grantee advances and an increase in unliquidated obligations for grantees, resulting in a higher *Accrued Grant Liabilities, Net* as compared to FY 2015.





Statement of Net Cost

The Statement of Net Cost presents the annual cost of operating NSF programs. The net cost of operations of each NSF program equals the program's gross cost less any offsetting revenue. Intragovernmental earned revenues are recognized when related program or administrative expenses are incurred. *Earned revenue* is deducted from the full cost of the programs to arrive at the *Net Cost of Operation*.

Approximately 95 percent of all current year NSF Net Costs of Operations incurred were directly related to the support of R&RA, EHR, MREFC programs; and Donations and

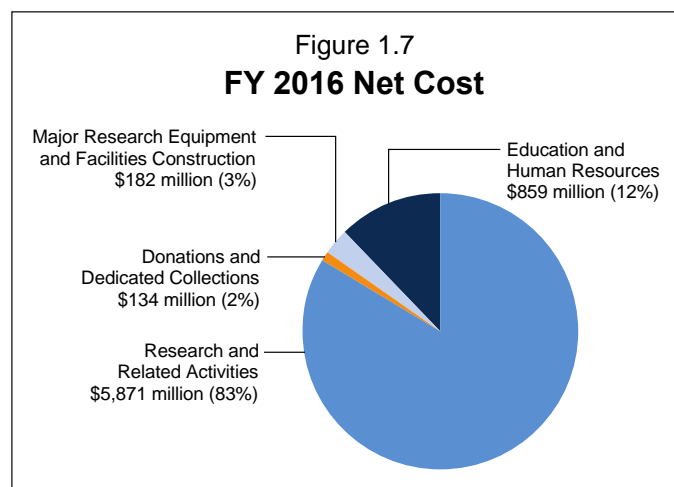
Dedicated Collections. Additional costs were incurred for indirect general operation activities (e.g., salaries, training, and activities related to the advancement of NSF information systems technology) and activities of the NSB and the OIG. These costs were allocated to R&RA, EHR, MREFC, and Donations and Dedicated Collections and account for 5 percent of the total current year Net Cost of Operations (Figure 1.7). These administrative and management activities are focused on supporting the agency's program goals.

Statement of Changes in Net Position

The Statement of Changes in Net Position presents the agency's cumulative net results of operation and unexpended appropriations for the fiscal year. NSF's Net Position increased by 4.2 percent, or \$516.0 million, in FY 2016.

Statement of Budgetary Resources

This statement provides information on how budgetary resources were made available to NSF for the year and the status of those budgetary resources at year end. For FY 2016, *Total Budgetary Resources* increased \$12.6 million from the FY 2015 level. *Budgetary Resources—Appropriations* for the R&RA, EHR, and MREFC accounts were \$5,989.7 million, \$879.0 million, and \$218.3 million, respectively. The combined *Budgetary Resources—Appropriations* in FY 2016 for the NSB, OIG, and AOAM accounts totaled \$376.5 million. NSF also received funding via warrant from the H-1B Nonimmigrant Petitioner Account (H-1B) in the amount of \$139.3 million, and via donations from foreign governments, private companies, academic institutions, nonprofit foundations, and individuals in the amount of \$24.4 million. In FY 2016, the *Budgetary Resources—Appropriations* line was also affected by H-1B sequestration in the amount of \$6.8 million.



Stewardship Investments

NSF-funded investments yield long-term benefits to the general public. NSF investments in research and education produce quantifiable outputs, including the number of awards made and the number of researchers, students, and teachers supported or involved in the pursuit of science and engineering research and education. NSF incurs stewardship costs as part of its longstanding commitment to invest in learning and discovery. In FYs 2016 and 2015, these costs amounted to \$371.2 million and \$329.7 million, respectively.

Limitations of the Financial Statements

In accordance with the guidance provided in OMB Circular A-136, NSF discloses the following limitations of the agency's FY 2016 financial statements, which appear in chapter 2, *Financials*, of this AFR. The principal financial statements have been prepared to report the financial position and results of operations of NSF, pursuant to the requirements of 31 U.S.C. 3515(b). While the statements have been prepared from NSF books and records in accordance with GAAP for federal entities and the format prescribed by OMB, the statements are in addition to the financial reports used to monitor and control budgetary resources, which are prepared from the same books and records. The statements should be read with the realization that they are for a component of the U.S. Government, a sovereign entity.

Other Financial Reporting Information

Debt Collection Improvement Act of 1996

Net Accounts Receivable totaled \$5.8 million at September 30, 2016. Of that amount, \$4.3 million is due from other federal agencies. The remaining \$1.5 million is due from the public. NSF fully participates in the Department of the Treasury Cross-Servicing Program. In accordance with the Debt Collection Improvement Act, as amended by the DATA Act, this program allows NSF to refer debts that are delinquent more than 120 days to the Department of the Treasury for appropriate action to collect those accounts. In accordance with M-04-10, *Memorandum on Debt Collection Improvement Act Requirements*, NSF writes off delinquent debt more than 2 years old. Additionally, NSF seeks Department of Justice concurrence for action items over \$100.0 thousand.

Cash Management Improvement Act of 1990

In FY 2016, NSF had no awards covered under Cash Management Improvement Act Treasury-State Agreements. The timeliness of NSF's payments to grantees through its payment systems makes the timeliness of payment issue under the Act essentially not applicable to the agency. No interest payments were made in FY 2016.

Federal Civil Penalties Inflation Adjustment Act of 1990

The Federal Civil Penalties Inflation Adjustment Act Improvements Act of 2015 (the 2015 Act) (Sec. 701 of Public Law 114-74)(2015 Act) further amended the Federal Civil Penalties Inflation Adjustment Act of 1990 (Public Law 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 initial catch-up adjustment is reflected in Table 1.3.

Table 1.3—FY 2016 Civil Monetary Penalty Adjustment for Inflation

Penalty	Authority	Date of Previous Adjustment	Date of Current Adjustment	Current Penalty Level
Knowing violations	Antarctic Conservation Act of 1978, as amended	2002	2016	\$27,500
Not knowing violations	Antarctic Conservation Act of 1978, as amended	2002	2016	\$16,250
Violations	Program Fraud Civil Remedies Act of 1986	1986	2016	\$10,781

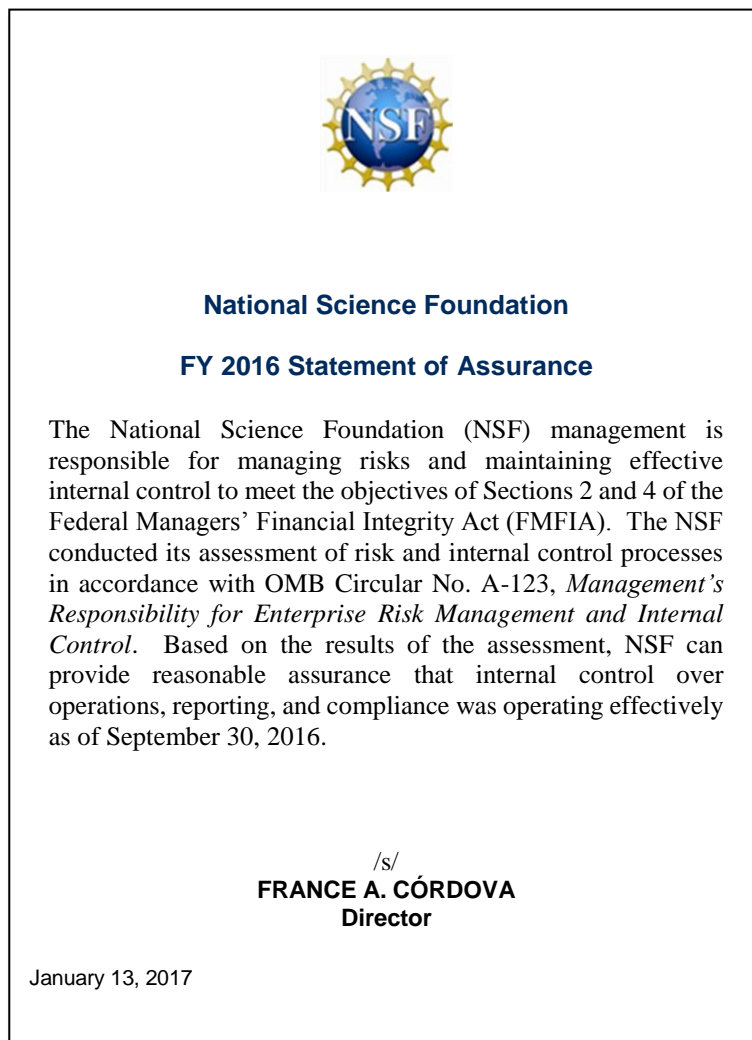
Systems, Controls, and Legal Compliance

Management Assurances

The Federal Managers' Financial Integrity Act (FMFIA)²⁶ requires that agencies conduct evaluations of their systems of internal control and provide reasonable assurance annually to the President and the Congress on the adequacy of those systems. Internal control is an integral component of an organization's management that provides reasonable assurance of effective and efficient operations, reliable financial reporting, and compliance with laws and regulations.

The FMFIA assurance statement provides management's assessment of the efficacy of the organization's internal control to support effective and efficient programmatic operations, reliable financial reporting, and compliance with applicable laws and regulations (FMFIA§2) and whether financial management systems conform to financial systems requirements (FMFIA§4).

The FY 2016 unmodified Statement of Assurance is the culmination of the efforts of NSF management's assessment of the design, implementation, and operating effectiveness of its system of internal control. For FY 2016, NSF's internal control assessment provides reasonable assurance that the objectives of the FMFIA and the Federal Financial Management Improvement Act (FFMIA) were achieved and also concludes that the internal control processes over financial reporting are effective.



Highlights from NSF's FY 2016 Internal Control Quality Assurance Program

NSF evaluated its systems of internal control in accordance with FMFIA and OMB Circular A-123 *Management's Responsibility for Enterprise Risk Management and Internal Control*.²⁷ Circular A-123 established an assessment process based on GAO *Standards for Internal Control in the Federal Government* (known as the Green Book).²⁸ The Green Book approaches internal control through a hierarchical structure of five components of internal control (control environment, risk assessment, control activities, information and communication, and reporting) supported by 17 required principles of internal control.

²⁶ FMFIA: https://www.whitehouse.gov/omb/financial_fmfi1982

²⁷ OMB Circular A-123: <https://www.whitehouse.gov/sites/default/files/omb/memoranda/2016/m-16-17.pdf>

²⁸ GAO *Standards for Internal Control in the Federal Government*: <http://www.gao.gov/products/GAO-14-704G>

The internal control review process supports NSF's strategic goal to *Excel as a Federal Science Agency*. Excelling as a federal science agency is essential to achieving and carrying out NSF's mission and accomplishing its other strategic goals: (1) transform the frontiers of science and engineering and (2) stimulate innovation and address societal needs through research and education.

In conducting its assessment of internal control over agency operations, reporting, and compliance with applicable laws and regulations the Internal Control Quality Assurance (ICQA) program team performed the following general steps:

1. Updated process documentation (narratives and flow diagrams) for each key business process. For FY 2016, process documentation continued to focus on activities supported by the Oracle core financial management system (iTRAK) and added large facility oversight as an assessable business process.
2. Conducted tests of all transactions selected in the samples and determined if the controls were designed adequately and operating effectively.
3. Selected samples based on the frequency of performance of the control from the universe of NSF controls performed during FY 2016. Sample size was determined using the GAO *Financial Audit Manual, Volume 1* (July 2008).
4. Conducted an entity-level control review to assess both the design and the operating effectiveness of key controls. The review was based on the GAO Green Book's five components and 17 principles. The review focused on the establishment of entity-level and activity-level objectives, risk identification and analysis, and related control activities.
5. Prepared a final report that details the results of testing and assisted NSF in meeting the reporting requirements for its FY 2016 Statement of Assurance.

In addition to completing the internal control reviews, the NSF ICQA program team assisted NSF in developing an ERM framework. Looking ahead, in FY 2017, the team plans to provide ERM training, facilitated workshops, and assistance to leaders and managers in developing plans for an incremental implementation process. NSF's goal is to integrate ERM within its key organizational processes such as strategic planning, budgeting, and performance management.

Internal Control over Financial Reporting—OMB Circular A-123, Appendix A

NSF's FY 2016 review for Internal Control over Financial Reporting consisted of evaluating five business processes for the period July 1, 2015, through June 30, 2016. The process areas were: Grants Management, Pay and Benefits, Financial Reporting, Large Facility Oversight, and Procure to Pay.

The ICQA team noted the following improvements in FY 2016:

1. iTRAK, NSF's primary business accounting system, completed its second year of operations. The system and associated processes continue to mature in terms of the overall system implementation lifecycle.
2. Business continuity operations included successfully testing recovery of iTRAK, the NSF network, and critical business systems.

Based on the results of the assessment, NSF provides reasonable assurance that its internal control over financial reporting is operating effectively and no material weaknesses were identified.

Improving the Management of Government Charge Card Programs—OMB Circular A-123, Appendix B

In FY 2016, NSF conducted a review of its charge card programs for compliance with selected guiding policies and procedures within the Charge Card Program Management Plan and the NSF Travel Card Program.

With the maturation of NSF's core financial system, iTRAK, NSF implemented additional controls that further strengthened purchase card processes, to include:

1. Purchase and vehicle card supporting documentation: In order for purchase and vehicle card transactions to be submitted for approval by the approving official, supporting documentation must be uploaded into the iTRAK system.
2. Budget Object Class (BOC) code: A feature requires the user to change the default BOC code on the card transaction to an appropriate BOC code for purchase card and vehicle card transactions, ensuring that NSF can track expenses accurately.

Based on the results of the assessment, NSF provides reasonable assurance that internal control processes related to the Government Charge Card Programs are operating effectively, and no material weaknesses were identified.

Requirements for Effective Estimation and Remediation of Improper Payments—OMB Circular A-123, Appendix C

NSF completed a qualitative risk assessment of FY 2015 improper payments. The risk assessment determined the NSF did not have significant susceptibility to improper payments for NSF grants, contracts, charge cards, or payroll payments.

During FY 2016, the NSF OIG completed a review of NSF's compliance with the IPERA and issued an inspection report in May 2016 concluding that NSF was compliant with IPERA reporting requirements for FY 2015. For details about the IPERA risk assessment and related OIG inspection report, please see *Appendix 2: IPERA Reporting Details* of this AFR.

Compliance with the Federal Financial Management Improvement Act of 1996—OMB Circular A-123, Appendix D

NSF is required by Appendix D of OMB Circular A-123, *Compliance with the Federal Financial Management Improvement Act of 1996*, to implement and maintain financial management systems that substantially comply with Federal Financial Management System Requirements, federal accounting standards, and the United States Standard General Ledger (USSGL) at the transaction level.

In FY 2016, NSF conducted a review of iTRAK using the Appendix D FFMIA System Compliance Determination tool. Based on the results of the review, NSF has determined that iTRAK was in compliance with FFMIA during FY 2016.

NSF has established a comprehensive IT Security Program that is consistent with Federal Information Security Modernization Act of 2014 and industry best practices. NSF's IT controls are effective in maintaining a secure IT environment. The agency's IT environment is supported by a suite of comprehensive policies and procedures that incorporate federal mandates and guidance in all domains. Numerous controls are implemented to protect agency financial information and information resources. Continuous monitoring verifies effective IT security controls are in place throughout the year.

In FY 2016, NSF became one of a few agencies to operate its financial system in the “cloud” through an agency “Authority to Operate.” More details are available in the next section, *Financial System Strategy and Framework*.

Other Federal Reporting and Disclosures

Anti-Deficiency Act (ADA): NSF is not aware of any ADA violations that are required to be reported for the year ended September 30, 2016.

Pay and Allowance System for Civilian Employees, provided primarily in Chapters 31–50 of Title 5, U.S.C.: The Department of the Interior, Interior Business Center (IBC) Federal Personnel/Payroll System (FPPS) is a Shared Service Provider and performs many of NSF’s payroll functions. IBC FPPS’s internal control is annually reviewed by auditors under the Statement on Standards for Attestation Engagements (SSAE 16). IBC FPPS’s controls are found to be suitably designed and operating effectively. This conclusion is based partly on transactional testing.

Internally, NSF performed testing on its pay and benefits internal control processes during the annual review to identify any deficiencies that could result in a material misstatement on the agency’s financial statements. There were no significant deficiencies noted for FY 2016.

Prompt Payment Act: While the Prompt Payment Act still mandates interest penalties on payments over 30 days, under OMB Memorandum 16-07, *Reporting of Accelerated Payment to Small Business Subcontractors*, NSF is accelerating payments to all contractors within 15 days of a proper invoice being received. This acceleration allows small business contractors to be paid as quickly as possible. Fourth quarter reporting, as of September 30, 2016, was 90 percent.

Government Charge Card Abuse Prevention Act of 2012, Pub. L. 112 – 194: The act requires that agencies insure that appropriate policies and controls are in place or that corrective actions have been taken to mitigate the risk of fraud and inappropriate charge card practices. NSF provides reasonable assurance that internal controls related to the Government Charge Card Programs are operating effectively, and no material weaknesses were identified. Additional information is provided above in *Improving the Management of Government Charge Card Programs—OMB Circular A-123, Appendix B*, page MD&A-24.

Provisions Governing Claims of the U.S. Government (31 U.S.C. 3711–3720E) (Including the Debt Collection Improvement Act of 1996): The Debt Collection Improvement Act is addressed on page MD&A-21.

Federal Information Security Modernization Act Management Act of 2014: This topic is addressed above in subsection *Compliance with the Federal Financial Management Improvement Act of 1996—OMB Circular A-123, Appendix D*, page MD&A-24.

Single Audit Act of 1984, Pub L. No. 98-502, and the Single Audit Act Amendments of 1996, P.L. 104-156. (A-136, section II.2.8): The Single Audit Act requires financial statement audits of non-federal entities receiving or administering grant awards with federal expenditures exceeding \$750,000 during its fiscal year. Federal agency internal control standards determine whether award expenditures are in compliance with laws and regulations. NSF, as are other federal agencies, is required to review the audit reports of recipients of its funding to determine whether necessary corrective actions are adequate and implemented in response to audit report findings and recommendations. NSF utilizes guidance from the *OMB Uniform*

*Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards (Uniform Guidance)*²⁹ and *Audit Follow-up*³⁰ as a basis for its audit resolution and follow-up activities.

During the period from July 1, 2015, through June 30, 2016, NSF resolved 207 single audit reports. The internal control review team assessed a random sample of 30 of these reports, reviewing supporting documentation, NSF Management Decision Letters, and evidence of grantee-implemented corrective actions.

NSF has fully implemented the Uniform Guidance and continues to ensure that NSF policies and procedures fully align with its requirements. NSF continually assesses the effects of changes in policies and practices (e.g., increase in single-audit thresholds, risk management, streamlining of federal requirements, timeliness) that have potential impact on stewardship over NSF investments. Under a major restructuring of its organizational unit contributing to pre- and post-award oversight, NSF has initiated efforts to strengthen audit resolution and other oversight functions through the deepening of subject matter expertise and more effective utilization of staff resources. In addition, NSF continues its formal, on-going dialogue with the OIG to address issues affecting audit resolution such as new methodologies, as well as application and interpretation of NSF policies and procedures.

In FY 2016, at the invitation of the OMB Council on Financial Assistance Reform (COFAR), NSF continued as an active member of the interagency Uniform Guidance Work Group to develop Frequently Asked Questions needed to clarify federal requirements set forth in the Uniform Guidance. In addition, NSF coordinated interagency development and clearance of Research Terms and Conditions, which completes federal implementation of the Uniform Guidance.

Financial System Strategy and Framework

Financial System Strategy

The goals for NSF's core financial system, iTRAK, align with NSF's strategic goals—to further scientific and organizational excellence and accountability for the public benefit. iTRAK ensures that transactions are posted in accordance with the U.S. Standard General Ledger at the transaction level; maintains accounting data to permit reporting in accordance with GAAP as prescribed by the Federal Accounting Standards Advisory Board; enforces strict funds control across the budgeting and spending functions to prevent ADA violations; and enables strong access control and definition of “responsibilities” to support segregation of duties control. iTRAK complies with OMB Memorandum M-10-26, *Immediate Review of Financial Systems IT Projects*, OMB Memorandum M-13-08, *Improving Financial Systems through Shared Services*, and OMB Circular A-123, *Appendix D*.

NSF completed its second successful year of iTRAK operations on September 30, 2016. During this second year of operations, NSF continued its focus on (1) maturing iTRAK system and business processes to improve operational efficiencies, (2) training users in targeted areas to improve user skills, and (3) providing financial data to the agency's data warehouse to enable users to combine financial and programmatic data for more informed decision-making. As iTRAK continues to mature, NSF will continue to expand its analytical capabilities towards a more mature and performance driven system to better support NSF's mission.

²⁹ Uniform Guidance (2 CFR 200): <http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=fd67dcb2fb543c275053150a6352be38&mc=true&n=pt2.1.200&r=PART&ty=HTML>

³⁰ Audit Follow-up (OMB Circular A-50): https://www.whitehouse.gov/omb/circulars_a050

NSF also focused on several federal mandates in FY 2016: Details on activities related to these mandates are as follows:

- FedRAMP (Federal Risk and Authorization Management Program) Compliance
In June 2016, Accenture obtained FedRAMP certification of its Federal Cloud Enterprise Resource Planning solution, making NSF one of a few agencies to operate its financial system in the “cloud” through an agency “Authority to Operate.” This certification was accomplished through NSF’s collaboration with the General Services Administration’s (GSA’s) FedRAMP Project Management Office and its shared service provider, Accenture Federal Services, over a 4-month period to meet all of the federal security requirements to operate iTRAK in Accenture’s “cloud” environment
- DATA Act Compliance
NSF is on track to meet the deadline to implement the requirements of the DATA Act by May 2017. To date, we developed an implementation plan that has been reviewed by OMB and Treasury, conducted several tests with OMB to identify data quality issues of our financial data, and validated file transmission to Treasury.
- Electronic Invoicing
OMB M-15-19, *Improving Government Efficiency and Saving Taxpayer Dollars through Electronic Invoicing*, requires agencies to implement electronic invoicing by September 30, 2018. NSF is in the planning phase of this initiative and is currently evaluating solution options. NSF plans to begin implementation in the second quarter of FY 2017.

Competing priorities coupled with limited resources continue to be key challenges facing the Foundation. Senior leadership will continue to work with internal and external stakeholders to agree on the order of priorities while managing risk.

Financial Management System Framework

NSF’s financial management system framework (Figure 1.8) focuses on the Foundation’s financial management systems, standard business processes, data, and information architecture to ensure reliable, timely, and consistent financial information that enables effective management of NSF resources and delivery of mission critical products and services.

NSF’s core financial system, iTRAK, interfaces with NSF’s awards, grants management, and business process systems including:

- Award Cash Management Service (ACM\$)
- Award Management and Award Letter System (“Awards”)
- eJacket, NSF’s internal awards processing system
- Research.gov and FastLane, NSF’s online websites through which researchers, research administrators and their organizations, and reviewers interact with NSF
- Graduate Research Fellowship Program System (GRFP)
- Guest Travel and Reimbursement System

iTRAK also interfaces with external systems operated by the U.S. Department of the Treasury; JPMorgan Chase Bank; and LearnNSF, the Foundation’s training system, and other federal systems such as the Federal Personnel Payroll System (FPPS), eTravel/Concur, and GSA’s System for Award Management (SAM).

Future iTRAK phases include electronic invoicing; compliance with the DATA Act; an Internal Revenue Service audit; and integration of an Acquisition Module, a Fixed Asset Module, and a Budget Formulation Module.

Figure 1.8—NSF Financial Management System Framework

