ARTIFICIAL INTELLIGENCE (AI)

Artificial Intelligence Funding[1]

(Dollars in Millions)

	FY 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request
BIO	$20.00	-	$20.90
CISE	344.00	-	369.18
EDU	35.00	-	40.00
ENG	88.00	-	91.96
GEO Programs	5.00	-	5.23
MPS	75.21	-	78.59
SBE	16.92	-	17.68
TIP	78.09	-	104.62
IA	1.00	-	1.00
Total	**$663.22**	**-**	**$729.16**

[1] Funding displayed may have overlap with other topics and programs.

Overview

AI is advancing rapidly and is increasingly demonstrating its potential to significantly transform our lives. NSF has a long and rich history of supporting AI research, setting the stage for today's widespread use of AI technologies in a range of sectors, from commerce to healthcare to transportation. NSF-funded research is laying the foundation for advances in AI that will transform not just these areas, but essentially every area of human endeavor, including science, education, energy, manufacturing, and agriculture. NSF's AI portfolio spans algorithms, robotics, human-AI interaction, trustworthy AI, and advanced cyberinfrastructure for AI, as well as use-inspired research in neuroscience, biology, chemistry, physics, intelligent transportation, and many other disciplines across the full breadth of science and engineering in which NSF invests.

In alignment with the recent White House *Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence,*[1] NSF supports fundamental and translational research, education and workforce development, and access to data and advanced computing research infrastructure that collectively strengthens the Nation's ability to responsibly harness AI to power discovery and economic growth. NSF's ability to bring together numerous fields of scientific inquiry uniquely positions the agency to play a pivotal role in expanding the frontiers of AI. In FY 2025, NSF will continue support for foundational research in AI, including machine learning (ML) and deep learning, natural language technologies, knowledge representation and reasoning, robotics, and computer vision, along with fairness, ethics, accountability, transparency, explainability, safety, security, and robustness across all areas of AI. In addition to foundational research in these areas, NSF also supports use-inspired and translational research that links AI innovation with science and the economy, including in the fields of agriculture, manufacturing, biotechnology, and health. Equally

[1] www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/

important is NSF's investment in education and education research, which grows the human capital and institutional capacity needed to nurture the next generation of AI researchers and practitioners as well as the AI technology that can be used to support learning more broadly. Finally, advances in AI rely upon access to data as well as advanced computing research infrastructure.

Through collaboration and coordination with the Office of Science and Technology Policy (OSTP), NSF leadership is helping to drive and coordinate AI R&D efforts across the federal government. For example, the NSF Director sits on the White House AI Council, which coordinates the timely implementation of federal AI policies, including those set forth in the recent AI Executive Order. In addition, NSF co-chairs the National Science and Technology Council (NSTC) Machine Learning and AI (MLAI), Networking and Information Technology R&D (NITRD), and Future Advanced Computing Ecosystem (FACE) Subcommittees, as well as the more AI-focused R&D Interagency Working Group, all of which serve to coordinate federal R&D investments in AI as well as other related information technology areas, including the underlying advanced computing ecosystem that is critical for advancing AI.

In 2022 and 2023, NSF co-led the development of the National AI R&D Strategic Plan: 2023 Update. The update reaffirmed the original eight AI strategies and added an additional strategy to underscore the need for a principled and coordinated approach to international collaboration in AI research. First issued in 2016, the National AI R&D Strategic Plan provides a coordinated federal strategy for AI R&D to ensure that the United States continues to lead the world in cutting-edge advances in AI that grow our economy, increase our national security, and improve our quality of life. NSF also played a pivotal role in the development of the original plan in 2016 and, in general, has aligned NSF's research, education and infrastructure efforts with these Federal R&D priorities.

The National AI Initiative Act of 2020[2] called on NSF in coordination with OSTP to form a National AI Research Resource (NAIRR) Task Force to investigate the feasibility of establishing a NAIRR and develop a roadmap detailing how such a resource could be established and sustained. Comprising members from government, academia, and the private sector, the NAIRR Task Force submitted its final report to the President and Congress, *Strengthening and Democratizing the U.S. Artificial Intelligence Innovation Ecosystem: An Implementation Plan for a NAIRR* in January 2023.[3] The report offers a roadmap and implementation plan for the NAIRR that would build on existing and future Federal investments. The President's *Executive Order on the Safe, Secure and Trustworthy Development and Use of AI* directs NSF, in coordination with other federal agencies and non-governmental partners, to establish a pilot implementation of the NAIRR. In FY 2025, NSF will continue to work with its partners to build on the NAIRR Pilot initiated in FY 2024. The NAIRR pilot[4] will enhance access to computational resources, software, datasets, models, services, and training to advance AI research and the use of AI in research and education.

Goals

NSF's leadership in AI has three intertwined components:
1. *Fundamental and Translational AI Research:* Sustain long-term investments in fundamental and

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[2] www.congress.gov/116/crpt/hrpt617/CRPT-116hrpt617.pdf#page=1210

[3] www.ai.gov/wp-content/uploads/2023/01/NAIRR-TF-Final-Report-2023.pdf

[4] https://new.nsf.gov/focus-areas/artificial-intelligence/nairr

translational AI research that will give rise to transformational technologies and, in turn, breakthroughs across all areas of science and engineering and across all sectors of society.

2. *Education and Workforce Development:* Develop AI systems that enhance learning for all and grow the next generation of talent to advance the U.S. AI R&D workforce, including those applying AI solutions, those working on AI systems, and those working alongside them.

3. *Access to Data and Advanced Computing Research Infrastructure:* Provide access to advanced cyberinfrastructure including scalable computing resources as well as high-quality, and accurate training datasets to advance AI research and education.

FY 2025 Investments

Fundamental and Translational AI Research

- In FY 2025, NSF will continue support for the National AI Research Institutes program that was initiated in FY 2019 to create national hubs for universities, federal and local agencies, industry, and nonprofits to advance AI research and workforce development in key areas addressing grand challenges. In FY 2020, FY 2021, and FY 2023 NSF awarded 20 institutes focusing on themes that included foundations of ML; trustworthy AI; AI-augmented learning; AI for accelerating molecular synthesis and manufacturing; human-AI interaction and collaboration; AI and advanced cyberinfrastructure and AI for discovery in physics. Each AI Institute receives up to $20.0 million over five years. NSF partnered with the U.S. Department of Agriculture National Institute of Food and Agriculture (USDA NIFA) to establish two institutes in each of FY 2020 and FY 2021, and one in FY 2023, advancing AI-driven innovation in agriculture and food systems; these five AI Institutes are being fully supported by USDA NIFA. In alignment with the President's *Executive Order on the Safe, Secure, and Trustworthy Development and Use of AI*, NSF plans to award up to two additional AI Institutes in FY 2024, and up to three AI Institutes in FY 2025. The latest National AI Research Institutes solicitation, issued in FY 2023, continued the collaboration with the DOD Office of the Undersecretary of Defense for Research and Engineering, the National Institute of Standards and Technology, and the Intel Corporation; and added new partnerships with Capital One Financial Corporation and the Simons Foundation. In FY 2024, NSF and its partners will begin evaluating the first AI institutes for possible renewal.

- NSF will continue investments in Expanding AI Innovation through Capacity Building and Partnerships (ExpandAI). This effort is designed to support the continued growth of a broad and diverse interdisciplinary research community for the advancement of AI and AI-powered innovation. The ExpandAI program aims to significantly broaden participation in AI research, education, and workforce development through capacity development projects and through partnerships within the National AI Research Institutes ecosystem. ExpandAI also includes partnerships with other federal agencies including DHS, DOD, NIST, and USDA NIFA.

- In FY 2025, through the Foundational Research in Robotics (FRR) program, NSF will continue to support robotics research that combines advances in engineering with innovations in computer science. The FFR program invests in robotics and autonomous systems that exhibit significant levels of computational capability and physical complexity, including research related to the design, application, and use of robotics to augment human function, promote human-robot interaction, and increase robot autonomy, many of which depend critically on AI approaches.

- The NSF Convergence Accelerator program has emphasized AI through a variety of themes dating back to FY 2020. For example, in FY 2021, the program invested in a set of projects focused on AI-Driven Innovation via Data and Model Sharing. More recently, in FY 2024, the program emphasized AI through themes on equitable water solutions, chemical sensing applications, and bio-inspired

design innovations. In FY 2025, building on the success of the program to date, NSF will continue an effort initiated in FY 2023 to regionalize the NSF Convergence Accelerator, advancing key technologies and addressing societal, national, and geostrategic challenges at the regional level throughout the U.S.

- In FY 2025, NSF will continue its Ethical and Responsible Research (ER2) program. The program supports investigating the ethical consequences of research activities in emerging scientific and technological including artificial intelligence, robotics, and cryptography. Research activities funded by ER2 directly support OSTP's *Blueprint for AI Bill of Rights,*[5] which sets principles and associated practices to help guide the design, use, and deployment of automated systems to protect the rights of the American public in the age of artificial intelligence. More broadly, NSF will continue to support research on the societal impacts of AI.
- In FY 2023 and FY 2024, as an outgrowth of a Convergence Accelerator program track on Open Knowledge Networks (OKN) and following an OKN Innovation Sprint co-led by NSF and OSTP, NSF together with multiple other federal agencies initiated investment in the development of a prototype OKN — an interconnected network of knowledge graphs supporting a very broad range of application domains. This work will continue in FY 2025. Open access to shared information, as afforded by the prototype OKN, is essential to the development and evolution of AI and AI-powered solutions needed to address complex challenges facing the Nation.

Education and Workforce Development
- As authorized by the 2022 CHIPS and Science Act, in FY 2024, NSF will support a study on AI research capacity at U.S. institutions of higher education, addressing, in part, (i) the factors that enable or could be implemented by universities to enable AI research, including by diverse institution types; and (ii) promising practices for advancing the participation of individuals of all backgrounds and perspectives in AI research programs.
- NSF has established five National AI Research Institutes to advance research in AI-Augmented Learning and Education. One was awarded in FY 2020, two in FY 2021 (one with support from Accenture), and two others in FY 2023 (both in partnership with the Department of Education's Institute of Education Sciences). The primary focus across these institutes is to advance AI-driven innovation to improve human learning and education and address the Grand Challenge of "Education for All." Each institute has specific research objectives. The FY 2020 AI Institute focuses on the use of AI as a social and collaborative "partner" to create learning experiences where students and teachers work and learn together more effectively, engagingly, and equitably. One of the FY 2021 AI Institutes advances research on the use of AI-driven cognitive assistants to support adult learning in online education settings; the other FY 2021 institute focuses on supporting K-12 student engagement in learning. One of the FY 2023 AI institutes will use AI to address the increasing need for speech and language services for children exacerbated by the COVID-19 pandemic; the other will produce new AI tools, techniques, and datasets to support K-12 student noncognitive skill development including outcomes such as persistence, resilience, and collaboration. These AI Institutes share a common goal to improve student learning outcomes, particularly addressing disparities impacting students from historically marginalized groups.
- In FY 2025, NSF will continue to address a critical shortage of cybersecurity educators and researchers in priority areas including the cybersecurity aspects of AI as well as AI for cybersecurity, through the Education track in the SaTC program. Similarly, the CyberCorps®: Scholarship for Service (SFS) program will continue to support collaborative efforts among the AI,

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[5] www.whitehouse.gov/ostp/ai-bill-of-rights/what-is-the-blueprint-for-an-ai-bill-of-rights/

cybersecurity, and education research communities to foster and support a robust federal cybersecurity workforce.

- As authorized by the CHIPS and Science Act, in FY 2024, NSF will submit to Congress a report on the need and feasibility to implement an AI Scholarship-for-Service (AI-SFS) program to recruit and train the next generation of AI professionals to meet the needs of federal, state, local and tribal governments. The report will include an assessment of the capacity of institutions of higher education to produce graduates with degrees, certifications, and relevant skills related to AI.
- The NRT program advances graduate education by combining interdisciplinary training with innovative professional development activities to educate the next generation of scientists and engineers capable of solving convergent research problems in areas of national need. In FY 2025, NRT will continue to include a special focus on traineeships in AI and other emerging industries that align with the Administration's priorities.
- In FY 2025, NSF's Computer Science for All (CSforAll) and Improving Undergraduate STEM Education: Computing in Undergraduate Education (IUSE:CUE) programs will continue to support projects that investigate promising educational approaches at the K-12 level to motivate and prepare a diverse cadre of learners for computationally intensive new industries, including those that rely on AI, in the context of the NSF EducateAI effort.[6]
- The NSF Experiential Learning in Emerging and Novel Technologies (ExLENT) initiative will support inclusive experiential learning opportunities designed to provide cohorts of diverse learners with the crucial skills needed to succeed in AI and related fields and prepare them to enter the workforce ready to solve our Nation's most pressing societal, economic, and geostrategic challenges.

Access to Data and Advanced Computing Research Infrastructure

- In FY 2025, NSF will continue to focus on the pilot implementation of the NAIRR mentioned above, to amplify efforts across the federal government to cultivate AI innovation and advance trustworthy AI. The NAIRR is envisioned as a widely accessible, national cyberinfrastructure that will advance and accelerate the U.S. AI R&D environment and fuel AI discovery and innovation in the United States. Specifically, NSF will continue to work with other federal agencies and the broader community on the NAIRR Pilot launched in 2024 to demonstrate the potential impact and value of the NAIRR concept. NSF supports a range of advanced computing systems and services for the full range of computational- and data-intensive research across all areas of science and engineering, including AI. For example, Frontera, the largest and most powerful supercomputer NSF has ever supported, will enable access to advanced computing resources for AI research. Furthermore, NSF will support innovative prototype systems such as Neocortex that targets the acceleration of AI-powered scientific discovery, and Voyager that targets research involving extremely large data sets using standard AI tools.
- In FY 2025 NSF will continue its investment in the operation of CloudBank, an entity that helps the academic community access and use public clouds for research and education by delivering a set of managed services designed to simplify access to public clouds. CloudBank is specifically enabling new research in AI by broadening the access and impact of cloud computing across many fields of research and education.
- For FY 2025, NSF will continue to collaborate with other federal agencies to enable researcher access to deep, high-quality, and accurate federal training datasets for AI systems. For example, NSF will invest in projects that will apply, mature, and scale the use of both hardware and software

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[6] www.nsf.gov/pubs/2024/nsf24025/nsf24025.jsp

foundations for enhancing privacy in a data economy. This work will build on a FY 2021 workshop that explored how researchers might collaborate with federal data stewards to bring the latest security- and privacy-enhancing techniques to bear on unlocking access to federal data sets, while adhering to applicable federal statutes, rules, and regulations. and a FY 2023, Privacy-Enhancing Technologies (PETs) Prize Challenges in collaboration with OSTP, NIST, and the Government of the United Kingdom, to mature PETs toward the point of demonstrating their viability in the context of specific use cases.