

Chapter 1

Management's Discussion and Analysis





Agency Overview

Mission and Vision

The National Science Foundation (NSF) was established in 1950 “to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...”¹ This mission remains relevant today as the agency supports research across all fields of science, technology, engineering, mathematics (STEM), and all levels of STEM education.

For more than seven decades, NSF has supported scientists and research that explores the unknown, and expands the frontiers of science and engineering. NSF-funded discoveries have led to essential breakthroughs and innovations that address the scientific, economic, and societal challenges facing the U.S. and the world. These discoveries often arise from research inspired by real-world needs and focused on practical solutions. Technologies like the Internet and 3D printing continue to evolve, while CRISPR reveals the blueprint of life, facilitating advances from COVID-19 vaccines to the creation of climate- and disease-resistant crops. These are just a few examples highlighting the outcomes and benefits of NSF's investments in fundamental research.



An electron microscope image of tiny, finely layered metal structures known as MXenes, between which scientists can slip different ions for various purposes. These MXenes were grown using a simplified and less toxic method invented by NSF-funded researchers. They hold promise for future high-tech electronics or energy storage. *Credit: Di Wang and Dmitri Talapin, University of Chicago.*

MXenes – An easy way to make atomically thin metal layers for new technology

MXenes, metals first synthesized in 2011, consist of atomically thin layers of transition metals that ions can move between. Unlike other metals, MXenes do not lose their properties (e.g., strong electrical conductivity) when in atomically thin layers, thanks to their strong chemical bonds. MXenes have historically been labor-intensive to make, but researchers at the University of Chicago were able to find a more efficient process with less toxic byproducts. This new process will allow for more metal alloy-MXene mixtures and different ions to flow between the layers. This advancement will lead to new devices that could potentially store energy or block electromagnetic wave interference.

Across all fields of STEM, NSF's investment in fundamental research and development has been a catalyst for transformative breakthroughs. For example, fiscal year (FY) 2023 funding supported multidisciplinary teams developing novel materials with broad, practical applications in healthcare, climate change, next-generation computing, and communications; biologists researching biological systems that improve food security and monitor drinking water for contaminants; and researchers in Antarctica advancing the field of neutrino astronomy with groundbreaking insights on the nature of the universe.

¹ National Science Foundation Act of 1950 (Public Law 81-507).

In addition to broadening access to research infrastructure and building interdisciplinary communities of researchers, research partnerships can accelerate scientific discovery as well as the translation of research into products and services. In FY 2023, NSF utilized CHIPS and Science Act funding to advance a public-private partnership supporting microelectronic and semiconductor investments. This effort will enable rapid progress in new semiconductor technologies and manufacturing, as well as in workforce development. NSF's decades of promoting collaboration among industry, academia, and government have propelled the American research enterprise and helped to secure our Nation's global leadership in science and technology.



The CREST Center for Advanced Magnets and Semiconductors at Morgan State University will advance scientific knowledge in advanced magnets and semiconductors, a field of great importance to modern technologies and the U.S. economy. *Credit: NSF.*

Center of Research Excellence in Science and Technology (CREST) Phase I Center for Advanced Magnets and Semiconductors

A new research and educational hub is being established at Morgan State University in Baltimore with funding from NSF's Center of Research Excellence in Science and Technology (CREST) program. The \$5 million, 5-year award was partly funded through the CHIPS and Science Act of 2022 and will support Morgan State University, the largest historically Black college and university (HBCU) in Maryland, in playing a vital role in producing a highly talented and diverse technology workforce. The center will partner with neighboring institutions to perform bold, innovative studies in advanced magnets and semiconductors and oversee STEM education and outreach initiatives for underrepresented minorities. This includes developing two new graduate programs, joint educational initiatives such as symposia and internships, and summer programs for high school students and science teachers.

NSF's sustained commitment to investing in our country's infrastructure, emerging technologies, and workforce development helps ensure every citizen has the opportunity to prosper in America's STEM-based workforce. This investment keeps the Nation's workers competitive and prepares them for future challenges. Core to these investments is an intentional focus on broadening participation in STEM, particularly by increasing engagement with minority-serving institutions (MSIs), community colleges, and other emerging research institutions. Capitalizing on the perspectives brought by these partner organizations is critical to creating truly transformational breakthroughs. One example is the GRANTED (Growing Research Access for Nationally Transformative Equity and Diversity) program. Launched in FY 2023, GRANTED aims to develop research capacity at emerging and developing research institutions to broaden participation and foster the skills and desire to serve within the Nation's science and engineering enterprise.

NSF's support for the Graduate Research Fellowship Program (GRFP) is an important component of its STEM workforce portfolio. Since 1952, NSF has funded approximately 68,000 Graduate Research Fellows, many of whom become leaders in their chosen fields and make groundbreaking and important discoveries in STEM research. NSF also has funded the research of 261 individuals who have won the Nobel Prize, along with 44 individuals who have won the Association for Computing Machinery (ACM) A. M. Turing Award, often referred to as the "Nobel Prize of Computing." NSF

programs and investments provide every aspiring scientist and engineer a real chance to prepare for and compete in their field.

A long-standing priority for NSF is the translation of science and engineering discoveries into innovative technologies and solutions that reach the marketplace and society. Key investments made in support of this priority include Partnerships for Innovation, NSF Innovation Corps (I-Corps™), and America's Seed Fund™ (also known as the Small Business Innovation Research and Small Business Technology Transfer [SBIR/STTR] programs). These programs support researchers as they pilot, prototype, and demonstrate their innovations and technologies. The programs facilitate the licensing of NSF-funded research outcomes and provide opportunities for entrepreneurial education. NSF investments have inspired start-up creation and fostered small businesses that have forged generations of new American jobs and, through these outcomes and innovations, have benefitted our society, economic competitiveness, and national security.



The first-ever Engines awards will help regional partners collaborate to advance key technologies, address societal challenges, and create economic opportunities. *Credit: NSF.*

NSF Regional Innovation Engines

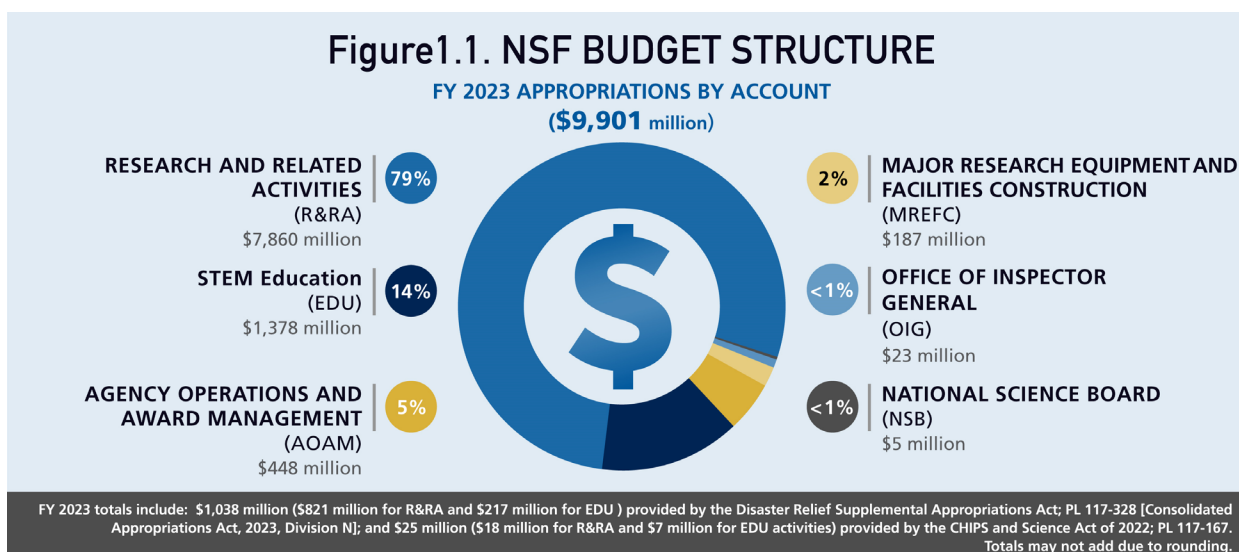
The NSF Regional Innovation Engines competition links local and regional partners to expand innovation and create collaborative, inclusive, and technology-driven innovation ecosystems across the Nation. The NSF Engines program is anticipated to be transformational for the Nation, ensuring the U.S. remains globally competitive in key technologies for decades to come. NSF named 16 finalists in August, spanning a range of key technologies as well as national, societal, and geostrategic challenges highlighted in the CHIPS and Science Act of 2022. Over a 10-year period, an NSF Engine recipient is expected to progress through three phases: nascent, emergent, and growth. When successful, an NSF Engine will lead to its region becoming a self-sustaining hub of economic activity for its specialized field.

NSF invests in a wide array of research infrastructure that is geographically distributed and broadly accessible to advance discovery, learning, and exploration. This infrastructure includes observatories, detectors, optical and radio telescopes research vessels, aircraft and autonomous airborne platforms, and other state-of-the-art tools. These essential investments foster collaboration and provide sophisticated research platforms. In 2023, NSF was an essential leader supporting scientists working to understand black holes at NSF-funded facilities (such as the Laser Interferometer Gravitational-Wave Observatory, the Event Horizon Telescope, and the international Atacama Large Millimeter/submillimeter Array), as well as providing data analysis time on supercomputers. In 2023, NSF supported improving computational models used for lifesaving weather predictions and climate projections by funding a Mid-scale Research Infrastructure-2 award to create the Airborne Phased Array Radar, which will provide critical input to those models. The Foundation's long-term commitment to steady advancements and upgrades to research facilities enables continued groundbreaking research across scientific disciplines.

NSF's vision is for the Nation to lead the world in science and engineering research and innovation, to the benefit of all, without barriers to participation. NSF staff pursue this vision by working to expand the frontiers of knowledge and integrate that knowledge into industry and education. In addition, NSF's core values include diversity and inclusion, integrity and excellence in devotion to public service, and innovation and collaboration in our support of the work of the scientific community and of each other. These values and the agency's vision are embodied in the plan's strategic goals: (1) EMPOWER: empower STEM talent to fully participate in science and engineering; (2) DISCOVER: create new knowledge about our universe, the world, and ourselves; (3) IMPACT: benefit society by translating knowledge into solutions; and (4) EXCEL: excel at NSF operations and management.

NSF by the Numbers

NSF is funded primarily through congressional appropriations that are provided to six accounts (shown in Figure 1.1): Research and Related Activities (R&RA), STEM Education (EDU), Major Research Equipment and Facilities Construction (MREFC), Agency Operations and Award Management (AOAM), the National Science Board (NSB), and the Office of Inspector General (OIG). Appropriations in these six accounts in FY 2023 totaled \$9,901 million.² In FY 2023, R&RA, EDU, and MREFC appropriations funded the agency's programmatic activities, accounting for 95 percent of NSF's total appropriations.



- R&RA invests in early-stage research and the development of a future-focused science and engineering workforce that can accelerate progress in fundamental and translational science and engineering research as well as support the private sector. This appropriation accounted for 79 percent of FY 2023 funding. The FY 2023 R&RA funding level of \$7,860 million was approximately \$860 million higher than FY 2022.

² Amount shown is NSF's FY 2023 discretionary appropriations. This amount does not include Donations and H-1B Nonimmigrant Petitioner Receipts. These amounts are included in NSF's appropriations shown in the Statement of Budgetary Resources (SBR). The SBR is on page Financials-19 of this Agency Financial Report (AFR).

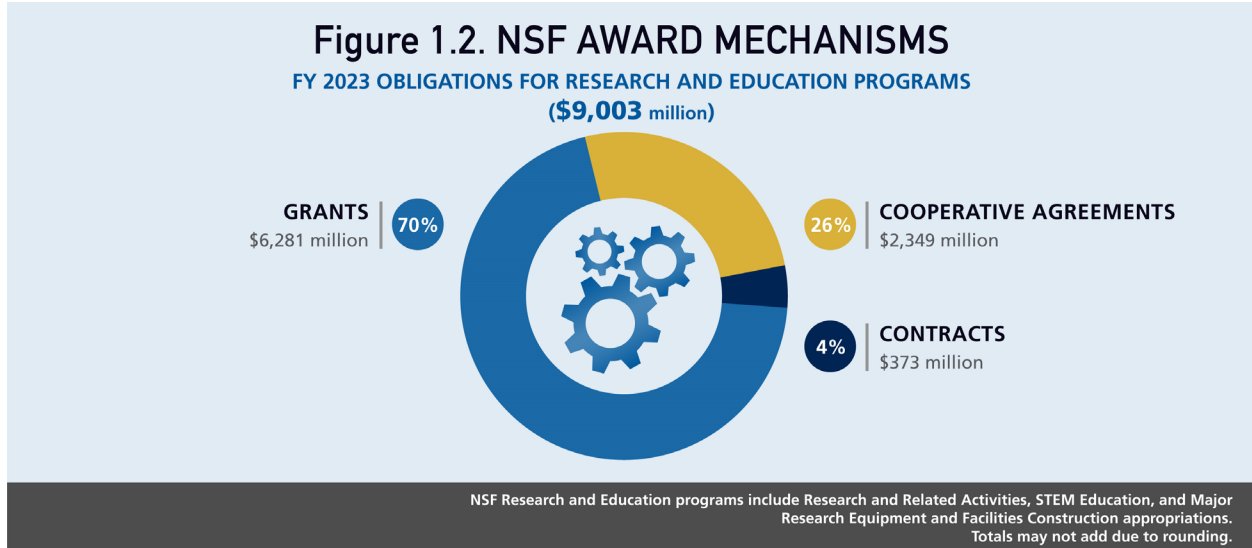
- Funding within NSF's EDU appropriation invests in education and training programs to help prepare a diverse, domestic STEM workforce. These investments—spanning pre-K through graduate school and beyond—ensure pathways for people and ideas ready to solve pressing global challenges in science and engineering. EDU is NSF's second-largest appropriation and is 14 percent of the agency's budget. EDU's FY 2023 funding level of \$1,378 million was \$229 million above the previous year's appropriation of \$1,149 million. Until FY 2023, the EDU appropriation was named Education and Human Resources (EHR).
- The MREFC appropriation supports the acquisition, construction, and commissioning of major facilities and larger mid-scale research infrastructure, providing unique capabilities at the frontiers of science and engineering. This account was 2 percent of the agency's total appropriations in FY 2023. The FY 2023 MREFC funding level of \$187 million was \$53 million lower than the FY 2022 level. Fluctuations in funding reflect changes in construction project requirements.
- FY 2023 AOAM funding of \$448 million supported NSF agency operations and award management activities through which NSF's science and engineering research and education programs are administered. AOAM was 5 percent of NSF's total FY 2023 appropriations, and funding increased by \$23 million between the two years.
- Separate appropriations support the activities of the OIG and the NSB; each accounted for less than 1 percent of NSF's total FY 2023 appropriations. The FY 2023 OIG appropriation of \$23 million increased approximately \$4 million over the FY 2022 appropriation. The NSB received an appropriation of \$5 million in FY 2023, almost \$500,000 higher than the previous year's funding level.

During FY 2023, NSF evaluated over 38,000 proposals through a competitive merit review process and made over 11,000 new competitive awards, primarily to academic institutions. In addition to these proposals, GRFP reviewed about 13,000 applications for fellowships. Almost 31,000 members of the science and engineering community participated in the merit review process as panelists and proposal reviewers.³ Awards were made to 1,850 institutions in all 50 states, the District of Columbia, and four U.S. territories. These institutions employ many of America's leading scientists, engineers, and educators; and they train the leading innovators of tomorrow. In FY 2023, approximately 353,000 people were directly involved in NSF-funded programs and activities. 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 novel curriculum and teaching methods.

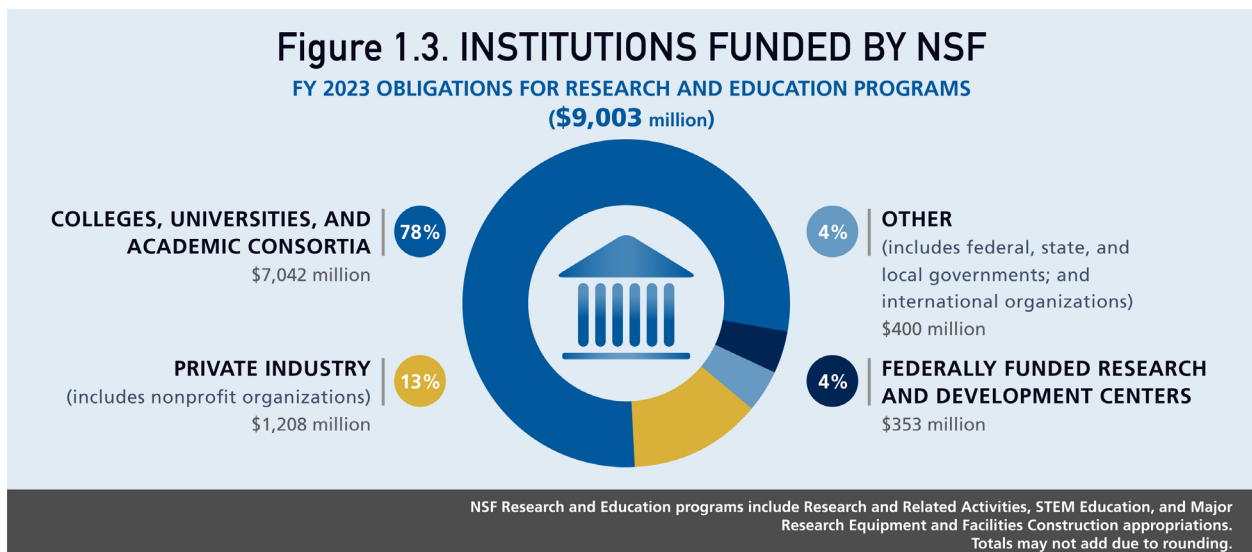
As shown in Figure 1.2, NSF's award funding was used primarily for financial assistance to carry out a public purpose through grants and cooperative agreements. Grants can be either standard awards, in which funding for the full duration of the project is awarded in a single fiscal year, or continuing awards, in which funding for a multiyear project is awarded in increments. Cooperative agreements are used when the project requires substantial agency involvement (such as research centers and

³ For more information about NSF's merit review process, see https://www.nsf.gov/bfa/dias/policy/merit_review/ and *NSF's Merit Review Process, FY 2021 Digest* (NSB-2023-14) at https://www.nsf.gov/nsb/publications/2022/merit_review/nsb202314.pdf.

major facilities). Contracts are generally used for the direct benefit of the federal government (i.e., to acquire products or services), but they may be used to benefit the public in specific circumstances. On a limited basis in FY 2023, NSF used "other arrangements" and "other transaction authority" to make awards. These two mechanisms support innovative approaches to fund programs managed by the Technology, Innovation and Partnerships (TIP) directorate.



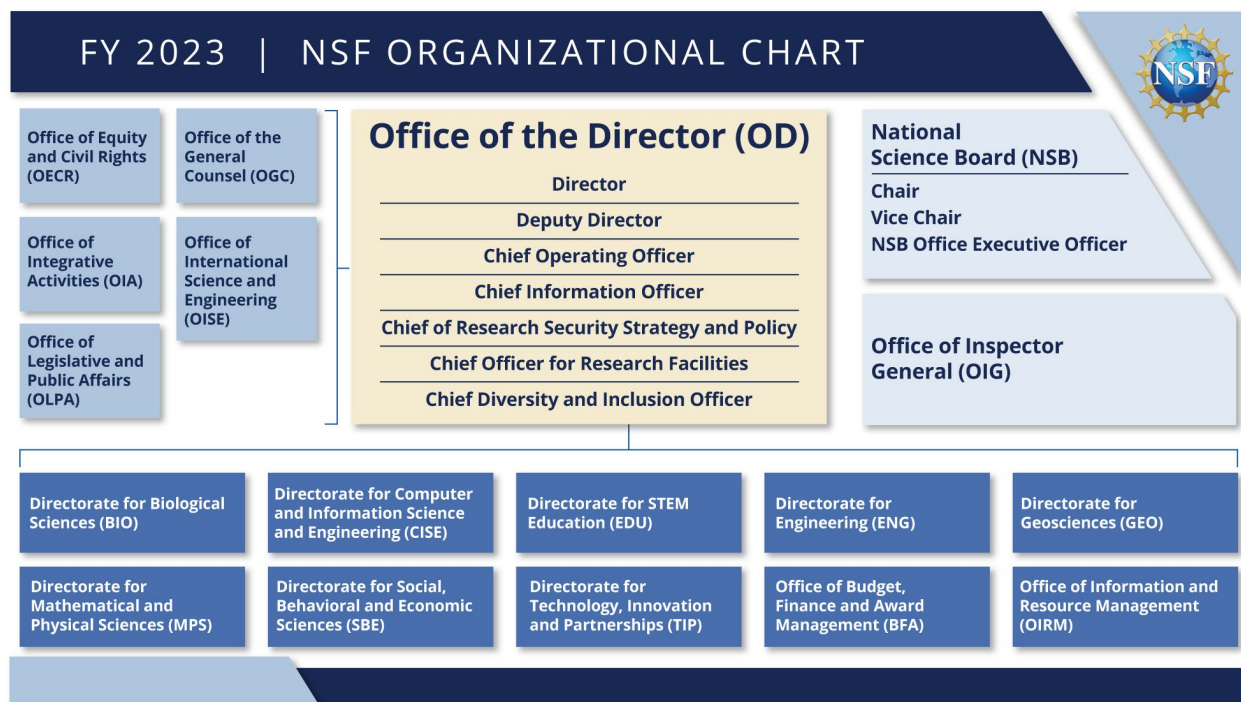
As shown in Figure 1.3, 78 percent of support for research and education programs (\$7,042 million) was provided to colleges, universities, and academic consortia. Private industry, including small businesses and nonprofit organizations, accounted for 13 percent (\$1,208 million), and support to Federally Funded Research and Development Centers accounted for 4 percent (\$353 million). Other recipients (i.e., federal, state, and local governments; and international organizations) accounted for 4 percent (\$400 million) of support for research and education programs.



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.⁴ As shown in Figure 1.4, NSF's organizational structure generally aligns with the major fields of science and engineering.⁵

Figure 1.4 FY 2023 Organizational Chart



The NSF Director and the 24-member NSB jointly pursue the goals and functions 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.”⁶ The NSB identifies issues critical to NSF’s future and helps chart the strategic direction of NSF’s budget and programs. The President appoints NSB members who are prominent contributors to the STEM research and education community.⁷ NSF’s Director is a member *ex officio* of the Board. The Director and the other NSB members serve 6-year terms.

In FY 2023, NSF’s workforce comprised approximately 1,500 federal employees and 200 scientists on temporary appointments under the Intergovernmental Personnel Act (IPA) program.⁸ NSF regularly recruits scientists, engineers, and educators through the IPA program who work at NSF for up to 4 years. They bring relevant perspectives from across the country and all fields of science supported by NSF, helping explore new directions for research in science, engineering, and education, including

⁴ The Director’s biography: https://www.nsf.gov/staff/staff_bio.jsp?lan=spanchan&from_org=

⁵ NSF’s organization chart: https://www.nsf.gov/staff/organizational_chart.pdf

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

⁷ NSB members during FY 2023 are shown in Appendix 9 of this AFR.

⁸ The 1,540 Full-time equivalents (FTEs) in FY 2023 included the federal employee workforce for NSF, the NSB, the OIG, and U.S. Arctic Research Commission.

emerging interdisciplinary fields. On returning to their home institutions from across academia, they bring knowledge of NSF programming and leading research from a national perspective.

In addition to the Foundation's headquarters in Alexandria, Virginia, NSF maintains an office in Christchurch, New Zealand, to support the United States Antarctic Program.

Management Challenges

In October 2022, the OIG identified eight management challenges for NSF in FY 2023.⁹ Management's report on the significant activities undertaken in FY 2023 to address these challenges is included in *Appendix 2B: Management Challenges – NSF's Response* of this Agency Financial Report (AFR). The report also discusses planned activities to address these challenges in FY 2024 and beyond. The following are highlights of the agency's significant actions and planned next steps to address the FY 2023 OIG Management Challenges.

Increasing Diversity in Science & Engineering Education and Employment

The lived experiences, cultural diversity, and range of viewpoints of the individuals working in STEM fields are critical to actualizing an inclusive STEM workforce, thereby underscoring the importance of increasing diversity in science and engineering education and employment. Inspired by the NSF Director's visionary leadership, the NSF Equity Ecosystem framework was created to address this Management Challenge. This framework arranges equity-related actions along three lines of effort: encouraging diversity, equity, inclusion, and accessibility (DEIA) within the NSF workforce; ensuring equity in the delivery of NSF programs; and widening engagement in STEM. In FY 2023, demonstrated progress towards this end is evidenced by the establishment of the Chief Diversity and Inclusion Officer position to enhance coordination and oversight of the agency's initiatives to increase participation in STEM fields and to direct the implementation of the DEIA Strategic Plan for 2022–2024. Across every NSF directorate and office, new funding opportunities have been developed or existing ones renewed to diversify the STEM workforce. In addition, there are coordinated efforts to advance the Agency Priority Goal to "Improve representation in the scientific enterprise," which is focused on expanding the representation of investigators and institutions submitting proposals to NSF. Going forward, NSF will continue to leverage its expertise on broadening participation by facilitating discussions across various communities of practice, as well as increasing and diversifying external engagements with underrepresented communities and emerging research institutions, particularly minority-serving institutions and those institutions located within Established Program to Stimulate Competitive Research (EPSCoR) jurisdictions.

⁹ Inspector General's Management Challenges for NSF in Fiscal Year 2023 can be accessed at <https://oig.nsf.gov/sites/default/files/reports/2022-11/Management-Challenges-National-Science-Foundation-Fiscal-Year-2023.pdf>.

NSF funding drives semiconductor industry in Arkansas

Arkansas has a strong track record in semiconductor and microelectronics research dating back to the 1970s. More than 20 companies in Arkansas manufacture semiconductors and related components, and NSF has awarded more than \$80 million to Arkansas colleges and universities for semiconductor-related research and education since 1990. This includes strategic investments like the EPSCoR-funded Arkansas Advancing and Supporting Science, Engineering and Technology Initiative, which supported a number of projects related to nanotechnology and microelectronics, as well as investments in 11 related start-up ventures and private firms. More recent NSF awards include an \$18 million grant co-funded by the EPSCoR and mid-scale research infrastructure programs to build and operate a national silicon carbide research and fabrication facility at the University of Arkansas, which will be the only openly accessible fabrication facility of its kind in the U.S.



Technicians learn to operate equipment to make semiconductors. *Credit: ATE Impacts.*

Overseeing the United States Antarctic Program (USAP)

Antarctica's remote location, extreme environment, and the short period of time each year during which the continent is accessible present challenges above and beyond those typically encountered for domestic construction projects and science operations. USAP's recovery from two seasons of drastic curtailment of activity during the pandemic is now underway. Construction on the Antarctic Infrastructure Modernization for Science project and the Information Technology and Communications primary addition resumed in FY 2023. A major focus of USAP in FY 2023 was implementing actions under the Sexual Assault and Harassment Prevention and Response (SAHPR) initiative, including hosting over 60 bystander trainings, deploying an On-Ice Victim Advocate, and establishing a 24/7 Antarctic Helpline. Going forward, NSF will complete a comprehensive USAP Climate Survey, continue efforts to transition to enhanced screening procedures for contractors, and expand preventive training to advance SAHPR efforts.

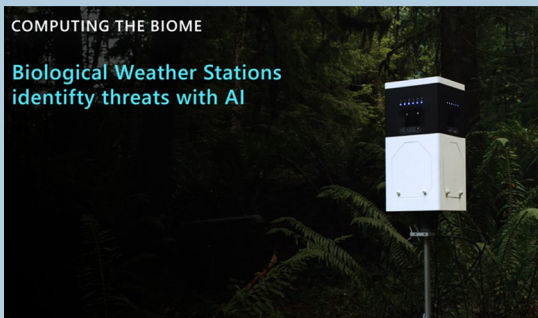
Overseeing Grants in a Changing Environment

NSF is taking important steps to position itself to effectively manage its evolving grant environment while implementing the requirements of the CHIPS and Science Act of 2022. It is conducting a strategic and methodical assessment of its current award oversight and control environment to proactively adapt to current and prospective grant portfolio changes. To focus on agency implementation activities, facilitate knowledge sharing, coordinate legislative requirements, and develop strategies, NSF has developed coalitions with other federal entities to exchange information and has established internal groups, including the EPSCoR Strategy, Engagement, and Consultation Group to help meet increased funding targets for EPSCoR jurisdictions. NSF will continue to invest resources into its ongoing objective to increase diversity in the STEM workforce and expand the institutional and geographic diversity of federal award recipients. Further, NSF's Enterprise Risk Management and award monitoring programs provide a strong foundation for the agency to address emerging risks.

For instance, NSF was able to leverage the agency's existing advanced monitoring program by providing pre-award business assistance and including special terms and conditions that established additional monitoring and controls for new TIP awardee recipients. The agency has also been reassessing its fraud risk inventory to evolve its risk mitigation and response strategies alongside changes to its financial assistance portfolio.

COMPUTING THE BIOME

Biological Weather Stations identify threats with AI



Computing The Biome researchers are developing new AI models that recognize disease-transmitting and invasive species instantaneously. These are being deployed onto Microsoft Premonition's Biological Weather Stations together with Harris County Public Health to enhance public health and biosecurity. *Credit: Microsoft.*

Biological weather stations identify threats with Artificial Intelligence

A team led by Vanderbilt University is creating a platform to detect biological threats and predict disease outbreaks in major cities. Under a \$5 million NSF cooperative agreement, the Computing the Biome effort initially focused on monitoring and predicting mosquito-borne diseases. The team of engineers, computer scientists, biologists, epidemiologists, and public health and policy experts from multiple organizations built data streams that combine information such as hyper-local weather, autonomously identified disease-transmitting insects, and genetically identified viruses and microbes. Artificial Intelligence (AI) systems use this data to detect and predict biothreats. The project was deployed in Houston and Harris County, Texas, and tests are being conducted in Nepal. The effort is one of 34 projects supported under Phase 2 of NSF's Convergence Accelerator program.

Managing the Intergovernmental Personnel Act (IPA) Program

NSF provides the opportunity for scientists, engineers, and educators to rotate into the agency on a temporary basis, bringing fresh perspectives from across all fields of science and engineering supported by the agency. NSF takes a proactive approach to managing the IPA program to appropriately consider and mitigate inherent risks associated with its execution, including through an IPA Steering Committee that advises the senior leadership on matters that directly concern policy on the use of the IPA Program.

NSF has identified the need to better vet incoming IPA rotators via the recent OIG audit of the agency's internal processes. To address concerns and risks identified, NSF established an IPA Vetting Working Group comprising agency leaders and subject matter experts. The Working Group has made recommendations to the Chief Operating Officer regarding the agency's approach to vetting candidates for IPA positions at NSF. The Working Group will continue to partner with NSF stakeholders to address issues such as (1) potential threats to national or economic security by IPA candidates with foreign affiliations or sources of funding; (2) potential risks due to other conflicts of interest and commitments; and (3) timeliness of vetting relative to employment offers and start of assignment.

Earthquake tests could help sustainable wooden structures reach new heights

Buildings constructed with mass timber—layers of bonded wood—can be erected more quickly and are more sustainable than those built with traditional construction materials. With building codes in the U.S. revised in the last few years to permit mass timber buildings of up to 18 stories, engineers want to determine the resilience of mass timber in earthquake zones. A team of structural engineering researchers subjected a 10-story mass timber building to a series of simulated earthquakes. The TallWood project took place at the Natural Hazards Engineering Research Infrastructure (NHERI)'s Large High-Performance Outdoor Shake Table at the University of California, San Diego. Both the NHERI TallWood project and the shake table are funded by NSF to advance the Nation's infrastructure resilience.



The 10-story mass timber building under construction on the shake table. Credit: Shiling Pei/Colorado School of Mines.

Overseeing NSF-Funded Research Infrastructure

NSF funds recipient institutions to manage the development, design, construction, operation, and disposition of research infrastructure (RI), which are state-of-the-art facilities that support research and education, including telescopes, ships, detectors, and distributed observatories. The RI portfolio is complex and has certain inherent risks, including meeting emergent scientific objectives, protecting the safety of life and property, potential implementation delays, and unanticipated additional costs. In FY 2023, NSF has continued to use the Office of the Director's Watch List to monitor projects at risk of experiencing cost or schedule overruns or performance issues or constituting a new, high-risk, large-scale endeavor for the agency. NSF also issued guidance, including a revised *Business System Review Guide* and *Mid-scale RI Pre-award Review Guidance*. Going forward, NSF will continue to enhance professional development for the RI oversight workforce, work across the agency to "right-size" mid-scale RI oversight, and implement corrective actions related to an OIG audit of divestment of major facilities.

Mitigating Threats to Research Security

NSF seeks to maintain a vibrant science and engineering community for the benefit of the Nation and to preserve the integrity of international collaboration. However, open scientific exchange and research face a challenge from some foreign governments. To mitigate threats to research security, NSF established the Office of the Chief of Research Security, Strategy and Policy and took multiple actions in FY 2023 to continue progress on this issue.¹⁰ The agency accomplished the following: 1) collaborated with the research community to develop research security training modules; 2) published a solicitation to establish the Safeguarding the Entire Community in the U.S. Research Ecosystem or SECURE Center (officially called the Research Security and Integrity Information Sharing Analysis Organization in the CHIPS and Science Act of 2022); 3) continued to serve as a co-chair on the National Science and Technology Council, Research Security Subcommittee to coordinate research

¹⁰ See updates at "Research Security at the National Science Foundation" at <https://new.nsf.gov/research-security>.

security efforts across the U.S. Government; 4) developed internal guidance and public-facing guidelines on research security data-related practices to define how NSF assesses research security-related risk and scaled data analytics capabilities; 5) created a process to support the vetting of incoming IPA assignments at NSF to mitigate research security-related risks; 6) began concept development and published proposed data elements for the foreign financial disclosure requirement under Section 10339B of the CHIPS and Science Act; and 7) initiated a pilot for the forthcoming malign foreign talent program prohibition under section 10632 of the CHIPS and Science Act. Going forward, NSF will continue to work with federal partners to meet CHIPS and Science Act research security and related requirements, develop and deliver additional trainings on research security for the research community, and continue to refine and scale up research security-related analytics capabilities.

Mitigating Threats Posted by the Risk of Cyberattacks

NSF recognizes the cybersecurity challenges of a digital federal government. NSF continues to implement a Zero Trust Architecture (ZTA), focusing on priority tasks to address the five pillars of the Zero Trust Maturity Model and to implement required actions in support of ZTA principles. NSF's near-term zero trust efforts are focused on establishing new capabilities to reduce risk and protect sensitive agency data from compromise. To this end, NSF made progress in the implementation of enterprise identity management and phishing-resistant multifactor authentication. The Foundation also enhanced logging and information-sharing capabilities and expanded retention periods to further enhance event correlation and incident management. To improve vulnerability information, NSF enhanced threat feed information and updated and implemented its password policy. NSF made significant progress in moving information technology systems and services to the cloud to modernize legacy technology, improve capacity and uptime, enable standardization of services, and leverage the security benefits of cloud-based infrastructure. Over 80 percent of NSF business applications and services are in the cloud. Also, NSF maintains strong access controls and a robust capability to quickly detect and respond to incidents, including state-of-the-art network and security protections.

Jumpstart into Cyber Summer Program

In partnership with the SANS Institute in Virginia, Whatcom Community College in Washington, and Sinclair Community College in Ohio, NSF launched the Jumpstart into Cyber Summer Program to create opportunities for technological innovation and prepare a skilled cyber workforce capable of solving the Nation's future challenges. Jumpstart into Cyber is designed to engage and empower students from groups underrepresented in STEM, including female, Black, African American, Latino, Hispanic, and Indigenous students. The program offers an unparalleled opportunity to gain valuable cybersecurity skills and preparation for future careers through a two step training course. Upon completion, this program will equip students with the knowledge and experience necessary to pursue the Global Information Assurance Certification (GIAC) Foundational Cybersecurity Technologies certification, a highly regarded credential in the cybersecurity industry.



Jumpstart into Cyber focuses on engaging underrepresented student groups in cybersecurity education. *Credit: ATE Impacts.*

Going forward, NSF will continue to refine its long-term ZTA migration plan in alignment with the Zero Trust Maturity Model and adapt its approach as federal guidance clarifies requirements around emerging zero trust requirements. To protect NSF sensitive data on removable storage devices, NSF will implement tools to only allow authorized removable media to be used on NSF-managed devices.

Addressing Harassment in the Academic Community

NSF is committed to combatting harassment and sexual assault anywhere science or education is conducted, including research stations, vessels, field sites, and NSF-funded programs. NSF has taken steps to help ensure all NSF-funded research and learning environments are free from sexual and other forms of harassment. Among other actions, NSF established a new SAHPR Office to serve as NSF's centralized communication point for sexual assault and sexual harassment matters, ensuring such matters are appropriately referred and providing access to resources and guidance to help prevent sexual assault and harassment. NSF continually bolsters its policies, guidelines, and stakeholder engagement so organizations clearly understand expectations and individuals understand their rights. For example, NSF continued to receive, review, and monitor notifications filed under the award term and condition that requires institutions to report findings of harassment or assault by NSF-funded principal investigators or co-principal investigators, and NSF reaffirmed expectations that research organizations establish and maintain clear and unambiguous standards of behavior.

Moving into FY 2024, NSF remains committed to continuing the work to combat sexual misconduct and to ensure all NSF-funded environments are safe, harassment- and assault-free spaces with a positive and inclusive culture.

Breakthrough in computer chip energy efficiency could cut data center electricity use

NSF funds several National Nanotechnology Coordinated Infrastructure (NNCI) centers. The NNCI Northwest Nanotechnology Infrastructure based in Seattle, Washington, and Corvallis, Oregon, has several projects, including photonic chips—microchips that use photons instead of electrons in integrated circuits. Photonic chips are currently used in multiple fields, including data and telecommunications, health and medicine, automotive manufacturing, and agriculture. Researchers at Oregon State University and Baylor University created a type of silicon photonics that reduce the energy consumption of chips used in supercomputers and data centers. Silicon photonics use silicon as the material light or other electromagnetic waves travel through in the circuit.



Engineers have developed a new method to compensate for temperature variations in photonic chips. *Credit: Oregon State University.*

Climate-related Financial Risk

In NSF's FY 2023 *Sustainability Report and Implementation Plan*¹¹ to the Council for Environmental Quality, NSF has established measures to evaluate on a regular cadence as part of external reviews the resilience of major facilities to natural hazards associated with climate change (e.g., fires, flooding, extreme wind, etc.). Formal reviews of facility conditions will now take place once every 5 years. The award recipient will generally conduct the assessments, and the resulting report will be provided to NSF. External panel recommendations will help inform agency decisions around future investments in the supporting infrastructure to reduce risk to the agency and the scientific community. NSF-owned assets in the Arctic and Antarctic are constructed to withstand the harshest environments on Earth, and their conditions are routinely assessed as part of ongoing operations due to the inherent risks. Over time, NSF will consolidate recapitalization needs for the full suite of research infrastructure into a unified plan.



NSF-funded wildfire research helps improve tools and policies for community and industry stakeholders.
Credit: Drone Amplified.

Just a warm-up: new wildfire interdisciplinary research center studies fire dynamics

The Wildfire Interdisciplinary Research Center (WIRC) at San José State University is an NSF Industry-University Cooperative Research Center that investigates wildfire science. WIRC focuses on fire weather (i.e., fire behavior and how weather leads to fire danger), fire modeling, fire's interaction with climate, and fire remote sensing. In October, WIRC performed a controlled fire burn in steep canyons to determine how fires intensify in canyons due to local weather, such as fire-induced winds, and topography. This was the first canyon wildfire study conducted anywhere in the world. WIRC's Fire Weather Research Laboratory also maintains datasets from all their field research and wildfire deployment, which are available upon request.

¹¹ NSF's cleared Sustainability Report and Implementation Plans are posted to the Council for Environmental Quality website: <https://www.sustainability.gov/contributing-agencies.html>.

Performance

NSF's FY 2023 performance results are based on the framework established by the agency's Strategic Plan for FYs 2022–2026: *Leading the World in Discovery and Innovation, STEM Talent Development, and the Delivery of Benefits from Research*.¹² The four strategic goals in this plan reflect four themes—Empower, Discover, Impact, and Excel—and they form the core of the plan. These themes focus on expanding frontiers, engaging people, and delivering solutions. Under each goal are two strategic objectives, which together encompass all areas of agency activity. This goal structure enables NSF to link its investments to longer-term outcomes.

Strategic Goals and Objectives

Strategic Goals	Strategic Objectives
1. Empower: Empower STEM talent to fully participate in science and engineering	1.1 Ensure accessibility and inclusivity – Increase the involvement of communities underrepresented in STEM and enhance capacity throughout the Nation.
	1.2 Unleash STEM talent for America – Grow a diverse STEM workforce to advance the progress of science and technology.
2. Discover: Create new knowledge about our universe, our world, and ourselves	2.1 Advance the frontiers of research – Accelerate discovery through strategic investments in ideas, people, and infrastructure.
	2.2 Enhance research capacity – Advance the state of the art in research practice.
3. Impact: Benefit society by translating knowledge into solutions	3.1 Deliver benefits from research – Advance research and accelerate innovation that addresses societal challenges.
	3.2 Lead globally – Cultivate a global science and engineering community based on shared values and strategic cooperation.
4. Excel: Excel at NSF management and operations	4.1 Strengthen at speed and scale – Pursue innovative strategies to strengthen and expand the agency's capacity and capabilities.
	4.2 Invest in people – Attract, empower, and retain a talented and diverse NSF workforce.

In support of Strategic Objective 1.1, Increase the involvement of communities underrepresented in STEM and enhance capacity throughout the Nation, NSF established an Agency Priority Goal for FY 2022–2023 to “Improve representation in the scientific enterprise.” The goal has focused on making changes to NSF practices, processes, and policies to foster an increase in proposal submissions from members of groups underrepresented in STEM and from underserved institutions. NSF implemented its approach to this goal through workgroups focused on needed changes in policy, data collection and analysis, engagement with external stakeholders, and internal engagement with NSF staff. The focus of these efforts has been to increase the number and percentage of proposals from groups underrepresented in STEM and from underserved institutions

¹² NSF's Strategic Plan is available at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf22068.

by 10 percent.¹³ NSF has made progress against this goal and will be continuing the focus on improving representation in STEM through its FY 2024–2025 Agency Priority Goal.

Progress Toward Achievement of Performance Goals

Each year, NSF issues reports to provide financial management and program performance information to demonstrate accountability to our stakeholders, including the American public. In addition to the AFR, NSF produces the Annual Performance Report.¹⁴ NSF's FY 2023 Annual Performance Report will appear in the *FY 2025 Budget Request to Congress* along with the Annual Performance Plan for FY 2025. This report will provide a complete discussion of NSF's performance measures, including descriptions of the metrics, methodologies, results, and trends. The topic areas of these goals and their FY 2023 targets are listed in the following table. Annual results will be provided in the FY 2023 Annual Performance Report along with information about NSF's verification and validation review of performance data, as required by the Government Performance and Results Modernization Act of 2010.



A California two-spot octopus (*Octopus bimaculoides*) in the Cliff Ragsdale lab at the University of Chicago.
Credit: Robert Kozloff/The University of Chicago.

Deciphering how octopi cool their brains

Cutting edge research demonstrates that California two spot octopi can adapt to dangerous changes in water temperature by altering their brains. This research, funded by NSF and led by the Marine Biological Laboratory in Woods Hole, Massachusetts, provides novel insight into how the environment can influence genetic information. Like other cephalopods, the California two spot octopus cannot generate its own body heat. By editing their RNA, the messenger molecule between DNA and proteins, octopi can prevent injury by altering the production of neural proteins in response to dangerous temperature drops that can occur during tide, water depth and seasonal changes. This research demonstrates how octopi, and potentially other animals, can adapt and protect themselves from potentially dangerous environmental conditions.

¹³ More information on NSF's Agency Priority Goal to "Improve representation in the scientific enterprise," as well as quarterly updates are available at <https://www.performance.gov/agencies/nsf/>.

¹⁴ These reports are made available on NSF's website as they are completed at: <https://new.nsf.gov/about/budget>.

FY 2023 Performance Goals


Strategic Objective	Annual Goal Statements
Empower 1.1	Two-year Agency Priority Goal: Improve representation in the scientific enterprise.
Empower 1.2	Increase utilization of the Education and Training Application (ETAP)
Discover 2.1	Major Facility Infrastructure Investments: Ensure program integrity and responsible stewardship of major research facilities and infrastructure.
Discover 2.2	Mid-Scale Infrastructure Investments: Ensure program integrity and responsible stewardship of mid-scale research infrastructure.
Impact 3.1	Grow Partnerships: Increase funding invested from 1) industry and non-profits and 2) other federal agencies that NSF programs leverage to support the science, technology, engineering, and mathematics (STEM) enterprise.
Excel 4.1	Robust and reliable IT services: Ensure availability of IT resources for NSF staff and the broader research community.
Excel 4.2	Human Capital Operating Plan (HCOP): Track progress against NSF's HCOP.
	Culture of Inclusion: Cultivate a workplace environment that proactively supports, engages, and recognizes all members of the workforce.
Cross-cutting	Make Timely Proposal Decisions: Inform applicants whether their proposals have been declined or recommended for funding within 182 days, or six months, of deadline, target, or receipt date, whichever is later.

In addition to these nine annual goals, NSF's FY 2023 Annual Performance Report will also include results for a number of other indicators that relate to NSF's role in these areas. For example, under Objective 1.1, information will be included on NSF funding to Minority-Serving Institutions and to institutions in EPSCoR states and jurisdictions, and under Objective 3.1, information will focus on participation in NSF's I-Corps and SBIR/STTR programs. These additional indicators are intended to foster an understanding of agency performance beyond annual output measures, and this approach draws upon the framework for evidence-based policymaking outlined in the Office of Management and Budget (OMB) guidance.^{14F¹⁵}

¹⁵ OMB Memorandum M-21-27 "Evidence-Based Policymaking: Learning Agendas and Annual Evaluation Plans" may be accessed at www.whitehouse.gov/wp-content/uploads/2021/06/M-21-27.pdf; OMB Memorandum M-19-23 "Phase 1 Implementation of the Foundations for Evidence-Based Policymaking Act of 2018: Learning Agendas, Personnel, and Planning Guidance" may be accessed at www.whitehouse.gov/wp-content/uploads/2019/07/M-19-23.pdf.

Renewing NSF

The NSF FY 2022-2026 Strategic Plan emphasized the agency's continued efforts to excel at operations and management to enhance performance of its mission and help contribute to U.S. leadership in research and education across all areas of STEM. In FY 2023, the enterprise-scale reform and process improvement efforts, collectively called Renewing NSF, continued to foster a culture of innovation and collaboration across the agency to implement key operational reforms. Primary outcomes in FY 2023 included the successful acquisition of support services to expand engagement across the agency for continuous assessment and prioritization of evolving reform opportunities; enhancement and maturation of functionality in the Program Suitability and Proposal Concept Tool and agency-wide formalization of the concept outline submission type in the NSF Proposal and Award Policies and Procedures Guide ; migration and upgrade of internal Partnerships guidance and transition of ownership to the TIP directorate; and development and issuance of initial agency-wide implementation of a streamlined post-merit review process for declines, building from the pilot activities completed last year. In addition to these activities, Renewing NSF has served as a strategic partner representing the Office of the Director to support distributed reform activities in IT Innovation Management, Account Management reform, and Project Reporting Compliance and resulting enhancements to internal and customer-facing systems and processes. The focus areas of Renewing NSF remain: (1) making information technology work even better for all; (2) adapting the workforce and the work; (3) streamlining, standardizing, and simplifying processes and practices; and (4) expanding and deepening public and private partnerships.



Revealing hidden patterns in STEM representation
More women, as well as Black, Hispanic, American Indian, and Alaska Native people, have collectively worked in STEM jobs over the past decade, according to NSF's National Center for Science and Engineering Statistics. These gains are diversifying the STEM workforce, and these groups are earning more degrees in science and engineering fields at all levels compared to previous years, according to the Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023 report. In addition to bringing a wide range of ideas, creativity, and skills to these fields, equal access to the STEM workforce is important because those jobs are associated with higher wages and lower unemployment rates—regardless of sex, race, ethnicity, or disability status.

Credit: NSF.

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 *National Science Foundation's Merit Review Process, Fiscal Year 2021 Digest*.¹⁶

¹⁶ NSF's *Merit Review Process, FY 2021 Digest* (NSB-2023-14) may be accessed at https://www.nsf.gov/nsb/publications/2022/merit_review/nsb202314.pdf

Figure 1.5 identifies three key portfolio measures: competitive proposals acted upon, new awards, and funding rates.

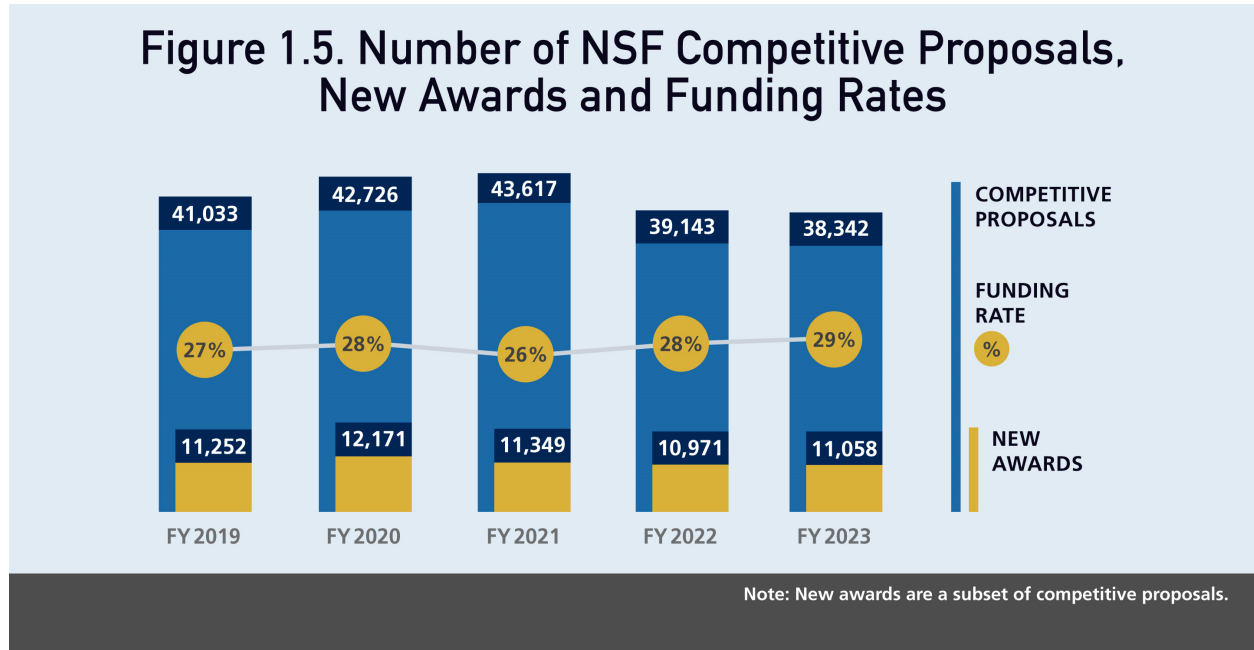


Table 1.1 provides proposal workload and management trends over 5 years. Highlights of these indicators are as follows:

- Between FY 2022 and FY 2023, the number of competitive proposal actions decreased by 2 percent; from 39,143 to 38,342.
- There were 11,058 new awards in FY 2023, a slight increase over FY 2022 new awards (10,971).
- The overall funding rate in FY 2023 was 29 percent, an increase of 1 percentage point. 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 was \$259,967, approximately \$39,000 higher than in FY 2022.
- The number of employees (full-time equivalent [FTEs]) increased between FY 2022 and FY 2023, 1,516 FTE and 1,540 FTE, respectively.
- The number of active awards was about the same in FY 2023: 58,477 compared to 58,384 in FY 2022. The 5-year average number of active awards is over 56,500.
- All NSF awardee institutions are required to submit payment requests at the award level to the NSF Award Cash Management Service (ACM\$). Award expenses are posted to the NSF financial system at the time of the payment request. Reliance on ACM\$ reduces the burden of manual invoicing and the potential for errors or missed payments.

Table 1.1 Proposal Workload and Management Trends

Measure		FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Percent Change (FY 2023-FY 2022)	Average (FY 2019-FY 2023)
Portfolio	Competitive proposal actions	41,033	42,726	43,617	39,143	38,342	-2.0%	40,972
	Competitive award actions	11,252	12,171	11,349	10,971	11,058	0.8%	11,360
	Average annual award size (competitive awards)	\$197,530	\$213,280	\$231,202	\$220,680	\$259,967	17.8%	\$224,532
	Funding rate	27%	28%	26%	28%	29%	+1 percentage point	28%
Proposal Workload	Number of employees FTE, usage ¹	1,415	1,421	1,456	1,516	1,540	1.6%	1,470
	Number of active awards ²	54,093	55,239	56,427	58,384	58,477	0.2%	56,524
	Proposal reviews conducted	192,033	199,526	211,903	187,318	179,958	-3.9%	194,148
Financial	Number of grant payments	20,935	22,169	23,794	27,065	27,426	1.3%	24,278
	Award expenses incurred but not reported at 9/30 (\$ in millions) ³	\$425	\$437	\$461	\$457	\$466	2.0%	\$440

Notes:

¹ FTEs shown include the federal employee workforce for NSF, NSB, OIG, and U.S. Arctic Research Commission.

² Active awards include all active awards regardless of whether funds were received during the fiscal year.

³ FY 2023 number reflects an accrual, and all other years reflect the validated estimate for the fiscal year. This metric does not include accruals for SBIR awards.

Financial Discussion and Analysis

NSF has a strong history of effective and efficient financial operations, consistent with the agency's *Excel* strategic goal: to excel at NSF operations and management. In FY 2023, NSF continued its focus on improvements to financial management processes, systems, and control environment. NSF also continued introducing new and innovative reporting tools that provide the right type of information at the right time. Throughout the year, NSF engaged in various financial management activities that demonstrated its commitment to upholding the highest standards of fiscal stewardship.

- *Reporting Innovations and process improvements*
 - With the implementation of the Quarterly Remittance Memo and dashboard, NSF staff have greater transparency into remittance trends by institution. They can use this information to encourage institutions to switch to more efficient electronic remittance methods. To further encourage efficiencies, NSF has been collaborating with the U.S. Department of the Treasury to develop alternative electronic remittance methods for institutions that cannot use Pay.gov due to internal cash management policies.
 - NSF has launched a new initiative called Grants with no ACM\$ Payments (GNAP). This initiative aims to improve monitoring open grant obligations by identifying NSF awards that have not had any financial drawdowns in over a year and notifying institutions of these awards. The backbone of this new initiative is two-pronged: a new dashboard and associated quarterly awardee notifications. GNAP brings increased transparency and data to support effective financial post-award monitoring efforts by both NSF and the awardee institutions. This initiative supplements the existing NSF post-award financial notifications for awards with canceling appropriations and high remaining balances close to award expiration.
- *G-Invoicing*: In FY 2023, NSF implemented G-Invoicing for Orders and Performance. G-Invoicing is a common online platform for federal partners to originate and manage interagency agreements (IAAs) and exchange that data with one another for consistent financial reporting. This implementation strengthens NSF's automation, transparency, and controls over IAA business processes.
- *Enterprise Risk Management (ERM)*: NSF's ERM program is vital in promoting a risk-aware culture within the organization and supporting informed decision-making and resource prioritization. In FY 2023, NSF continued to apply the essential ERM concepts of risk appetite and tolerance to its risk profiles, facilitating effective risk assessment, management, and decision-making. NSF's Data Analytics and Assurance Program (DAAP) has also improved risk monitoring by employing innovative analytical tools. To further enhance its ERM capabilities, the agency has expanded its knowledge-sharing and training efforts, developed a program-level risk management guide, and updated risk profile templates. NSF's ERM program has continued to mature each year with sustained guidance by the Chief Operating Officer and participation by ERM Risk Captains from directorates and offices across the agency.

NSF's financial statements received an unmodified audit opinion, indicating they are free from significant errors or misstatements. The internal control program for financial reporting was found to have no material weaknesses or significant deficiencies. You can find the Independent Auditor's Report on the first page of Chapter 2, Financials, followed by management's response.

Understanding the Financial Statements

The following discussion of NSF's financial condition and results of operations should be read together with the FY 2023 financial statements and accompanying notes, found in Chapter 2, Financials, of this AFR.

In accordance with guidance in OMB Circular No. A-136, *Financial Reporting Requirements*, NSF's FY 2023 financial statements and notes are presented in a comparative format to facilitate analysis of FYs 2023 and 2022. Table 1.2 summarizes the changes in NSF's financial position in FY 2023 relative to FY 2022; and explanations of changes for financial statement line items that may be of likely public or congressional interest are provided in the paragraphs below the table.

Table 1.2 – Changes in NSF's Financial Position in FY 2023

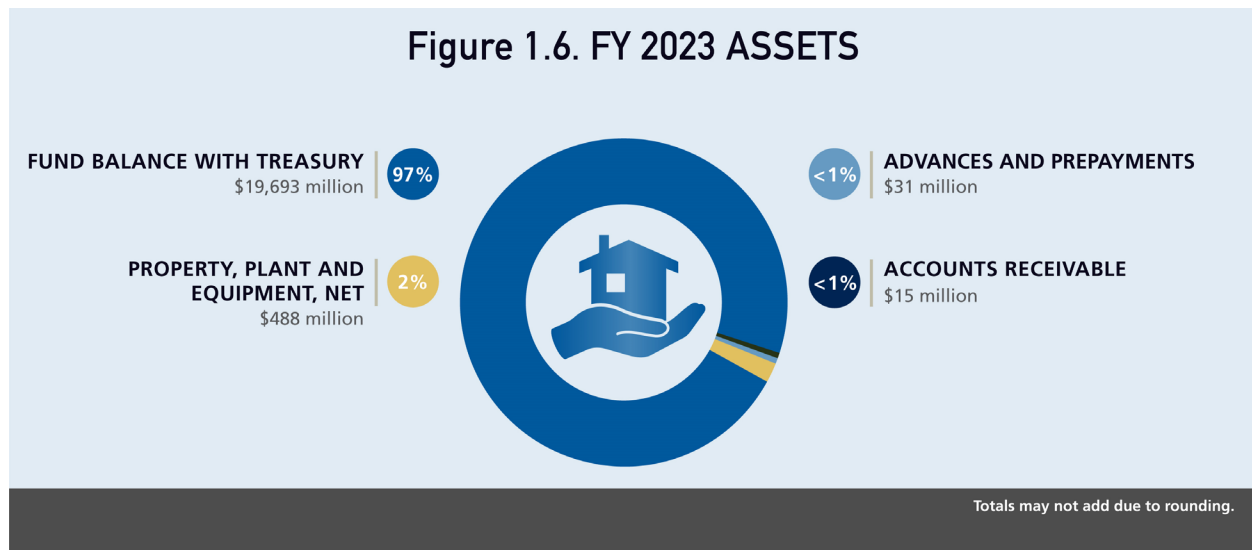
(Dollars in Millions)

Financial Categories	FY 2023	FY 2022	Dollar Change	Percentage Change
Assets	\$20,227	\$19,233	\$994	5%
Liabilities	\$830	\$796	\$34	4%
Net Position	\$19,397	\$18,438	\$959	5%
Net Cost	\$9,029	\$8,190	\$839	10%
Budgetary Resources	\$11,075	\$10,217	\$858	8%

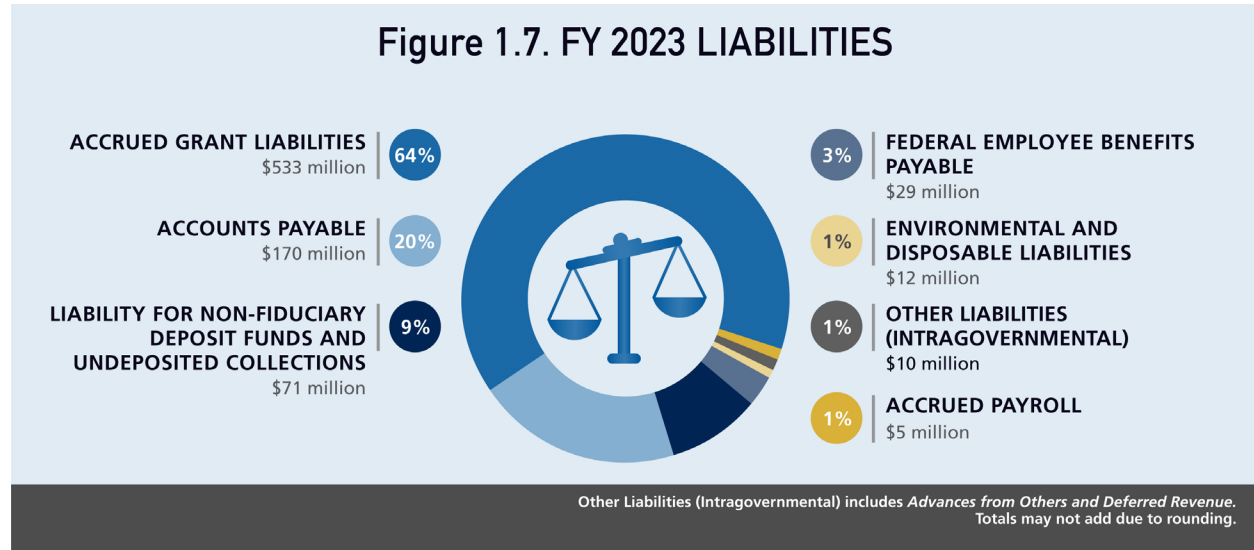
Balance Sheet

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). In FY 2023, *Assets* (Figure 1.6) increased \$994 million (5 percent) from FY 2022. Most of the change occurred in the *Fund Balance with Treasury* line, which increased \$982 million (5 percent) in FY 2023. NSF is authorized to use *Fund Balance with Treasury* to make expenditures and pay amounts due through the disbursement authority of Treasury. The *Fund Balance with Treasury* is increased through appropriations and collections and decreased expenditures and rescissions.

Figure 1.6. FY 2023 ASSETS



In FY 2023, *Liabilities* (Figure 1.7) increased \$34 million (4 percent) over the *Liabilities* reported in FY 2022. Driving this change was a \$32 million net increase in *Accounts Payable*. In FY 2023, *Accounts Payable (Intragovernmental)* decreased \$5 million while *Accounts Payable (Other Than Intragovernmental)* increased \$37 million due to a larger non-federal accounts payable accrual recorded at year-end. *Accounts Payable (Other Than Intragovernmental)* is estimated annually by utilizing historical data based on the actual expenses incurred but not reported as a percentage of current fiscal year expenses. NSF determines *Accounts Payable (Intragovernmental)* by performing outreach to its federal trading partners and recording offsetting payables for any reported trading partner *Accounts Receivable*.



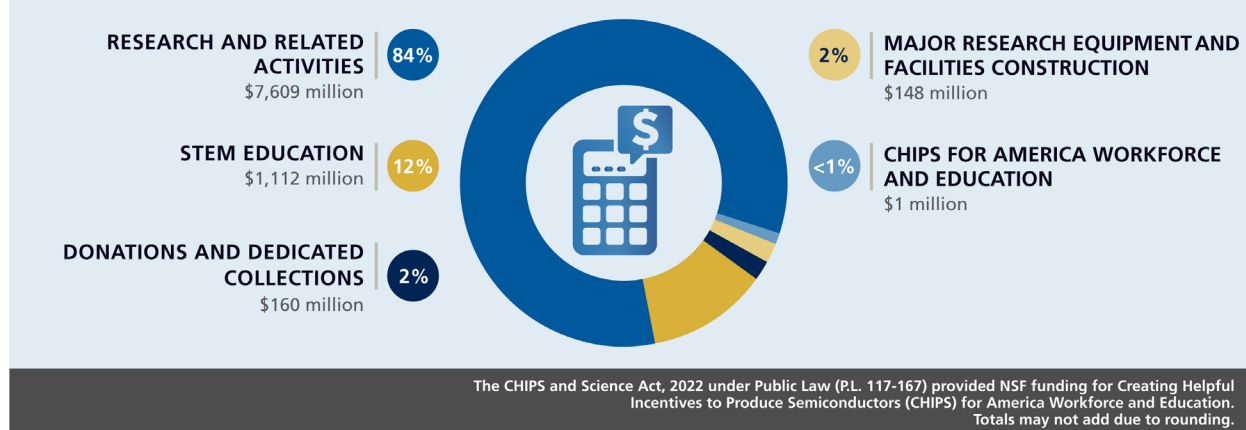
Statement of Net Cost

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 earned 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 Operations*.

Approximately 95 percent of FY 2023 *Net Cost of Operations* (Figure 1.8) was directly related to the support of R&RA, EDU, MREFC, CHIPS for America Workforce and Education, 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 the R&RA, EDU, MREFC, CHIPS for America Workforce and Education, and Donations and Dedicated Collections programs and account for approximately 5 percent of FY 2023 *Net Cost of Operations*. These administrative and management activities support the agency’s program goals.

In FY 2023, *Net Costs* related to the Coronavirus Aid, Relief, and Economic Security (CARES) Act (2020) and American Rescue Plan (ARP) (2021) for R&RA, EDU, and MREFC were \$146 million, \$14 million, and \$28 million, respectively.

Figure 1.8. FY 2023 NET COST



Statement of Changes in Net Position

The Statement of Changes in Net Position presents the agency's cumulative results of operations and unexpended appropriations for the fiscal year. In FY 2023, NSF's *Unexpended Appropriations* increased \$941 million from FY 2022 and NSF's *Cumulative Results of Operations* increased \$18 million, for a total increase in *Net Position* of \$959 million.

CARES and ARP funding resulted in Unexpended Appropriations of \$2 million and \$293 million, respectively. As NSF continues to provide support for COVID-19 related research, costs will increase, which will lead to a decrease in net position.

Statement of Budgetary Resources

The Statement of Budgetary Resources 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 2023, *Total Budgetary Resources* increased \$857 million from the FY 2022 level. *Budgetary Resources—Appropriations* in FY 2023 for the R&RA, EDU, MREFC, and CHIPS for America Workforce and Education programs were \$7,842 million, \$1,371 million, \$187 million, and \$25 million, respectively. The combined *Budgetary Resources—Appropriations* in FY 2023 for the NSB, the OIG, and AOAM accounts totaled \$476 million. NSF also received \$138 million of funding via warrant from the Nonimmigrant Petitioner Account (H-1B) and \$28 million of donations from private companies, academic institutions, nonprofit foundations, and individuals.

Limitations of the Financial Statements

The financial statements are prepared to report the financial position, financial condition, and results of operations, consistent with the requirements of 31 U.S. Code § 3515(b). The statements are prepared from records of federal entities in accordance with federal generally accepted accounting principles (GAAP) and the formats prescribed by OMB. Reports used to monitor and control budgetary resources are prepared from the same records. Users of the statements are advised that the statements are for a component of the U.S. Government.

Analysis of Systems, Controls, and Legal Compliance

Management Assurances

The Federal Managers' Financial Integrity Act of 1982 (FMFIA)¹⁷ and the OMB Circular A-123, Management's Responsibility for Enterprise Risk Management and Internal Control,¹⁸ require NSF to evaluate annually the effectiveness of agency internal controls and provide reasonable assurance to the President and the Congress on control system adequacy.

NSF assures its internal control system supports a mature, agile, and sustainable control environment. This proactive approach supports effective governance and oversight informed by internal and external risk. A strong risk-based framework ensures focus on the most consequential management issues and confidence that operations function as intended. The risk-based approach also supports a maturing ERM program.

The FY 2023 unmodified Statement of Assurance, with no material weaknesses, provides reasonable assurance as to the overall adequacy and effectiveness of internal controls based upon information that the system of internal control is operating efficiently and effectively.

NSF's internal control assessment provides reasonable assurance that the objectives of FMFIA and the Federal Financial Management Improvement Act of 1996 (FFMIA) were achieved and that the internal control process over financial reporting is effective.



National Science Foundation

FY 2023 Statement of Assurance

The National Science Foundation (NSF) management is responsible for managing risks and maintaining effective internal control to meet the objectives of Sections 2 and 4 of the *Federal Managers' Financial Integrity Act* (FMFIA).

NSF conducted its assessment of risk and internal control processes in accordance with OMB Circular No. A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*. Based on the results of the assessment, NSF can provide reasonable assurance that internal control over operations, reporting, and compliance was operating effectively as of September 30, 2023.

/s/

Sethuraman Panchanathan
Director

November 14, 2023

17 FMFIA can be accessed at: <https://www.congress.gov/bill/97th-congress/house-bill/1526/text>

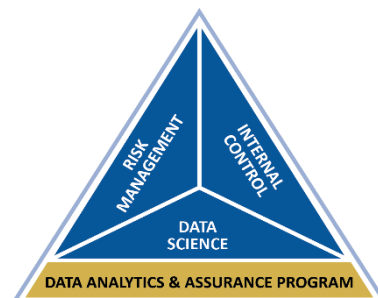
18 OMB Circular A-123 can be accessed at:

<https://obamawhitehouse.archives.gov/sites/default/files/omb/memoranda/2016/m-16-17.pdf>

Highlights from NSF's FY 2023 Data Analytics and Assurance Program (DAAP)

NSF's DAAP adapts knowledge sharing for ERM and internal control risks leveraged by data science and innovative technology to continuously improve the effectiveness of risk monitoring. The DAAP supports the NSF mission by:

- Dealing with the proliferation of data.
- Leveraging artificial intelligence and automation.
- Targeting and reducing the cost of compliance efforts.
- Strengthening management decision-making.



The DAAP's areas of focus for FY 2023 were as follows:

ERM – NSF continued to mature its ERM program in alignment with risk management standards issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) ERM Integrated Framework. Efforts included engaging directorates on addressing program-level risks and developing ERM guidance and data science products to support monitoring and analyzing agency risk.

Internal Control – Oversight of NSF's internal controls over financial reporting was conducted to evaluate program integrity in accordance with OMB Circular A-123, the Green Book, and COSO's Internal Control Integrated Framework and Internal Control Over Financial Reporting Compendium of Approaches and Examples through the following key activities:

- Assessed internal control entity-level controls
- Conducted Biannual Risk and Control Checkpoints related to key risk areas
- Conducted internal control over financial reporting risk assessment through testing and modernizing the control environment
- Developed initial inventory of existing fraud risk prevention and detection activities to inform NSF's triennial improper payments risk assessment in FY 2024
- Provided support for the validation of the grant accrual
- Completed IT General Controls assessment
- Supported the Statement of Standards for Attestation Engagements (SSAE 18) review cycle.

In addition, the DAAP monitors internal controls over compliance, including: the *Anti-Deficiency Act*; *Digital Accountability and Transparency Act*; *Government Charge Card Abuse Prevention Act*; *Federal Information Security Modernization Act Management Act*; *Federal Financial Management Improvement Act*; *Single Audit Act*, and other requirements applicable to internal control.

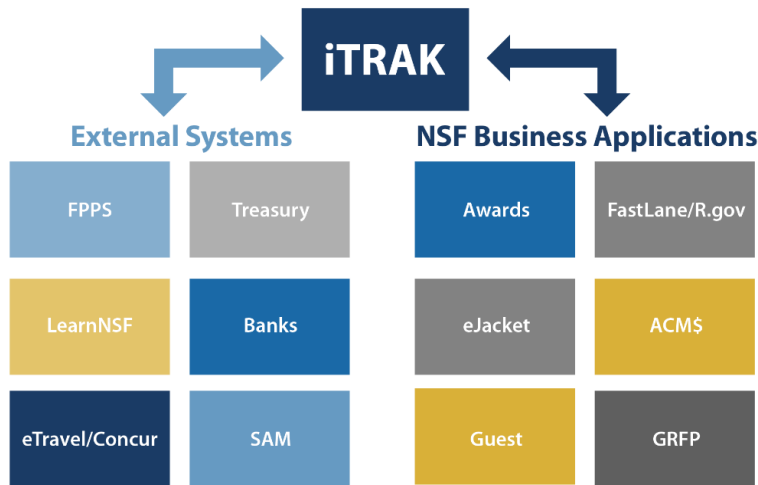
Financial Management Systems

NSF's financial management system, iTRAK (Figure 1.6), is NSF's Oracle-based, commercial-off-the-shelf financial system and is hosted off-premises in a cloud environment. In compliance with FMFIA, FFMIA, and other federal requirements, iTRAK provides automated business processes, funds control management, and financial reporting capabilities for NSF's external and internal customers, including grantees, financial and administrative staff, and program managers. iTRAK also performs

system edit checks and provides an audit trail for financial transactions, thereby strengthening internal controls. By enabling efficient and effective execution of financial activities and business operations, iTRAK's service provider provides NSF assurance for its financial system through service provider audits (more technically referred to as SSAE No. 18) at the application, platform, and infrastructure levels. All three levels received unmodified audit opinions (i.e., clean) for FY 2023.

In FY 2023, NSF continued planning for the next generation financial system and will continue enhancing iTRAK's functional and technical capabilities to streamline operations and comply with emerging cybersecurity requirements and other federal mandates.

Figure 1.9—NSF Financial Management System Framework



iTRAK supports the agency's stewardship role by providing managers and staff with financial data and reports to aid in data analysis so they can make informed decisions about the programs they manage and support. iTRAK interfaces with NSF's awards, grants management, and business systems including:

- Award Cash Management Service (ACM\$).
- MyNSF Awards (Awards) — NSF's award and award amendment processing, approval, and notification system.
- eJacket — NSF's internal proposal processing system, post-award request tracking and approval system, and document repository.
- Research.gov — Website for the research community that provides quick access to research information and grants management services. Research.gov will replace FastLane.
- Graduate Research Fellowship Program (GRFP) System.
- Guest Travel and Reimbursement System (Guest).

iTRAK also interfaces with external systems operated by Treasury, Citibank, and LearnNSF, the Foundation's training system, and other federal systems such as the Federal Personnel Payroll System (FPPS), eTravel/Concur, and the General Services Administration's System for Award Management.