



2020–2024 PROGRESS REPORT:
ADVANCING TRUSTWORTHY ARTIFICIAL
INTELLIGENCE RESEARCH AND
DEVELOPMENT

A report by the
ARTIFICIAL INTELLIGENCE RESEARCH AND DEVELOPMENT
INTERAGENCY WORKING GROUP

SUBCOMMITTEE ON NETWORKING & INFORMATION
TECHNOLOGY RESEARCH & DEVELOPMENT

and the Subcommittee on Machine Learning & Artificial
Intelligence

of the
NATIONAL SCIENCE & TECHNOLOGY COUNCIL

July 2024

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976 to provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, health, foreign relations, and the environment, among other topics. OSTP leads interagency science and technology policy coordination efforts, assists the Office of Management and Budget with an annual review and analysis of federal research and development in budgets, and serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the federal government. More information is available at <https://www.whitehouse.gov/ostp>.

About the National Science and Technology Council

The National Science and Technology Council (NSTC) is the principal means by which the executive branch coordinates science and technology policy across the diverse entities that make up the federal research and development enterprise. A primary objective of the NSTC is to ensure science and technology policy decisions and programs are consistent with the President's stated goals. The NSTC prepares research and development strategies that are coordinated across federal agencies aimed at accomplishing multiple national goals. The work of the NSTC is organized under committees that oversee subcommittees and working groups focused on different aspects of science and technology. More information is available at <https://www.whitehouse.gov/ostp/nstc>.

About the Subcommittee on Machine Learning and Artificial Intelligence

The Machine Learning and Artificial Intelligence (MLAI) Subcommittee (MLAI-SC) monitors the state of the art in machine learning (ML) and AI within the federal government, in the private sector, and internationally to watch for the arrival of important technology milestones in the development of AI, to coordinate the use of and foster the sharing of knowledge and best practices about ML and AI by the federal government, and to consult in the development of federal MLAI R&D priorities. The MLAI-SC reports to the NSTC Committee on Technology and the Select Committee on AI.

About the Subcommittee on Networking & Information Technology Research & Development

The Networking and Information Technology Research and Development (NITRD) Program has been the nation's primary source of federally funded work on pioneering information technologies (IT) in computing, networking, and software since it was first established as the High-Performance Computing and Communications program, following passage of the High-Performance Computing Act of 1991. The NITRD Subcommittee of the NSTC guides the multiagency NITRD Program in its work to provide the research and development foundations for ensuring continued U.S. technological leadership and for meeting the nation's needs for advanced IT. The National Coordination Office (NCO) supports the NITRD Subcommittee and its Interagency Working Groups (IWGs). More information is available at <https://www.nitrd.gov/about/>.

Artificial Intelligence Research and Development Interagency Working Group

The NITRD AI R&D Interagency Working Group coordinates federal R&D in AI; it also supports and coordinates activities tasked by the Select Committee on AI and the NSTC Subcommittee on Machine Learning and Artificial Intelligence. This vital work promotes U.S. leadership and global competitiveness in AI R&D. The AI R&D IWG spearheaded the 2019 update of the National Artificial Intelligence Research and Development Strategic Plan. More information is available at <https://www.nitrd.gov/coordination-areas/ai/>.

About This Document

This document reports current trends and examples of federal R&D investments, program information, and activities in AI that directly address the R&D challenges and opportunities noted in the *National Artificial Intelligence Research and Development Strategic Plan: 2023 Update*¹.

Copyright Information

This document is a work of the United States government and is in the public domain (see 17 USC §105). Subject to stipulations below, it may be distributed and copied, with acknowledgement to NITRD NCO. Copyrights to graphics included in this document are reserved by original copyright holders or their assignees and are used here under the government's license and by permission. Requests to use any images must be made to the provider identified in the image credits, or to NCO if no provider is identified.

References in this document to any specific commercial products, publications, processes, services, manufacturers, companies, trademarks, or other proprietary information are intended to provide clarity and do not constitute an endorsement or recommendation by the U.S. government.

¹ <https://www.nitrd.gov/pubs/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf>

NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

Chair

Arati Prabhakar, Assistant to the President for Science and Technology; Director, Office of Science and Technology Policy

Executive Director (Acting)

Kei Koizumi, Principal Deputy Director for Science, Society, and Policy, Office of Science and Technology Policy

SELECT COMMITTEE ON ARTIFICIAL INTELLIGENCE

Chair

Arati Prabhakar, Assistant to the President for Science and Technology; Director, Office of Science and Technology Policy

Rotating Co-Chairs

Laurie Locascio, Undersecretary of Commerce for Standards and Technology, Department of Commerce

Sethuraman Panchanathan, Director, National Science Foundation (NSF)

Geraldine Richmond, Under Secretary for Science and Innovation, Department of Energy (DOE)

SUBCOMMITTEE ON MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Co-Chairs

Tess deBlanc-Knowles, Special Assistant to the Director for AI, NSF

Travis Hoppe, Assistant Director for AI Research and Development, OSTP

Diane Staheli, Assistant Director for AI Applications, OSTP

Ceren Susut, Associate Director, Advanced Scientific Computing Research, Office of Science, DOE/SC

Elham Tabassi, Chief AI Advisor, National Institute of Standards and Technology, NIST

Executive Secretary

Faisal D'Souza, NITRD NCO

SUBCOMMITTEE ON NETWORKING AND INFORMATION TECHNOLOGY RESEARCH AND DEVELOPMENT (NITRD)

Co-Chairs

Joydip Kundu, Deputy Assistant Director, Computer and Information Science and Engineering, NSF

Craig Schlenoff, Director, Networking and Information Technology Research and Development National Coordination Office (NCO)

Executive Secretary

Nekeia Butler, NITRD NCO

ARTIFICIAL INTELLIGENCE RESEARCH AND DEVELOPMENT INTERAGENCY WORKING GROUP

Co-Chairs

John Garofolo, Senior Advisor for Applied Analytics Programs, NIST

Michael Littman, Division Director Information and Intelligent Systems, NSF

Steven Lee, Program Manager in Applied Mathematics, DOE/SC

Technical Coordinator

Faisal D'Souza, NITRD NCO

Writing Team

Allison Dennis, NIH
Faisal D'Souza, NITRD NCO
David Etim, DOE/NNSA

John Garofolo, NIST
Neil Gerr, DARPA
David Kuehn, DOT

Steven Lee, DOE/SC
Michael Littman, NSF
Anup Mathur, Census

Nikunj Oza, NASA
Ann Stapleton, USDA
Farrokh Vatan, DHS

Table of Contents

Executive Summary	1
Introduction	2
How To Read This Report	4
Strategy 1: Make Long-Term Investments in Fundamental and Responsible AI Research	5
Strategy 2: Develop Effective Methods for Human-AI Collaboration.....	13
Strategy 3: Understand and Address the Ethical, Legal, and Societal Implications of AI	18
Strategy 4: Ensure the Safety and Security of AI Systems	23
Strategy 5: Develop Shared Public Datasets and Environments for AI Training and Testing	27
Strategy 6: Measure and Evaluate AI Technologies Through Standards and Benchmarks	32
Strategy 7: Better Understand the National AI R&D Workforce Needs	35
Strategy 8: Expand Public-Private Partnerships to Accelerate Advances in AI.....	40
Strategy 9: Establish a Principled and Coordinated Approach to International Collaboration in AI Research (<i>new</i>).....	44
Conclusion and Next Steps	48

List of Tables

Table 1. Summary of AI R&D Activities by Federal Entities in the Nine Strategic Priorities	2
Figure 1. Summary of AI R&D Investments by Federal Entities	4

Executive Summary

The Biden-Harris Administration have moved with urgency to manage the risks of artificial intelligence (AI) and seize its opportunity. In 2023, President Biden issued a landmark executive order to advance American leadership in safe, secure, and trustworthy AI innovation. This 2020–2024 Progress Report underscores the remarkable growth in federal AI research and development (R&D) investment² since the 2016–2019 Progress Report: Advancing Artificial Intelligence R&D.³ Federal agencies are directing substantial investments to tackle critical challenges such as climate change, health care advancement, cybersecurity enhancement, defense support, scientific discovery, and operational efficiency in key sectors like manufacturing and transportation.

Aligned with the National AI R&D Strategic Plan: 2023 Update,⁴ referred to as “the 2023 Strategic Plan update,” this report demonstrates federal agencies’ commitment to supporting key national initiatives, including the Blueprint for an AI Bill of Rights⁵ and the Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence 14110,⁶ referred to as the AI EO 14110. This report systematically documents the significant progress made by agencies to advance the field of AI in a manner that is beneficial to the American people and in advancing the strategic priorities of the 2023 Strategic Plan update:

Strategy 1: Make long-term investments in fundamental and responsible AI research.

Strategy 2: Develop effective methods for human-AI collaboration.

Strategy 3: Understand and address the ethical, legal, and societal implications of AI.

Strategy 4: Ensure the safety and security of AI systems.

Strategy 5: Develop shared public datasets and environments for AI training and testing.

Strategy 6: Measure and evaluate AI technologies through standards and benchmarks.

Strategy 7: Better understand the national AI R&D workforce needs.

Strategy 8: Expand public-private partnerships to accelerate advances in AI.

Strategy 9: Establish a principled and coordinated approach to international collaboration in AI research (new).

This report highlights AI research first by strategy, then by describing agency contributions that provide a whole-of-government overview.

² <https://www.nitrd.gov/apps/itdashboard/ai-rd-investments/>

³ <https://www.nitrd.gov/pubs/AI-Research-and-Development-Progress-Report-2016-2019.pdf>

⁴ <https://www.nitrd.gov/pubs/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf>

⁵ <https://www.whitehouse.gov/ostp/ai-bill-of-rights/>

⁶ <https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/>

Introduction

This report provides a detailed summary of federal AI R&D activities over the last four years, with examples of federal agency programs and activities aligned with the nine strategies described in the 2023 Strategic Plan update. This report illuminates the importance of federal investments in AI R&D that exemplify how federal AI R&D activities are driving advances in AI and, in turn, impacting many sectors of the economy. While this report is not meant to be exhaustive, it is reflective of the significant cross-agency activities supported by the federal government. Additional details on agency R&D programs can be found in the AI Research Program Repository.⁷ While some smaller, cross-sector, or classified activities are unable to be included in this report, these efforts also contribute significantly to the nation's commitment to advancing trustworthy AI.

This report is structured around the nine strategic priorities of the 2023 Strategic Plan update. For each strategy, key agency programs and activities addressing that strategy are highlighted, with an emphasis on efforts undertaken following the release of the 2023 Strategic Plan update. Some activities contribute to multiple strategies and these cross-cutting efforts are noted where appropriate. Table 1 summarizes the involvement of federal R&D agencies participating in the Networking Information Technology Research and Development (NITRD) AI R&D Interagency Working Group, in each of the nine strategies, where Xs represent some level of effort by the agencies in the strategic priorities. These contributions are highlighted in more detail in the remainder of the report. The overall picture that emerges is that of a comprehensive response to the 2023 Strategic Plan update through a defined set of investments, progress, and accomplishments, along with noteworthy continuity in federal AI R&D strategy across multiple Administrations.

AI R&D Strategic Priorities	Census	DARPA	DHS	DoD*	DOE/NNSA	DOE/SC	DOT	ED/IES	FBI	HHS/ONC	NASA	NIH	NIJ	NIOSH	NIST	NOAA	NSF	NTIA	USDA-NIFA	USPTO	VA
1. Make long-term investments in fundamental and responsible AI research.	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X	X
2. Develop effective methods for human-AI collaboration.		X	X	X	X	X		X			X	X			X	X	X		X	X	
3. Understand and address the ethical, legal, and societal implications of AI.			X	X			X	X			X	X	X		X	X	X		X	X	X
4. Ensure safety and security of AI systems.		X	X	X	X	X					X	X			X		X	X			X

⁷ <https://www.nitrd.gov/apps/ai-research-program-repository/>

2020–2024 Progress Report: Advancing Trustworthy Artificial Intelligence Research and Development

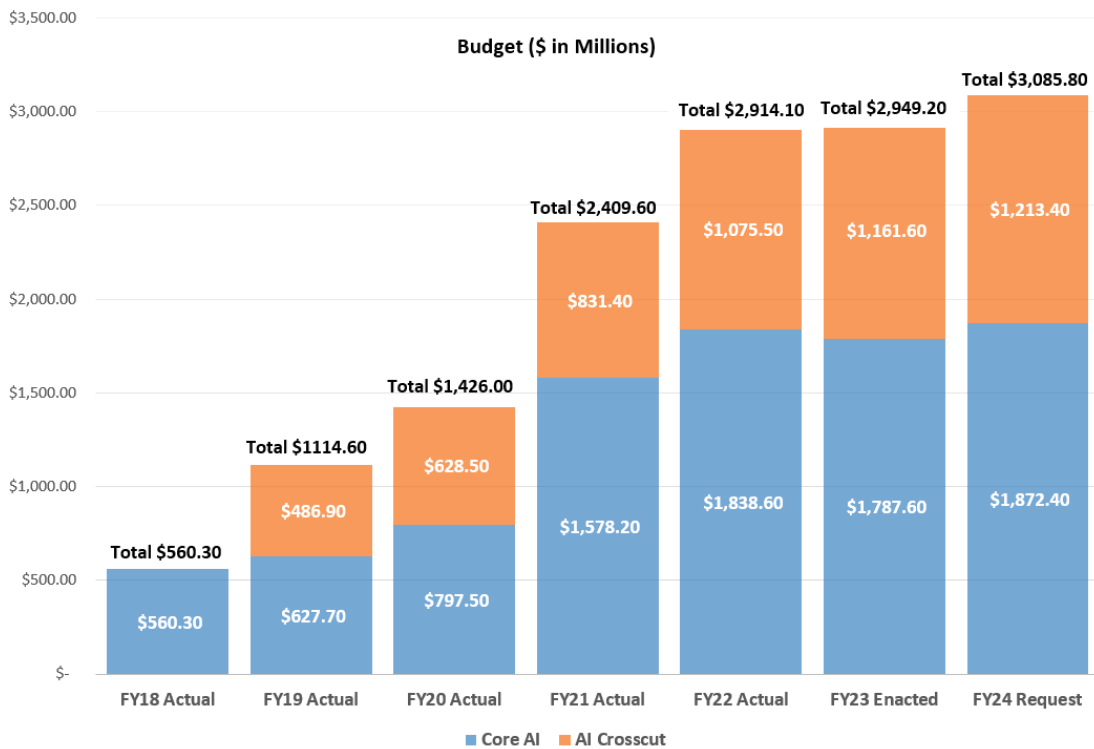
AI R&D Strategic Priorities	Census	DARPA	DHS	DoD*	DOE/NNSA	DOE/SC	DOT	ED/IES	FBI	HHS/ONC	NASA	NIH	NIJ	NIOSH	NIST	NOAA	NSF	NTIA	USDA-NIFA	USPTO	VA
5. Develop shared public datasets and environments for AI training and testing.		X	X	X		X	X				X	X	X		X	X	X			X	X
6. Measure and evaluate AI technologies through benchmarks and standards.			X	X	X	X		X		X		X	X		X	X	X				
7. Better understand the national AI R&D workforce needs.	X		X	X	X	X		X				X	X		X		X		X	X	X
8. Expand public-private partnerships to accelerate advances in AI.			X	X	X	X				X		X			X	X	X		X	X	X
9. Establish a principled and coordinated approach to international collaboration in AI research.		X	X	X	X	X	X					X			X	X	X			X	X
Legend:																					
Census	Census Bureau										NIH	National Institutes of Health									
DARPA	Defense Advanced Research Projects Agency										NIJ	National Institute of Justice									
DHS	Department of Homeland Security										NIOSH	National Institute for Occupational Safety and Health									
DoD	Department of Defense										NIST	National Institute of Standards and Technology									
DOE/NNSA	Department of Energy/National Nuclear Security Administration										NOAA	National Oceanic and Atmospheric Administration									
DOE/SC	Department of Energy/Office of Science										NSF	National Science Foundation									
DOT	Department of Transportation										NTIA	National Telecommunications and Information Administration									
ED-IES	Department of Education Institute of Education Sciences										USDA-NIFA	U.S. Department of Agriculture/National Institute of Food and Agriculture									
FBI	Federal Bureau of Investigation										USPTO	United States Patent and Trademark Office									
HHS/ONC	Department of Health and Human Services/Office of the National Coordinator										VA	U.S. Department of Veterans Affairs									
NASA	National Aeronautics and Space Administration																				

* DoD performs R&D in the AI R&D Strategies through coordinated activities by its service agencies.

The NITRD National Coordination Office reports unclassified federal investments in AI R&D through its annual NITRD and National AI Initiative Office (NAIO) Supplement to the President’s Budget.⁸ As seen in Figure 1, the unprecedented growth in AI R&D investments from Fiscal Year (FY) 2018 to FY 2024 reflects the federal government’s commitment to advancing safe, trustworthy, transparent, and fair AI. This substantial investment underscores the federal government’s commitment in maintaining leadership in AI, fostering economic growth, and addressing critical challenges that impact the nation’s technological trajectory. Figure 1 shows two types of AI R&D investments gathered from the Supplement to the President’s Budget:

- (1) Core AI: Investments with a primary emphasis on AI R&D, which are reported under the AI Program Component Area (PCA). PCA’s are the “bucketing” mechanism that federal agencies use to report budget information for their networking and information technology research and development.
- (2) AI Crosscut: Investments with primary emphases in areas other than AI, which are reported in other PCAs. AI Crosscut is not available for FY 2018.

Figure 1. Summary of AI R&D Investments by Federal Entities



This report will be updated periodically to document the nation's progress in sustaining and advancing the priorities of the 2023 Strategic Plan update.

How To Read This Report

To guide readers through the agency AI programs or activities collected in this report, the content is arranged first by the nine strategic priorities listed in the 2023 Strategic Plan update, and then alphabetically by agency. Furthermore, callout boxes are inserted throughout this document showing AI R&D related progress supporting the AI EO 14110.

⁸ <https://www.nitrd.gov/publications/>

Strategy 1: Make Long-Term Investments in Fundamental and Responsible AI Research

Recent progress in AI has been fueled by decades of investment in AI research. To continue to expand the effectiveness of this technology and its broad benefits, it is essential that the federal government maintain a long-term vision that prioritizes innovation. Agencies recognize the importance of long-term investments in trustworthy AI research, as demonstrated by the substantial progress over the past four years in all relevant application areas. This section provides salient examples of efforts toward advancing data-focused methodologies for knowledge discovery, fostering federated machine learning (ML) approaches, understanding theoretical capabilities and limitations of AI, pursuing research on scalable general-purpose AI systems, developing more capable and reliable robots, advancing hardware for improved AI, creating AI or improved hardware, and embracing sustainable AI computing systems.

Census Bureau – Decennial Census Program: As part of the multiyear research effort of the 2030 Census, the Census Bureau is investigating several AI-based options for the collection, processing, and dissemination of 2030 Census data.

- In a pilot project started in the Census Bureau’s Data Science Training Program⁹, Census Bureau staff were able to successfully automate the comparison of satellite imagery from two different points in time to identify changes in housing units—a process known as Automated Change Detection (ACD). Development of the ACD process is still underway; however, initial moderate-resolution ACD models were successful in identifying change in a fraction of the time it took to document changes using manual change detection processes prior to the 2020 Census.
- In a series of research projects, Census staff are using natural language processing and ML for automatically classifying race and ethnicity of decennial respondents by analyzing write-in data, classifying residence status of respondents for the Post Enumeration Survey (PES) based on analyzing PES person records and processing of PES interviewer field notes to identify specific entities present in the data.

Defense Advanced Research Projects Agency¹⁰ (DARPA): DARPA seeks to advance the state of the art of AI and to apply state-of-the-art AI to create new capabilities for national security missions.

- AI algorithms developed under DARPA’s Air Combat Evolution¹¹ (ACE) program have progressed from controlling simulated F-16s flying aerial dogfights on computer screens to controlling an actual F-16 in flight.¹² ACE software running on a specially modified F-16 test aircraft known as the X-62A or VISTA (Variable In-flight Simulator Test Aircraft) flew multiple flights over several days at the Air Force Test Pilot School at Edwards Air Force Base, California. The flights demonstrated that AI agents can control a full-scale fighter jet and provided invaluable live-flight data.

⁹ <https://www.census.gov/about/census-careers/working-at-census/learning-opportunities.html>

¹⁰ <https://www.darpa.mil/>

¹¹ <https://www.darpa.mil/program/air-combat-evolution>

¹² <https://www.darpa.mil/news-events/2023-02-13>

- DARPA’s Artificial Intelligence Cyber Challenge¹³ (AIxCC) program aims to develop and demonstrate AI-based techniques for automated discovery and remediation of software vulnerabilities at speed and scale to secure widely used, critical code. AIxCC is using a contest model where teams create automation and tools to complete vulnerability discovery and remediation challenges. Performer teams will use AI to create automated tools for vulnerability discovery and remediation, focusing on tools that are suitable for broad deployment and applicable to critical infrastructure sectors.

Department of Defense (DOD): The DOD invests in the development of AI-enabled solutions across the Department, while also selectively scaling proven solutions for enterprise and across DOD use cases.¹⁴

AI EO 14110	Advancing Governance, Innovation, and Risk Management for Agency Use of AI
<p>On March 28, 2024, the Office of Management and Budget (OMB) published a policy¹⁵ for the use of AI by the U.S. government. This policy focuses on strengthening AI governance, advancing responsible AI innovation, and managing risks from the use of AI by directing agencies to adopt mandatory safeguards for the development and use of AI that impacts the rights and safety of the public.</p>	

- The Theoretical Foundations of Deep Learning research aims to establish a principled theory of deep learning grounded in rigorous mathematical principles. The Design Thrust aims to tackle the trial-and-error nature of current deep network design. The Build Thrust addresses mathematical challenges in deep network training and the Test Thrust focuses on mathematical issues in characterizing deep network performance beyond training.
- The Machine Intelligence for Nuclear Explosion Monitoring effort advances the U.S. ground-based seismic nuclear monitoring mission by using advanced data science methods to develop analytical tools and data exploitation algorithms to rapidly and reliably detect, locate, and characterize seismic events and aid in distinguishing between natural and man-made events.

Department of Education (ED): Primarily based in the Institute of Education Sciences (IES),¹⁶ ED has programs that are funding R&D that leverage AI to address the nation’s most pressing education needs, from early childhood to adult education.

- IES has invested in a number of programs including two AI Institutes^{17,18} with NSF that address inclusive intelligent educational technologies and support children with speech and language processing challenges; three data science training programs for researchers; a newly announced R&D center that augments classroom teaching and learning via generative AI intelligence; continued investment in its Small Business and Innovative Research program, and new awards under the transformative research program in the Education Sciences grants program.

¹³ <https://www.darpa.mil/news-events/2023-08-09>

¹⁴ <https://www.ai.mil/>

¹⁵ <https://www.whitehouse.gov/wp-content/uploads/2024/03/M-24-10-Advancing-Governance-Innovation-and-Risk-Management-for-Agency-Use-of-Artificial-Intelligence.pdf>

¹⁶ <https://ies.ed.gov/>

¹⁷ https://www.nsf.gov/awardsearch/showAward?AWD_ID=2229612&HistoricalAwards=false

¹⁸ https://www.nsf.gov/awardsearch/showAward?AWD_ID=2229873&HistoricalAwards=false

- The From Seedlings to Scale¹⁹ program will fund R&D for breakthrough ideas that challenge what is currently possible in important areas such as: developing approaches to help learners build skills throughout their lives; creating tools and systems that can accurately identify and determine the needs of individual neurodiverse learners; creating next-generation tools for educators for feedback, recommendations, and supports; and creating new techniques and approaches to help educators and learners implement strategies to support behavior and emotion regulation.

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Defense Programs:

The DOE/NNSA is investing in developing AI and ML methods for operations in the unique high-security and high-consequence environment in which the NNSA must operate.

- The Advanced Simulation and Computing Artificial Intelligence for Nuclear Deterrence (AI4ND) Strategy aims to develop AI systems and methodologies to assist in reducing cost and schedule in the discovery, design optimization, manufacturing, certification, deployment, and surveillance phases of a nuclear warhead system. It also aims to increase the agility and responsiveness of the weapons complex, improve the efficiency of the NNSA production sites, and deepen the insights obtained from simulation and experimental data.
- The NNSA currently employs best-practice verification, validation, and uncertainty quantification to ensure trust in applying its modeling and simulation capabilities to its high-consequence mission. The NNSA is developing a mathematical foundation for verification and validation to implement and assess methods that ensure results generated from AI can be trusted by the scientific community in general, and specifically by the nuclear security community. By assessing the credibility of solutions and interpreting model predictions, the NNSA seeks to gain knowledge of why or how a specific prediction was made, resulting in transparent and explainable AI systems.

Department of Energy/Office of Science (DOE/SC): DOE/SC invests in programs for basic research and in the innovative use of AI in support of its scientific missions.

- Basic research in scientific ML and AI has the potential to accelerate discovery and innovation. These DOE/SC investments develop robust, interpretable, and domain-aware foundations for the use of AI for science. Foundational research advances enable innovative science capabilities based on learning from massive datasets, predictive machine learning-enabled modeling and simulations, and intelligent automation and decision support for complex systems and processes.²⁰
- Three program offices initiated 14 projects in data, AI, and ML at DOE scientific user facilities. The projects are aimed at both automating facility operations and managing data modeling, acquisition, mining, and analysis for the interpretation of experimental results. The projects involve large X-ray light sources, neutron scattering sources, particle accelerators, and nanoscale science research centers.²¹

¹⁹ <https://www.federalregister.gov/documents/2023/10/12/2023-22482/request-for-information-on-potential-new-program-from-seedlings-to-scale-s2s>

²⁰ <https://science.osti.gov/ascr/Research/Artificial-Intelligence-AI>

²¹ <https://www.energy.gov/articles/department-energy-announces-37-million-artificial-intelligence-and-machine-learning-doe>

Department of Homeland Security (DHS): DHS is investing in AI research and development to secure the homeland with the use of responsible AI.

- Science and technology investments in the Human-AI Teaming for Cybersecurity is providing an understanding of how AI (and other tools) make humans more effective, while understanding the risks and challenges to inform best teaming practices. This effort will identify and develop metrics and frameworks for assessing technology insertion.
- Basic research on model drift, adversarial AI, and enhanced explainable AI for the mission, user, and decision maker is informing how to measure the trustworthiness of AI in DHS use cases. This research includes approaches to incorporate domain knowledge and human expertise into AI models and explanations. For example, DHS-funded research is developing innovative methods to create and test biometric technologies to ensure that they work equitably across demographic variabilities.

Department of Transportation Federal Highway Administration (DOT/FHWA): The DOT/FHWA continues to sustain AI research investments in highway transportation.

- The Exploratory Advanced Research²² program addresses the need for higher-risk, early-stage research in highway transportation. In FY 2023, the program funded six AI research projects across a range of applications including improving traffic safety for vulnerable road users and inspection of structures.
- The Small Business Innovation Research (SBIR) program supported a topic on traffic monitoring that led to two awards for AI computer vision applications.

Department of Veterans Affairs (VA): The VA continues to ensure appropriate investments supporting critical considerations such as trustworthy, responsible, and safety in the earliest phases of AI R&D efforts.

- VA published its Trustworthy AI Framework (TAI) in August of 2023. VA’s TAI policy crosswalks seamlessly with the frameworks in Executive Order on Promoting the Use of Trustworthy AI in the Federal Government 13960,²³ and those of other agencies. Several VA offices and VA medical centers are already leveraging AI in their work with great care to ensure that AI proposals and efforts are properly evaluated and responsibly used to guide decision-making. TAI is also an evaluation criterion to guide VA’s current AI Tech Sprints for ambient dictation for clinical encounter notes and community care document processing of clinical notes.
- In September 2023, VA’s National AI Institute (NAII) and VA researchers published a study demonstrating that a VA trustworthy AI pilot program—AI R&D Committee and Institutional Review Board Supplementary Module—was successful in detecting research proposals that lacked sufficient risk-mitigation measures.

²² <https://highways.dot.gov/research/research-programs/exploratory-advanced-research/exploratory-advanced-research-overview>

²³ <https://trumpwhitehouse.archives.gov/presidential-actions/executive-order-promoting-use-trustworthy-artificial-intelligence-federal-government/>

Federal Bureau of Investigation (FBI): The FBI is examining AI and ML techniques to anticipate and defend against threats and keep the American people safe.

- The Threat Intake Processing System (TIPS)²⁴ Database serves as a repository for crime related tips submitted to the FBI by the public. The FBI uses AI algorithms to identify, prioritize, and process actionable tips in a timely manner. The algorithms allow for triage of immediate threats to help FBI field offices and law enforcement respond to the most serious threats first. Based on the algorithm's score, highest priority tips are arranged first in the queue for human review. FBI continues to examine and advance algorithms and models through training on a variety of new datasets submitted through TIPS.

National Aeronautics and Space Administration (NASA): NASA is performing AI R&D for its full scope of mission challenges, including within aeronautics, earth science, space science, and human and autonomous space exploration.

- NASA's development of autonomy-enabling capabilities addresses challenges in settings such as Advanced Air Mobility, the Lunar Gateway, and the surface of the Moon and Mars. ML is essential to NASA's success as the models informing intelligent machine decision-making will need to evolve without humans in the loop due to long-distance communications challenges, including high temporal latency. ML is being applied in science data analysis to identify new trends and relationships, and to guide real-time observations by data collected in-situ.
- NASA is developing ML algorithms for identifying and characterizing safety issues and contributing to safety in aeronautics data. In particular, NASA is developing anomaly detection algorithms for heterogeneous time series data and algorithms for identifying precursors that predict known safety issues. NASA's precursor identification algorithms have shown some ability to identify corrective actions, whether taken by humans or automation, that reduce the probability of an adverse event.

National Institutes of Health (NIH): NIH invests in biomedical research that uses or advances AI.

- NIH's Advancing Health Research through Ethical, Multimodal AI program will develop ethically focused and data-driven multimodal AI approaches to more closely model, interpret, and predict complex biological, behavioral, and health systems and enhance our understanding of health and the ability to detect and treat human diseases.
- NSF-NIH Program - Smart and Connected Health in the era of AI and Advanced Data Science²⁵ supports the development of transformative high-risk, high-reward advances in computer and information science, engineering, mathematics, statistics, behavioral and/or cognitive research to address pressing questions in the biomedical and public health communities.

National Institute for Occupational Safety and Health (NIOSH): NIOSH is investing in specific technical projects at the interface between AI and worker safety, health, and well-being.

- NIOSH is actively involved in advancing specific technical initiatives including the auto-coding of industry and occupation data within worker compensation and national surveillance systems, the

²⁴ <https://www.fbi.gov/file-repository/pia-tips.pdf/view>

²⁵ <https://new.nsf.gov/funding/opportunities/smart-health-biomedical-research-era-artificial>

study of AI system design and its comprehensive impact on workers in terms of injury prevention, health equity, and overall well-being, as well as the implementation of worker compensation studies. The initiative contributes to the refinement and optimization of AI algorithms for processing and categorizing vast amounts of data efficiently.

- NIOSH is dedicated to pioneering advancements such as the development of improved test methods for assessing penetration rates for personal protective equipment, automating identification of nanoscale particulates, and deep learning-based histology scoring of nanomaterial-induced lung toxicity. These applications will demonstrate and advance how AI systems learn and interpret intricate patterns in diverse datasets, enhancing analysis methods and contributing to a deeper understanding of potential risks.

National Institute of Standards and Technology (NIST): NIST is leading fundamental and applied measurement science research to support responsible and trustworthy AI and researching the use of AI in measurement science in the areas of physical science, chemical science, materials science, engineering and autonomous machines, manufacturing science, building and fire science, and information technology and communications science programs.

- NIST is performing AI research across many fundamental and applied metrology domains. Many labs are researching the use of AI techniques for analyzing acquired data; for example, brain-inspired (neuromorphic) AI hardware, algorithms, and training methods guided by physical measurement research are being explored to enable advantages over conventional AI systems in information processing speed, energy efficiency, and connectivity.
- NIST is evolving the Configurable Data Curation System,²⁶ a critical data-infrastructure originally focused on accelerating advanced materials innovation, design, and deployment, to other critical domains domestically and internationally.

National Oceanic and Atmosphere Administration (NOAA): NOAA invests in AI R&D, using ML algorithms to improve the accuracy and timeliness of weather and climate predictions as well as to better understand the impacts of environmental changes on our planet.

- NOAA's LightningCast product is an emerging NOAA AI technology success story. LightningCast has been demonstrated multiple times in the NOAA Hazardous Weather Testbed, receiving high ratings from National Weather Service forecasters. Now widely utilized for decision support for outdoor events, aviation, wildland fire management and general forecasting, LightningCast is currently undergoing transition to operational use by NOAA's National Environmental Satellite, Data, and Information Service (NESDIS).
- A collaborative effort between National Ocean Service (NOS) and the National Weather Service produced the first national rip-current prediction system, which rates the likelihood of hazardous currents, providing hourly predictions up to six days in advance. A research partnership with NOS, the Southeast Coastal Ocean Observing Regional Association, and UC Santa Cruz developed a model to detect rip currents in webcam video as they occur, as part of the WebCOOS camera network. Rip currents cause 80% of beach rescues and about 100 U.S. deaths each year.

²⁶ <https://www.nist.gov/programs-projects/configurable-data-curation-system-cdcs>

National Science Foundation (NSF): The NSF has supported innovative AI research for many decades and continues to fund important breakthroughs.

- The National Artificial Intelligence Research Institutes (AI Institutes) program²⁷ represents a cornerstone commitment to fostering long-term, fundamental research in AI while also delivering significantly on all elements of the 2023 Strategic Plan update. In addition to the 25 institutes themselves, the AI Institutes ecosystem includes the Expanding AI Innovation through Capacity Building and Partnerships (ExpandAI)²⁸ program, designed to broaden and diversify the AI research community.
- The investments of the Division of Information and Intelligent Systems (CISE/IIS)²⁹ support research and education on the interrelated roles of people, computers, and information, and the role AI plays in bringing these three elements together. With roughly 500 new projects a year across many interdisciplinary crosscutting programs and three core programs on Human-Centered Computing, Information Integration and Informatics, and Robust Intelligence, Information and Intelligent Systems (IIS) contributes to the full breadth of long-term AI research investments.

AI EO 14110	AI Focused Regional Innovation Engines
<p>NSF-led Regional Innovation Engines place science and technology leadership as the central driver to advance critical technologies like AI, address pressing national and societal challenges, cultivate partnership across the U.S. R&D ecosystem, and stimulate economic growth and job creation. With an initial investment of \$15 million over two years and up to \$160 million over the next decade toward each NSF Engine, seven of the inaugural 10 NSF Engines will harness AI to tackle key challenges, such as the Piedmont Triad Medicine Regenerative Engine that will leverage AI to create and scale breakthrough clinical therapies. Across all 10 NSF Engines announced in January 2024, NSF's initial two-year investment of \$150 million is being matched by more than \$350 million in commitments by state and local governments, private industry, and nonprofits including philanthropy.</p>	

United States Department of Agriculture (USDA): USDA’s scientists, researchers, and partners leverage AI to improve nutrition quality and food security for all Americans, cultivate new sources of food, develop new bioproducts, and enhance the sustainability and resilience of our food, forestry, and agriculture production systems.³⁰

- USDA-funded AI Institutes³¹ have advanced knowledge across themes including next-generation cybersecurity, neural and cognitive foundations of AI, climate-smart agriculture and forestry, trustworthy AI, and AI-augmented learning.
- Programs such as Sustainable Agriculture and Forestry Research, Agriculture Extension and Education, and Rapid Response to Extreme Weather Events Across Food and Agriculture Systems,³²

²⁷ <https://new.nsf.gov/funding/opportunities/national-artificial-intelligence-research>

²⁸ <https://new.nsf.gov/funding/opportunities/expanding-ai-innovation-through-capacity-building/nsf23-506/solicitation>

²⁹ <https://new.nsf.gov/cise/iis>

³⁰ <https://www.usda.gov/sites/default/files/documents/usda-science-research-strategy.pdf>

³¹ <https://www.nifa.usda.gov/grants/funding-opportunities/artificial-intelligence-ai-research-institutes>

³² <https://www.nifa.usda.gov/grants/programs/agriculture-food-research-initiative-afri/rapid-response-extreme-weather-events-across-food-agriculture-systems-a1712>

develop, advance, and leverage AI systems to predict and solve present and future agricultural production-system challenges.

United States Patent and Trademark Office (USPTO): The USPTO's core mission is focused on fostering innovation in science and technology, but it also benefits from advances in science and technology to support its work.

- Enriched Citation,³³ a data-dissemination system, identifies the references cited in specific patent-application documents, including: bibliographic information of the reference, the claims that the prior art was cited against, and the relevant sections that the examiner relied upon. The system extracts information from unstructured office actions and provides relevant information through a structured public-facing application programming interface. This is a crucial AI task, as it involves organizing and representing data in a way that facilitates efficient analysis and retrieval.
- Inventor Search Assistant³⁴ service helps inventors “get started” identifying relevant documents, figures, and classification codes used to conduct a search for novelty. The system takes a user-entered short description of an invention and provides a user-selectable set of recommended documents, figures, and classification areas. AI-driven automation enhances efficiency by quickly providing inventors with a starting point for their research, demonstrating how AI can streamline and expedite complex tasks.

³³ <https://developer.uspto.gov/api-catalog/uspto-enriched-citation-api-v2>

³⁴ <https://developer.uspto.gov/inventor-search/>

Strategy 2: Develop Effective Methods for Human–AI Collaboration

As AI transitions from a lab science to one with broadly deployed applications, better understanding of how to build AI systems that interact smoothly with people is critical. This section documents important progress in developing the science of human-AI teaming, seeking improved models and metrics of performance, cultivating trust in human-AI interactions, pursuing greater understanding of human-AI systems, and developing new paradigms for AI interactions and collaborations.

Defense Advanced Research Projects Agency (DARPA): DARPA is developing technologies to enable machines to function not only as tools that facilitate human action but also as trustworthy partners to human operators, which is especially important for military systems and mission-critical applications.

- Researchers in DARPA’s In the Moment³⁵ effort have developed a new large language model (LLM)-based algorithm that can serve as the basis for a trusted AI system aligned with a human decision-maker. The algorithm understands natural language descriptions of attributes such as "mission focus", predicts how strongly different courses of action align to such attributes, and provides detailed explanations justifying the predictions.
- DARPA’s Environment-driven Conceptual Learning³⁶ (ECOLE) program is creating AI agents capable of continually learning from linguistic and visual input.³⁷ These intelligent computational agents would be able to collaborate with humans to help them analyze image, video, and multimedia documents during time-sensitive analytical tasks for national security, where reliability, robustness, and trustworthiness are essential.

Department of Defense (DOD): The DOD invests in the development of AI-enabled solutions across the Department that have the potential to expedite decision-making processes while enhancing the quality and precision of such decisions.

- Strengthening Teamwork for Robust Operations in Novel Groups³⁸ (STRONG), a collaborative program, focuses on identifying and implementing the fundamental research necessary to develop individualized, adaptive technologies that promote effective teamwork in novel groups of humans and intelligent agents. This venture brings together diverse, multidisciplinary expertise to support scientific breakthroughs relevant to specific and critical scientific questions that must be addressed to enable human-AI collaboration.
- The Autonomous Air Combat Operation program advances the state of art in AI research by developing AI-driven autonomy for airborne tactical platforms with the goal of developing and deploying an advanced AI-driven autopilot capable of performing aviation and navigation functions and autonomous behaviors such as advanced intelligence, surveillance and reconnaissance, and beyond visual range combat.

³⁵ <https://www.darpa.mil/program/in-the-moment>

³⁶ <https://www.darpa.mil/program/environment-driven-conceptual-learning>

³⁷ <https://www.darpa.mil/news-events/2023-07-18>

³⁸ <https://arl.devcom.army.mil/cras/strong-cra/>

Department of Education (ED): The ED Office of Educational Technology is addressing the need for sharing knowledge, engaging educators, and refining technology plans and policies for AI use in education.

- The AI and Future of Teaching and Learning Report³⁹ emphasizes the importance of the role of people in the educational process, rejecting the notion of AI as replacing teachers. Teachers and other people must be “in the loop” whenever AI is applied to recognize patterns and automate educational processes. The report calls upon all constituents to adopt a human-centered and human-informed perspective in any application, including education, of AI.

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Defense Programs: AI will assist in improving the NNSA’s ability to assess current and new environments for weapon systems and reduce design margins in environmental specifications prior to experimental data being available.

- The NNSA’s AI focus initiatives are developing methods, algorithms, and software for enabling AI-assisted code generation, scientific discovery, and High-Performance Computing (HPC) facility operations.
- The NNSA seeks to employ real time AI-assisted defect screening for material and part certification. Automated inspection and testing processes will bring significant savings in cost and time over current methods by helping human inspectors with this task.

Department of Energy/Office of Science (DOE/SC): DOE/SC invests in basic research, computational software, and tools to enhance the productivity of human-AI approaches for scientific discovery and innovation.

- The Community for Autonomous Scientific Experimentation (CASE) stems from a DOE National Laboratory-led Autonomous Discovery workshop and report. The goal of this community is to bring together researchers to discuss developments and share best practices on AI and machine learning methods for autonomy and accelerated scientific discovery.⁴⁰
- Increased human-AI productivity for scientific discoveries requires real-time, interactive, algorithms and the development of the AI software ecosystem to enable advances at the next-generation of user facilities.⁴¹ To support this objective, in September 2023, DOE announced \$30 million in research to enhance human-AI productivity and scientific advances at experimental user facilities.

Department of Homeland Security Science and Technology Directorate (DHS S&T): DHS S&T research investments focus on understanding how humans, AI, and autonomous systems interact and collaborate, to optimize human-machine systems and performance.

- DHS S&T is developing systems for first responders for applications to natural disaster management in which many diverse sensors combine to provide cohesive situational awareness. By using

³⁹ <https://tech.ed.gov/files/2023/05/ai-future-of-teaching-and-learning-report.pdf>

⁴⁰ <https://autonomous-discovery.lbl.gov/home>

⁴¹ <https://www.energy.gov/science/articles/department-energy-announces-30-million-research-accelerate-scientific-advances>

generative AI and multi modal tools, DHS S&T is developing techniques for incorporating first-principles models into a data-driven learning method.

- The Human-AI Teaming for Cybersecurity program aims to improve trust in collaboration between humans and AI by integrating advanced AI and big compute into operations, with responsibility and accountability of AI systems as a key focus.

National Aeronautics and Space Administration (NASA): NASA is working on methods to allow for human-AI collaboration in various environments including space and on aircraft.

- As round-trip communication time increases for human space exploration due to traveling increasing distances from Earth, interfaces to remote spacecraft require increasing autonomy. The Adaptive Human Computer Interfaces effort is developing ML methods to understand normal usage patterns and identify anomalies due to crew member difficulties, such as health impairment.
- AI tools for materials discovery, design, and characterization aim to automatically characterize materials, predict their properties, inform researchers through visualizations, and iteratively suggest experiments. R&D into innovative modes of communication, including but not limited to gestures, eye gaze, speech, and measurable physiological metrics are ongoing as we seek to transition from machines as decision support tools (DSTs) to machines as teammates.

National Institutes of Health (NIH): NIH leverages explainable AI techniques to develop new interfaces with patients and physicians.

- NIH’s National Institute of Mental Health supports the transformation of classical “black box” machine learning models into explainable AI “glass box” models, without significantly sacrificing performance. Explainable AI will further our understanding of the neural circuitry linked to behavior⁴² and to improve our understanding of therapeutic strategies to enhance cognitive, affective, or social function.

National Institute of Standards and Technology (NIST): NIST has performed research in developing measurement methods and metrics for usability, and human-computer interaction for many years and is extending this research into the intersection of AI technology and human use.

- NIST has begun fundamental research in examining and establishing measures of user trust in AI technologies and in quantifying how humans and AI technologies individually and interdependently impact interaction outcomes. NIST is developing a new set of methodologies and metrics for quantifying how well a system maintains safe functionality within societal contexts.
- NIST is developing software and standards to lower barriers for AI-human interactions while enhancing AI interpretability and trustworthiness. This work includes developing a taxonomy of human/AI activities to facilitate use-case development, identifying commonalities across domains, and developing new forms of interaction-focused metrics and techniques for AI evaluation.

National Oceanic and Atmospheric Administration (NOAA): NOAA is initiating pilots using AI translation technology to benefit staff workflows and to increase equity in service delivery.

- The National Weather Services (NWS) AI Language Translation Project is investigating how to leverage language models to quickly translate NWS products at scale to address gaps in service to

⁴² <https://grants.nih.gov/grants/guide/notice-files/NOT-MH-23-110.html>

multilingual communities. During the 2022 hurricane season, AI-based language models drastically reduced the time required for translation of Tropical Cyclone Public Advisories and Tropical Weather Outlooks using human-in-the-loop interactive training by NWS San Juan and leveraging “model memories” to recognize and use past human-verified translations automatically.

- As part of its Automated Image Analysis Strategic Initiative,⁴³ the NOAA National Marine Fisheries Service (NMFS) catalyzed development of CoralNet, a novel human-in-the-loop AI for classifying coral reef imagery. The site deploys deep neural networks via an intuitive graphical user interface which allow fully and semi automated annotation of images. It also serves as a data repository and collaboration platform. CoralNet is open source and free to use thanks to generous support from NSF and NOAA.

National Science Foundation (NSF): NSF investments advance foundational and use-inspired research in human-AI collaboration, build the AI-human collaboration talent pool, and create nexus points for academia, government, and industry.

- The AI Institute for Collaborative Assistance and Responsive Interaction for Networked Groups (AI-CARING) is an AI Institute that supports older adults, their caregivers, and health care providers with an emphasis on Mild Cognitive Impairment (MCI) and other challenges. Its mission is to develop the next generation of personalized collaborative AI systems that improve the quality of life and independence of aging adults living at home.
- Human Language Technologies is the umbrella for a cluster of research programs in AI and linguistics supported by several NSF programs. It includes the Research on Innovative Technologies for Enhanced Learning (RITEL) program,⁴⁴ designed to support early-stage research in emerging technologies for teaching and learning that respond to pressing needs in real-world educational environments where human-AI collaboration is essential.

United States Department of Agriculture (USDA): Research and development in human-AI collaboration for digital agriculture and capacity building are key features of USDA’s AI investments.

- The AI Institute, Agricultural AI for Transforming Workforce and Decision Support (AgAID), harnesses the combined power of people and artificial intelligence in key areas related to perennial specialty crops with predictive AI models that allow farmers to effectively predict and respond to extreme weather like frost and drought, and develop AI labor intelligence, through an innovative AI-Ag-Human coalition framework.

United States Patent and Trademark Office (USPTO): The USPTO benefits from advances in science and technology to support its work, particularly at the human-AI interface.

- The USPTO released extensions of their next-generation patent search tool, Patent Search AI, to assist examiners in identifying potentially relevant documents and additional subject areas to consider earlier within the search process. The system takes input from published or unpublished patent applications and provides recommendations on potential prior art, giving the examiners the ability to sort by similarity to a patent application.

⁴³ <https://www.st.nmfs.noaa.gov/aiasi/Home.html>

⁴⁴ <https://new.nsf.gov/funding/opportunities/research-innovative-technologies-enhanced-learning/nsf23-624/solicitation>

- The USPTO released an AI-capable external virtual assistant, USPTO Virtual Assistant^{45, 46}, for helping customers find answers to common questions on USPTO’s website. The initial release focused on trademark questions, with later versions adding patent and other information. This expanded tool is another way the USPTO has leveraged machine learning to offer improved services. Over time, the USPTO will expand its knowledge base and improve its ability to recognize and answer questions.

⁴⁵ <https://www.uspto.gov/about-us/news-updates/uspto-launches-new-virtual-assistant-0>

⁴⁶ <https://www.uspto.gov/about-us/news-updates/uspto-virtual-assistant-now-available-patents-customers>

Strategy 3: Understand and Address the Ethical, Legal, and Societal Implications of AI

Broad deployment of AI means broad influence on society and individuals, which entails interdisciplinary collaboration to explore nuanced ethical conditions, refine legal frameworks, and understand societal attitudes towards AI systems. This section focuses on progress in making investments in fundamental research to advance core values through sociotechnical systems design and on the ethical, legal, and societal (ELS) implications of AI; understanding and mitigating social and ethical risks of AI; using AI to address ELS issues; and understanding the broader impacts of AI.

Department of Defense (DOD): The DOD adopted ethical principles for the use of AI⁴⁸ that applies to both combat and non-combat functions and assists the U.S. military. The 2022 DOD Responsible AI Strategy & Implementation Pathway⁴⁹ set the course for operationalizing these principles throughout the AI system lifecycle.

- The Autonomy Capability Team (ACT3), a Special Operations organization’s mission is to operationalize AI at scale for the Air Force by leveraging an innovative ‘start-up’ business model to combine the blue-sky vision of an academic institution, the flexibility of an AI startup, and the discipline of a production development company. The goal is to define the shortest path to successful transition of solutions, working closely with pilots and spacecraft operators to understand the best way to design AI systems that incorporate elements of trust, safety, and ethics.
- The Responsible AI (RAI) Toolkit provides a process that identifies, tracks, and improves alignment of AI projects to RAI best practices and the DOD AI Ethical Principles, while capitalizing on opportunities for innovation. It guides the user through tailorable and modular assessments, tools, and artifacts throughout the AI product lifecycle. The RAI Toolkit builds on earlier DOD work such as the Responsible AI (RAI) Guidelines and Worksheets as well as external standards like the NIST AI Risk Management Framework and Toolkit.

AI EO 14110	Guidelines for AI that Identify and Mitigate Biases in Health Care
<p>The HHS AI Task Force published guiding principles⁴⁷ for addressing racial biases in health care algorithms. The guideline’s overarching goals include promoting health and health care equity during all health care algorithm life-cycle phases, ensuring health care algorithms and their use are transparent and explainable, authentically engaging patients and communities during all health care algorithm life-cycle phases to earn trust, explicitly identifying health care algorithmic fairness issues and tradeoffs, and establishing accountability for equity and fairness in outcomes from health care algorithms.</p>	

Department of Education (ED): ED is engaging stakeholders to further define the landscape of use cases and appropriate development processes for AI in education.

⁴⁷ <https://www.hhs.gov/about/news/2023/12/15/guiding-principles-help-healthcare-community-address-potential-bias-resulting-from-algorithms.html>

⁴⁸ https://www.ai.mil/blog_02_26_21-ai_ethics_principles-highlighting_the_progress_and_future_of_responsible_ai.html

⁴⁹ <https://media.defense.gov/2022/Jun/22/2003022604/-1/-1/0/Department-of-Defense-Responsible-Artificial-Intelligence-Strategy-and-Implementation-Pathway.PDF>

- The Office of Educational Technology is developing new resources, policies, and guidance regarding AI, particularly focused on addressing safe, responsible, and accessible uses of AI in education. This work will take the form of two deliverables: A toolkit to support teachers and school staff in implementing past recommendations, and a developer’s guide to provide resources on how to build trust and understanding in the AI marketplace and essential questions to ask to guide responsible development.
- ED is collaborating with civil rights enforcement agencies as a part of an interagency convening hosted by DOJ,⁵⁰ to safeguard civil rights through robust enforcement, policy initiatives and ongoing education and outreach. The convening explored ways to leverage shared resources to address discrimination or other adverse situations that may arise through the use of AI and other advanced technologies. Additionally, ED held its own series of listening sessions with civil rights and educational technology groups.

Department of Homeland Security Science and Technology Directorate (DHS S&T): DHS S&T is committed to ensuring that AI/ML research, development, test, evaluation, and departmental applications comply with statutory and other legal requirements, sustain privacy protections, and maintain civil rights and civil liberties for individuals.

- DHS S&T is conducting research into how models’ decay and is developing metrics that can measure their continued validity over time. Another area of focus is on better understanding how bias enters the model, through data and/or through algorithms.
- DHS S&T conducted research and released a report in 2023 on the digital forgery landscape, identifying current methods in which synthetic media continues to manifest harm. The report provides an overview of tools and techniques currently used by bad actors to generate digital forgeries and deepfakes. The assessment also identifies various detection and authentication technologies and tools that currently exist or are in development as countermeasures, providing some insight into the ways to challenge or rebut fake or altered content.⁵¹

Department of Transportation Federal Highway Administration (DOT/FHWA): The FHWA’s investments in research programs include approaches that deal with societal implications of AI.

- In FY 2023, the Exploratory Advanced Research (EAR) program supported two pilots to build cross-disciplinary communities. One aim of the pilot efforts is to broaden the engagement in AI and data science among under-represented groups.

Department of Veterans Affairs (VA): The VA prioritizes the critical tenants of ensuring trustworthy, responsible, and safe AI efforts across the AI lifecycle to include ethical, legal, and societal considerations.

- VA continues to incorporate ethical, legal, and societal considerations of AI efforts within the TAI framework. Engagement with VA ethics and legal teams continue to support all forthcoming TAI considerations and governance functions. This includes cross-operational perspectives to include health care, benefits, cemetery services, as well as information and technology.

⁵⁰ <https://www.justice.gov/opa/pr/readout-justice-departments-interagency-convening-advancing-equity-artificial-intelligence>

⁵¹ [S&T Digital Forgeries Report: Technology Landscape Threat Assessment | Homeland Security \(dhs.gov\)](#)

National Aeronautics and Space Administration (NASA): NASA and its Chief AI Officer are developing an AI governance structure to ensure that its uses of AI are ethical, safe, and explainable.

- NASA has prepared a report, NASA Framework for the Ethical Use of Artificial Intelligence,⁵² on ethical AI considerations in the form of draft principles (Fair, Explainable & Transparent, Accountable, Secure & Safe, Human-Centric & Societally Beneficial, Scientifically & Technically Robust).
- NASA is developing explainable ML algorithms to produce explanations for why anomalies and their precursors in aviation data are identified as such, in the form of key contributing features.

National Institutes of Health (NIH): NIH is deeply invested in advancing the capabilities of biomedical researchers employing AI methodologies to minimize the risks that could result from their research and enhance ethical frameworks for biomedical AI.

- NIH continues to be committed to protecting people participating in research and privacy of their data. A robust system of policies relevant for research with AI includes: the “Common Rule”, which requires IRBs to consider risks to research participants; NIH Certificates of Confidentiality, which prohibits the unauthorized disclosure of identifiable, sensitive information that has been collected or used in research; and NIH review of investigators’ plans for responsible data sharing and management, all of which apply to AI research.
- Since 2023, secondary use of data from NIH-funded research for AI development is subject to both the NIH Policy on Data Management and Sharing,⁵³ and in the case of genomics data, the NIH Genomic Data Sharing policy.⁵⁴ These policies expect that researchers maximize scientific data sharing or, per the supplemental information Elements of an NIH Data Management and Sharing Plan,⁵⁵ a compelling rationale should be provided. The use of patient-derived data for use in research is approved and monitored at NIH through Data Access Committees.

National Institute of Justice (NIJ): The NIJ is supporting research to lead the way in applying AI to address criminal justice needs and understanding the impacts on ethical, legal, and societal implication.⁵⁶

- The Predictive Forensic Deoxyribonucleic Acid (DNA) and Predictive Policing⁵⁷ effort funds a workshop on probabilistic genotyping, forensic DNA phenotyping, and forensic investigative genetic genealogy technologies. The effort also funds a workshop on law enforcement use of person-based predictive policing approaches using algorithms, and their impact on privacy, civil liberties, accuracy, or disparate impact concerns.
- The Strengthening Data-Driven Pretrial Releases in New Jersey⁵⁸ effort, in collaboration with the New Jersey Administrative Office of the Courts, seeks to examine and revise use of the Public Safety

⁵² <https://ntrs.nasa.gov/api/citations/20210012886/downloads/NASA-TM-20210012886.pdf>

⁵³ <https://sharing.nih.gov/data-management-and-sharing-policy>

⁵⁴ <https://sharing.nih.gov/genomic-data-sharing-policy>

⁵⁵ <https://sharing.nih.gov/data-management-and-sharing-policy/planning-and-budgeting-for-data-management-and-sharing/writing-a-data-management-and-sharing-plan#elements-to-include-in-a-data-management-and-sharing-plan>

⁵⁶ <https://nij.ojp.gov/topics/articles/using-artificial-intelligence-address-criminal-justice-needs>

⁵⁷ <https://nij.ojp.gov/funding/O-NIJ-2023-171870.pdf>

⁵⁸ <https://nij.ojp.gov/funding/awards/15pnij-21-gg-02806-ress>

Assessment (PSA) tool designed to yield objective pretrial release recommendations but criticized for its inherent bias. The goal is to refine the tool by applying ML and data analysis, and to support the state’s pretrial reform objectives of limiting the use of pretrial detention, and reducing racial disparities in the system, while maintaining public safety.

National Institute of Standards and Technology (NIST): NIST is leading in the development of frameworks, research, tools, resources, data, and standards to support a measured approach to the ethical, legal, and societal challenges of AI.

- NIST is expanding programs in developing measurement science for explainable and interpretable AI, AI transparency, AI-related data privacy, and cognitive research in understanding characteristics of trustworthy AI that will support future best practices and standards. NIST also co-sponsored the creation of the AI Institute for Trustworthy AI in Law and Science (TRAILS)⁵⁹ with NSF to support extramural research in responsible and trustworthy AI.
- NIST is developing guidelines so that agencies can evaluate the efficacy of differential-privacy-guarantee protections as well as guidelines, tools, and practices to support agencies’ implementation of minimum risk management practices as well as the measurement and management of bias in AI systems and the data used to create them.

National Oceanic and Atmospheric Administration (NOAA): NOAA participates in community activities to understand principles of ethical and trustworthy AI.

- In the summer of 2022, NOAA contributed to a workshop on Trustworthy AI for Environmental Science (TAI4ES). The workshop was organized by the National Center for Atmospheric Research (NCAR) and the NSF-funded AI Institute for Research on Trustworthy AI in Weather, Climate, and Coastal Oceanography (AI2ES) and its goal was to learn about the foundations of trustworthiness for AI, and how ML systems are developed for environmental science applications. NOAA affiliated subject matter experts provided several presentations during sessions of the workshop.
- NOAA has been conducting a yearly AI workshop on Leveraging AI in Environmental Sciences that is open to public attendees. In 2023, the workshop included a plenary session “Research to Application Transition and AI Risk Management.” In 2022, the workshop included a closing plenary on “Ethical and Responsible AI.”

National Science Foundation (NSF): NSF recognizes that integrating AI systems into society requires understanding the sociotechnical boundary.

- The Designing Accountable Software Systems (DASS)⁶⁰ program supports foundational research aimed towards a deeper understanding and formalization of the bi-directional relationship between software systems and the complex social and legal contexts within which software systems must be designed and operate. The DASS program brings researchers in computer and information science and engineering together with researchers in law and social, behavioral, and economic sciences to jointly understanding the drivers of social goals for software systems.

⁵⁹ <https://www.nist.gov/news-events/news/2023/05/nist-partners-nsf-new-institute-trustworthy-ai-law-society-trails>

⁶⁰ <https://new.nsf.gov/funding/opportunities/designing-accountable-software-systems-dass>

- The Ethical and Responsible Research (ER2) program supports investigating the ethical consequences of research in emerging scientific and technological areas, including artificial intelligence and robotics, so that the research is responsive to the needs and values of society. The ER2 program encourages researchers to examine how technologies, such as artificial intelligence, impact research practices such as authorship, collaboration, mentoring, and peer review.

United States Department of Agriculture (USDA): The USDA funds research and performs outreach on technology to anticipate the unforeseen and unintended consequences of technological innovation, including cultural, health, welfare, equity, ethical, and environmental impacts.

- USDA’s Agriculture and Food Research Initiative, through its Social Implications of Food and Agricultural Technologies⁶¹ program area priority supported development of AI governance methodologies for precision agriculture, including innovative collaborations on decision-making and outreach through museum exhibits.

United States Patent and Trademark Office (USPTO): Part of the USPTO’s core mission is to advise on intellectual property (IP) policy, which includes the legal implications of AI and understanding its broader impacts.

- The USPTO is working with officials in other countries to align policies related to AI and intellectual property so that stakeholders do not face drastically different legal regimes around the world, a state of affairs that will hinder realization of the positive benefits of AI.
- The USPTO is carefully studying stakeholder feedback and the complicated issues that arise from the intersection of AI and IP. The goal is to promote the innovative and creative benefits that flow from AI, while mitigating its potential harms to IP rights.

AI EO 14110	Guidance for AI-Assisted Inventions
The USPTO has issued guidance on AI-assisted inventions and makes clear that AI-assisted inventions are not categorically unpatentable. It also provides instructions to examiners and stakeholders on determining the correct inventor(s) to be named in a patent or patent application for inventions created by people with the assistance of one or more AI systems.	

⁶¹ <https://www.nifa.usda.gov/social-implications-food-agriculture-technologies>

Strategy 4: Ensure the Safety and Security of AI Systems

The engineering processes for developing current AI systems are still quite young, and best practices for producing dependable implementations are still taking shape. In addition, the systems themselves can be inscrutable, making errors and attacks difficult to detect. This section examines efforts to build safe and trustworthy AI, and secure AI systems.

Defense Advanced Research Projects Agency (DARPA): DARPA is developing technologies to ensure the safety, security, and trustworthiness of AI systems.

- DARPA’s Semantic Forensics⁶² (SemaFor) program created a video forensic model that identifies manipulated video through anomaly detection, such as when a manipulated speaker’s lips are subtly out of sync with their voice. The SemaFor model achieved an average detection precision of nearly 90%, outperforming previous state-of-the-art forensic detection models also trained using unsupervised learning.
- DARPA’s Assured Autonomy⁶³ program demonstrated an AI-based system to warn a landing aircraft of ground objects on or near a runway. In eight test flights conducted in commercial airspace, the system recorded no false positives or false negatives. The Assured Autonomy runway incursion warning capability supports both manned and unmanned aircraft and represents a critical enabler for the wider deployment of autonomous aircraft.

Department of Defense (DOD): The DOD invests in the development of trustworthy, safe and secure AI systems.

- The Comprehensive Assessment of Sensor Exploitation Center⁶⁴ conducts tailored experiments to gain a complete understanding of performance including evaluating robustness to variations in operating conditions, assessing the accuracy of algorithm confidence crucial for fusion and resource management, and ensuring the rejection of confusers (non-target objects) not present in the training data. The experiments also focus on the ability of the off-line training process to adapt to new targets and conditions by integrating surrogate and synthetic data into the training strategy.
- The Systematic Testing of Artificial Intelligence Image Recognition (STAR) program develops technologies that significantly advance the science of testing autonomous systems. These technologies improve the safety and user trust in autonomous system tests and operations. One mechanism is by creating an image classifier robustness test tool to assist testers prove that AI-based imagers can perform well enough to make safety-critical decisions.

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Defense Programs: NNSA Advanced Simulation and Computing (ASC) will explore how to integrate existing safety and security practices with emerging trustworthy AI/ML concepts including bias reduction, interpretability, and explainability.

- NNSA is developing a mathematical foundation for verification, validation, and assessment methods, that ensure results generated from AI are safe and can be trusted for use.

⁶² <https://www.darpa.mil/program/semantic-forensics>

⁶³ <https://www.darpa.mil/program/assured-autonomy>

⁶⁴ <https://www.afrl.af.mil/About-Us/Fact-Sheets/Fact-Sheet-Display/Article/2331833/afrlry-compase/>

- NNSA continues to invest in research that protects privacy by ensuring the design of safe and reliable AI through best practices, and by developing guidelines for AI safety and security.

Department of Energy/Office of Science (DOE/SC): DOE/SC invests in AI research and privacy-enhancing technologies (PETs) for learning from distributed but collectively shared datasets.

- DOE/SC is at the forefront of promoting research and development in privacy-preserving AI technologies through interagency collaborations such as the Bridge2AI program led by the NIH.⁶⁵
- DOE/SC and NSF have established a Research Coordination Network (RCN) for advancing Privacy Enhancing Technologies (PETs) for AI. A key goal of the RCN is to foster collaborations in AI while addressing critical issues related to data privacy and security in AI research.⁶⁶

Department of Homeland Security (DHS): DHS invests in research and development to protect critical infrastructure from sophisticated cyberattacks and adversarial AI attacks, targeting control systems to natural disasters disrupting essential services.

- DHS is studying the risks against DHS AI use cases by malicious or unintentional misuse, accidents, or other errors and failures of AI technology. The primary objective of this effort is to develop an AI risk assessment framework for DHS use cases to manage and mitigate the identified risks and to gain the trust of the end users of these technologies.
- Informed by a DHS S&T hosted workshop in Adversarial AI (AAI), which was the largest of its kind in the USG,⁶⁷ DHS has started a line of research Counter Adversarial AI and assessment of Adversarial AI techniques and threats. This research will provide rigorous analysis and recommendations on effective countermeasures to the use of adversarial AI in DHS missions and inform test and evaluation (T&E) methods.

AI EO 14110	AI Risk Assessments in Critical Infrastructure Sector
<p>Nine agencies—including the Department of Defense, the Department of Transportation, the Department of Treasury, and Department of Health and Human Services—submitted their risk assessments to the Department of Homeland Security. These assessments, which will be the basis for continued federal action, ensure that the United States is ahead of the curve in integrating AI safely into vital aspects of society, such as the electric grid.</p>	

Department of Veterans Affairs (VA): The VA continues to ensure that safety and security considerations across business as well as technical software and infrastructure needs are considered within the tenants of TAI efforts and supporting AI governance functions.

- VA continues to evaluate how best to incorporate safety and security of AI systems within the TAI framework while also aligning with the NIST AI Safety Institute across sociotechnical considerations across all operational areas providing services to veterans across health care, benefits, cemetery services, as well as operational areas across the VA.

⁶⁵ <https://www.energy.gov/science/articles/department-energy-invests-1-million-artificial-intelligence-research-privacy>

⁶⁶ <https://www.energy.gov/science/articles/nsf-and-doe-establish-research-coordination-network-dedicated-enhancing-privacy>

⁶⁷ <https://www.dhs.gov/science-and-technology/publication/risks-and-mitigation-strategies-adversarial-artificial-intelligence-threats>

National Aeronautics and Space Administration (NASA): NASA has significant efforts on software verification and validation, which is vital for the safe operation of AI systems and engineered systems in general, as well as cybersecurity of software and communications network on which NASA systems rely.

- One of NASA’s programs, Software Verification and Validation, is conducting research on the verification and validation of software for space exploration and aviation. Formal verification has been applied to numerous autonomous systems to produce trustworthy component software. These capabilities also allow for reasoning about verifying safety, creating, and visualizing safety cases, and supporting risk-based decision-making. NASA performs risk and resilience analysis for complex systems, including those for piloted and, increasingly, autonomous aerial systems.
- Through NASA’s Cybersecurity program, NASA is assessing and securing AI enabled aviation systems and networks enabled by or that use AI, especially Urban Air Mobility.

National Institutes of Health (NIH): NIH is committed to ensuring the safety and security of AI systems in biomedical research domains.

- NIH and DOE are co-leading on the National AI Research Resource (NAIRR) Secure pilot to enable AI research involving sensitive data requiring special handling and protections. The NAIRR Secure pilot will assemble exemplar privacy/security-preserving resources (e.g., data enclaves, secure compute resources, and privacy preserving tools) and develop requirements for the future.
- NIH works with Federal Advisory Committees to ensure safety and security of AI. For example, the Novel and Exceptional Technology and Research Advisory Committee (NEXTRAC) Report⁶⁹ on Data Science and Emerging Technology in Biomedical Research examined some of the questions and concerns about how AI/ML models and algorithms are trained and how they are used in the real world.

AI EO 14110	Reducing Risks at the Intersection of AI and CBRN Threats
<p>An HHS AI Task Force has been established and is dedicated to biosafety and biosecurity (chemical, biological, radiological, and nuclear or CBRN defense). They are working to enhance the screening framework to encourage providers to implement comprehensive, scalable, and verifiable screening mechanisms. HHS Administration for Strategic Preparedness and Response (HHS/ASPR) has developed a screening framework⁶⁸ with guidance to industry to screen synthetic nucleic acid orders for “sequences of concern” and, if flagged, check customer legitimacy. NIST initiated a consortium to engage with industry and relevant stakeholders to develop guidelines for possible use by synthetic nucleic acid sequence providers.</p>	

National Institute of Standards and Technology (NIST): NIST is developing measurement science, frameworks, best practices, standards, tools, and resources to support and assess the safety and security of AI systems.

- NIST established the U.S. Artificial Intelligence Safety Institute (USAISI) to support development and deployment of safe and trustworthy AI. NIST also initiated the U.S. AI Safety Institute

⁶⁸ <https://aspr.hhs.gov/legal/synna/Pages/syndna.aspx>

⁶⁹ <https://osp.od.nih.gov/policies/novel-and-exceptional-technology-and-research-advisory-committee-nextrac#tab3>

Consortium (with over 200 members), which will help develop tools to measure and improve AI safety and trustworthiness.

- NIST is running the TrojAI public challenge on behalf of IARPA. This challenge is fostering the development of techniques to detect if AI models were trained with contaminated data and can contain hidden behaviors, thereby enhancing the trust and safety in predictions from AI models.

National Science Foundation (NSF): With society’s increasing dependence on robust, reliable AI systems, NSF’s investments have expanded to include a focus on the safety and security of these systems.

- The Safe Learning-Enabled Systems⁷⁰ program, a partnership between the NSF, Open Philanthropy and Good Ventures, has the goal of fostering foundational research that leads to the design and implementation of learning-enabled AI systems in which safety is ensured with high levels of confidence. Any system claiming to satisfy a safety specification must provide rigorous evidence, through analysis corroborated empirically and/or with mathematical proof.
- The Secure and Trustworthy Cyberspace (SaTC)⁷¹ program is one of the largest at the NSF. Its goals are to protect and preserve the growing social and economic benefits of cyber systems while ensuring security and privacy. Although not an AI-specific program, SaTC supports projects that encompass the full range of topics surrounding the safety and security of AI systems, from detecting deepfakes to making AI systems less prone to hallucinations.

National Telecommunications and Information Administration (NTIA): The NTIA is helping develop the policies necessary to verify that AI systems work as they claim—without causing harm. This initiative will help build an ecosystem of AI audits, assessments, certifications, and other policies to support AI system assurance and create earned trust.⁷²

- AI Accountability: A Request for Comment (RFC)⁷³ was published in the Federal Register seeking feedback on what policies can support the development of AI audits, assessments, certifications, and other mechanisms to create earned trust in AI systems. When closed, this RFC received a total of 1476 comments.

⁷⁰ <https://new.nsf.gov/funding/opportunities/safe-learning-enabled-systems>

⁷¹ <https://new.nsf.gov/funding/opportunities/secure-trustworthy-cyberspace-satc>

⁷² <https://www.ntia.gov/issues/artificial-intelligence>

⁷³ <https://www.federalregister.gov/documents/2023/04/13/2023-07776/ai-accountability-policy-request-for-comment>

Strategy 5: Develop Shared Public Datasets and Environments for AI Training and Testing

The engine behind many current-generation AI systems is the availability of data and of computing infrastructure for training on this data. To advance the state of the art in AI R&D, high-quality and well-structured data and software are needed. This section focuses on progress made in developing and making accessible datasets to meet the needs of a diverse spectrum of AI applications, developing shared large-scale and specialized advanced computing and hardware resources, making testing resources responsive to commercial and public interests, and developing open-source software libraries and toolkits for AI training and testing.

Defense Advanced Research Projects Agency (DARPA): DARPA develops and shares datasets and environments for AI training and testing to enhance U.S. capabilities in AI.

- DARPA's Guaranteeing AI Robustness Against Deception⁷⁴ (GARD) program is developing defenses against adversarial attacks on ML models, as well as resources for characterizing ML defenses and assessing the scope of their applicability. These resources include a virtual testbed, toolbox, benchmarking dataset, and training materials, which are available to the broader research community via a public repository.

Department of Defense (DOD): The DOD is committed to expanding public access to information and adopting a presumption in favor of openness and access with regard to making high-quality, authoritative data sets available to the public, as long as they are not restricted for national security, privacy or other statutory reasons.⁷⁵ For datasets that cannot be fully open, the DOD aims to expand secure sharing within authorized communities through collaborative ecosystems.

- COEUS, an effort named after the Greek god of intelligence, serves as a collaborative workspace for data engineers and scientists with centralized access to data, code, and other projects. COEUS provides a flexible, cloud-native platform to support candidate AI/ML model testing and evaluation, data labeling, model training, and data product automation and dissemination. The platform enables the discovery, sharing, and reuse of artifacts to accelerate algorithm development for faster delivery to the field.⁷⁶
- The Research and Engineering AI Hubs is a cross-DOD Services data-specific collaboration to share data, synthetics data generation, modeling and simulation environments, AI model development capability, and research expertise to solve mission critical problems.

Department of Energy/Office of Science (DOE/SC): DOE/SC invests in high-quality data and software for the training and testing of advanced AI systems.

- DOE/SC is actively involved in advancing AI research and development via high-performance computing and massive datasets from its experimental user facilities. By leveraging such resources, SC contributes to advances in new methods and algorithms that increase the reliability, robustness,

⁷⁴ <https://www.darpa.mil/program/guaranteeing-ai-robustness-against-deception>

⁷⁵ <https://data.defense.gov/>

⁷⁶ https://www.obtportal.army.mil/Portals/98/User%20Graphics/Portal-Home/Tech%20Talks/COI%20Flyer_05252022.pdf

and rigor of machine learning for scientific research.⁷⁸

- The Public Reusable (PuRe) Data initiative focuses on the generation of high-value community data resources that include data repositories, knowledge bases, analysis platforms, and other activities for making curated scientific data publicly available. Resources cover a wide range of scientific disciplines such as atmospheric data, biological and environmental research, and materials databases for physical sciences.⁷⁹

Department of Homeland Security Science and Technology Directorate (DHS S&T):

DHS S&T continues to identify technically mature capabilities and match them to mission needs to facilitate understanding and adoption of existing AI/ML solutions by DHS Components and stakeholders. DHS S&T is advancing capabilities that can be used by non-specialists to curate and process large datasets, while advising the Department on the technical and policy infrastructure needed for AI/ML.

- Through the Multi-Cloud Ecosystems program, DHS is researching environments in which users can access multiple clouds to train models and develop analysis approaches that will enable large-scale data analytics and AI on sensitive Cybersecurity and Infrastructure Security Agency (CISA) cybersecurity data. DHS has invested extensive development effort into efficient architectures for data and information sharing.
- The Synthetic Data program focuses on training detection algorithms for airport scanners, which require millions of data points. Scanning millions of pieces of luggage and cargo is not realistic, so the program seeks to understand the current state of the art and to identify opportunities for creating synthetic data sets that are good enough for training AI/ML for airport screening.

Department of Transportation Federal Highway Administration (DOT/FHWA): The FHWA is funding research to safely collect, use, and make available pedestrian data.

- In FY 2022, the EAR⁸⁰ program conducted a study on the diversity of pedestrian data and found researchers had limited access to curated, well distributed data on pedestrians that would allow for development and testing of AI systems that can improve the safety and mobility of all travelers.
- In FY 2024, the EAR program supports research on novel methods to collect, label, and analyze pedestrian data. Novel collection methods will address issues of consent and privacy to include

AI EO 14110	Expand Partnerships to utilize DOE’s Computing Capabilities and AI Testbeds to build Foundation Models
<p>On February 13, 2024, the Department of Energy Office of Science (DOE/SC) issued a Funding Opportunity Announcement (FOA) on Advancements in Artificial Intelligence for Science⁷⁷. This FOA seeks to develop and advance foundation models for computational science, federated and privacy-preserving training for foundation and other AI models, energy-efficient AI algorithms, and more. Basic research and development collaborations for testing, training, and building foundation models will enhance the use of AI for advances in multiple science and energy domains.</p>	

⁷⁷ <https://science.osti.gov/grants/FOAs/-/media/grants/pdf/foas/2024/DE-FOA-0003264-000001.pdf>

⁷⁸ <https://science.osti.gov/Initiatives/AI>

⁷⁹ <https://science.osti.gov/Initiatives/PuRe-Data>

⁸⁰ <https://highways.dot.gov/research/research-programs/exploratory-advanced-research/exploratory-advanced-research-overview>

under-represented pedestrians such as people using assistive devices such as wheelchairs or white canes for mobility or sensory conditions.

Department of Veterans Affairs (VA): The VA executes AI Tech Sprints by making federal data available and incentivizing collaboration and innovation through Challenge.Gov.⁸¹

- The VA is participating in the NAIRR Pilot supporting across all 4 pilot phases of NAIRR Open, NAIRR Secure, NAIRR Classroom, and NAIRR Software in strategy, best practices, and lessons learned around leveraging trustworthy AI approaches, governance frameworks, as well as cloud-first best practices. The VA’s experience of sharing data through previous VA Data Commons efforts and VA’s AI training platform known as ASPIRE (Strategy #7) are particularly relevant.
- The VA is spearheading two critical AI Tech Sprints as part of the AI EO 14110 to support the clinical value proposition in evaluating and leveraging AI for decreasing health care worker burnout. The first is focused on providing clinical scribing capabilities to streamline clinical documentation during and after appointments. The second is on community care document processing where the aim is to develop an AI-based system to rapidly ingest health records from outside the VA system and make them accessible to clinicians to drive meaningful clinician decision-making.

National Aeronautics and Space Administration (NASA): NASA makes the data that it produces publicly available to the extent possible, including significant Earth science data through Distributed Active Archive Centers (DAACs).

- The Earth Science Technology Office Advanced Information Systems Technology Program⁸² (AIST) of NASA has 28 ongoing projects and recently released a new call for proposals. The ongoing projects represent collaborations to provide novel information systems and technologies to reduce the risk, cost, and development time of NASA space- and ground-based information systems to significantly increase the accessibility and utility of science data, and to enable advanced observation measurements and Earth science information capabilities.
- Through the Enterprise Data Platform program, NASA is working toward building a platform that stores or connects to a wide variety of NASA datasets and enables search across the repository.

National Institutes of Health (NIH): NIH makes a wealth of biomedical data available to research communities and aims to make these data findable, accessible, interoperable, and reusable—or FAIR. Additionally, the NIH seeks to make these data usable with AI and ML applications.

- Bridge to Artificial Intelligence (Bridge2AI) Program⁸³ sets the stage for widespread adoption of AI in medicine as it develops ethically sourced “flagship” AI-ready data sets that span biomedical/behavioral research and establishes training curricula. Several other NIH programs relevant to AI training and testing include Nutrition for Precision Health, Science Collaborative for Health disparities and Artificial intelligence bias REduction (SchARe), National COVID Cohort Collaborative (N3C), and Medical Imaging and Data Resource Center (MIDRC).
- SchARe Think-a-Thons series target underrepresented populations, such as women and health disparity populations, in data science to gain and upskill AI and cloud computing knowledge to

⁸¹ <https://www.challenge.gov>

⁸² <https://esto.nasa.gov/aist/>

⁸³ <https://commonfund.nih.gov/bridge2ai>

conduct health disparity, health care delivery and health outcomes research using cloud computing resources, including over 250 population science, behavioral, environmental and social determinants of health data sets.

National Institute of Justice (NIJ): The NIJ develops and provides research datasets accessible through data.gov and the National Archive of Criminal Justice Data.

- The Human Trafficking Project⁸⁴ initiative involves establishing the Southern Methodist University’s Human Trafficking Data Warehouse, a comprehensive platform designed to address data deficiencies. It includes the development of a human computation / machine learning game to extract and complete human trafficking datasets. The research objectives encompass understanding the economic links to human trafficking, analyzing spatial and temporal patterns, identifying disparities in outcomes, and employing human-in-the-loop machine learning.
- Examining the Changing Dynamics of Homicide in Los Angeles (LA), 1990–present⁸⁵ Project uses the rich array of variables culled from the homicide files to improve understanding of the natural structure and situational dynamics of homicides, the factors associated with lethality in gun violence, and the natural structure of the processes involved in homicide investigations. It combines publicly available data with data from LA Police Department’s Murder Books, as well as earlier information from 4,000 murder books that cover LA’s South Bureau area.

National Institute of Standards and Technology (NIST): NIST creates and openly shares technical reference datasets across fundamental and applied AI R&D domains and many scientific research domains to support broad R&D engagement, accelerated robust R&D, meaningful progress measurement, and conformance assessment.

- NIST is participating in National Artificial Intelligence Research Resource pilot and has established a hub for instrumenting and operationalizing the AI Risk Management Framework (RMF)⁸⁶ and sharing resources and data that support the development and testing of responsible and trustworthy AI systems and technologies. NIST is researching approaches for computing and capturing properties of data used in training AI models, and for using these data properties to compute and associate uncertainties with AI-based inferences.
- NIST provides openly available data to support R&D and performance and conformance testing spanning all of its fundamental and applied scientific areas as well as a variety of machine learning and AI research areas and applications. Many NIST datasets are considered the gold standard for research. For example, NIST created the Joint Automated Repository for Various Integrated Simulations, density functional theory (JARVIS-DFT)—with more than 30,000 materials and 500,000 properties to be support automated materials discovery.

National Oceanic and Atmospheric Administration (NOAA): NOAA is increasing the discoverability, accessibility and AI-readiness of its vast repository of over 60 petabytes of environmental intelligence.

- The new AI-ready Tropical Cyclone PRecipitation, Infrared, Microwave, and Environmental Dataset (TC PRIMED) dataset collocates satellite imagery with ancillary model information to create a 22-

⁸⁴ <https://nij.ojp.gov/funding/awards/15pnij-22-gk-00246-brnd>

⁸⁵ <https://nij.ojp.gov/funding/awards/15pnij-22-gg-01422-ress>

⁸⁶ <https://airc.nist.gov/home>

year dataset of TC-centric scenes, driving the future of TC trajectory, intensity and coastal impact prediction. It is available from the NOAA Open Data Dissemination (NODD) program and is being permanently archived with the National Centers for Environmental Information (NCEI) and included in the NAIRR Pilot.

- NOAA Fisheries is leveraging the NOAA Open Data Dissemination (NODD) Program to make a wide variety of datasets available to the public. These include, but are not limited to, datasets comprising coral reef seafloor imagery and images from underwater fish surveys. The NOAA NAIEC and NCAI are proposing a centralized Public AI-Ready Training Data Repository ("Hub"), from which NMFS would benefit greatly.

National Science Foundation (NSF): The NSF has long recognized the critical role of public datasets in science. For example, NSF has supported the Protein Data Bank continuously since 1975, a resource that became the training set for the AlphaFold protein structure predictor.

- NAIRR is a concept for a shared national research infrastructure to connect U.S. researchers to responsible and trustworthy AI resources, as well as the needed computational, data, software, training, and educational resources to advance research, discovery, and innovation. Goals for the NAIRR Pilot⁸⁷ are to demonstrate the NAIRR concept, spur innovation, increase diversity of talent, improve capacity, and advance safe, secure, and trustworthy AI in research and society.
- The Building the Prototype Open Knowledge Network (Proto-OKN)⁸⁸ program supports the creation of a prototype Open Knowledge Network, an interconnected network of knowledge graphs supporting a very broad range of application domains. Open access to shared information is essential for the development and evolution of AI and AI-powered solutions needed to address the complex challenges facing the nation.

United States Patent and Trademark Office (USPTO): USPTO contributes to AI by democratizing access to datasets and computer resources.

- The USPTO has made data⁸⁹ and analyses⁹⁰ available to assist researchers and policymakers focusing on the determinants and impacts of AI invention. The Office of the Chief Economist released the Artificial Intelligence Patent Dataset⁹¹ (AIPD). It identifies a subset of U.S. patents that contain one or more of several AI technology components (including ML, Natural Language Processing, computer vision, speech, knowledge processing, AI hardware, evolutionary computation, and planning and control).
- The USPTO's participation in the NAIRR Pilot is centered on the provision of USPTO data resources to NAIRR Pilot users. This participation allows for the collocation of computational resources and equally valuable data resources. Users of the NAIRR Pilot can request USPTO data be made available on their computational environments, working toward a seamless experience for performing state-of-the-art research on one of the only federal datasets to have been widely adopted in training today's most capable AI models.

⁸⁷ <https://new.nsf.gov/focus-areas/artificial-intelligence/nairr>

⁸⁸ <https://new.nsf.gov/funding/opportunities/building-prototype-open-knowledge-network-proto>

⁸⁹ <https://www.uspto.gov/ip-policy/economic-research/research-datasets>

⁹⁰ <https://www.uspto.gov/sites/default/files/documents/OCE-DH-AI.pdf>

⁹¹ <https://www.uspto.gov/ip-policy/economic-research/research-datasets/artificial-intelligence-patent-dataset>

Strategy 6: Measure and Evaluate AI Technologies Through Standards and Benchmarks

Providing concrete metrics of safety, efficiency, applicability, and more is essential to the systematic and effective deployment of any technology at any stage of maturity. This section summarizes progress in developing a broad spectrum of AI standards, establishing AI technology benchmarks, increasing the availability of AI testbeds, engaging the AI community in standards and benchmarks, and developing standards for auditing and monitoring of AI systems. Through an online NITRD portal, the AI R&D Testbed Inventory,⁹² agencies have made 42 testbeds available.

Department of Defense (DOD): The DOD invests in programs and activities emphasizing the need for continuous evaluation of the operational and ethical performance of AI.⁹³

- Central Test and Evaluation Implementation program ensures autonomous capabilities in the ground and sea domains are rigorously tested and evaluated through the delivery of measurement data and the assessment of hardware integration facilities, modeling and simulation, and live testing. In the air domain, a specialized autonomy test capability is emphasized, focusing on air range safety, integration with the national airspace, and the intricate dynamics of human-machine networking. This holistic strategy aims to validate the effectiveness and safety in each domain.
- Collection of Reusable Space AI Resources program attempts to collect AI models for on-demand, within simulation, access using a common simulation framework for both quick reference & evolutionary build-up of models. Its goal is to promulgate basic performance (Test and Evaluation, Verification and Validation, and Execution) and coding standards.

Department of Education (ED): ED is engaging academia and industry in AI challenges around high-leverage education use cases.

- ED’s Institute of Education Science’s (IES) National Center for Education Statistics recently hosted two “automated scoring data challenges” to develop AI models that could replace human-assigned scores for the National Assessment of Educational Progress,⁹⁴ open-ended response items with AI-provided scores in reading and math subject areas. Open-ended assessment items allow students to better explain their ideas than multiple-choice items but are time (and resource)-consuming as they are typically hand-scored by people.

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Defense Programs: AI/ML technologies will support improvement of NNSA’s ability to invest in fundamental research areas and evaluate work performed in collaborations with subject matter experts across the Nuclear Security Enterprise.

- The NNSA engages in collaborative opportunities with strategic partners to influence standards and develop benchmarks for AI models and algorithms.
- The NNSA research investments aims to evaluate AI systems for accelerating design and production systems that support stockpile stewardship and nuclear deterrence.

⁹² <https://www.nitrd.gov/apps/ai-rd-testbed-inventory/>

⁹³ https://www.dote.osd.mil/Portals/97/pub/reports/DOTE_Strategy_Imp_Plan-Apr2023.pdf

⁹⁴ <https://nces.ed.gov/nationsreportcard/about/>

Department of Energy/Office of Science (DOE/SC): DOE/SC supports the development and use of standards and benchmarks to advances AI for science and energy research.

- Exascale ML technologies have been developed using a co-design process to improve the efficiency and effectiveness of DOE’s leadership class computing resources and large-scale experimental user facilities. Standards and benchmarks are needed to measure and evaluate performance trade-offs, facilitate high-performance implementations, enable the reliable integration of AI/ML technologies with applications, and for related tasks.

Department of Homeland Security Science and Technology Directorate (DHS S&T): DHS S&T is playing a central role in enabling the broader DHS workforce to understand and make use of AI/ML to fulfil their missions while adhering to ethical standards and principles.

- DHS S&T is developing an AI Implementation Plan with a maturity model assessment methodology to drive next-generation AI/ML technologies for cross-cutting Homeland Security capabilities. This plan will also facilitate use of proven AI/ML capabilities in Homeland Security missions and build an interdisciplinary AI/ML-trained workforce.

National Institutes of Health (NIH): NIH invests in research into novel methodologies to detect and correct bias in biomedical AI-based applications.

- The National Center for Advancing Translational Sciences (NCATS) Bias Detection Tools in Health Care Challenge⁹⁵ in FY2023, sought to encourage the development of bias-detection and -correction tools that foster “good algorithmic practice” and mitigate the risk of unwitting bias in clinical decision-support algorithms.

National Institute of Justice (NIJ): The NIJ contributes to improving ML and its application across NIJ through standards and benchmarks.

- The Review and Revalidation of the First Step Act Risk Assessment Tool is a collaborate effort to explore whether further refinements to the metrics and scoring scheme of Prisoner Assessment Tool Targeting Estimated Risk and Needs (PATTERN) may help improve the equitability, efficiency, and predictive validity of the risk assessment system. This will include an exploration of the inclusion of additional information (e.g., more recent programming data) and how it may be used to improve prediction and fairness.

National Institute of Standards and Technology (NIST): NIST has developed community-focused evaluations, challenges, testing suites, testbeds, and standards to support R&D and rigor in ML technologies for decades and is continuing to evolve its evaluations into emerging AI technologies and needs. NIST works across government and with

AI EO 14110	Developing Guidelines, Best Practices, and Evaluations for Trustworthy AI
NIST, in collaboration with other agencies, is developing an AI Risk Management Framework profile for generative AI; a secure software development framework for generative AI and dual-use foundation models; guidelines for evaluations and AI red-teaming; a landscape view of standards, tools and techniques for authenticating and labeling synthetic content; guidelines for evaluating the efficacy of differential-privacy-guarantee protections; and a plan for global engagement on promoting and developing AI standards.	

⁹⁵ <https://ncats.nih.gov/funding/challenges/winners/bias-detection>

industry in standards development and serves as the Federal Standards Coordinator regarding AI standards under the AI Standards Coordination Working Group (AISCWG).⁹⁶

- The NIST-IARPA TrojAI project has generated 18 datasets for use in public challenge rounds, ranging from image classification to reinforcement learning and cybersecurity, and released these datasets to the research community.
- NIST is developing new community workshop and benchmarking programs that integrate multidisciplinary science supporting trustworthy AI as well as emerging AI technologies including Generative AI.

National Oceanic and Atmospheric Administration (NOAA): NOAA participates in community activities that cover standards and benchmarks for AI technologies.

- NOAA has been conducting a yearly AI workshop on Leveraging AI in Environmental Sciences that is open to public attendees. In 2023, the theme of the workshop was on AI and benchmarking frameworks.
- NOAA recognizes the need for infrastructure to train and evaluate ML models efficiently and effectively and the need for a structured environment for conducting experiments and iterating on model designs. This workflow encompasses a standard set of tools, libraries, and practices designed to streamline the process of model training, validation, and performance evaluation. It will need to be implemented using enterprise-level solutions for ML Operations (MLOps), which include version and data provenance control, trained model archiving, and continuous testing.

National Science Foundation (NSF): Evaluation of AI systems is key to their successful deployment. NSF is working with partners to support crucial standards and benchmarks.

- TRAILS,⁹⁷ jointly funded by NSF and NIST, will develop novel methods, metrics, and advanced ML. Federal officials at NIST will collaborate with TRAILS in the development of meaningful measures, benchmarks, test beds and certification methods—particularly as they apply to important topics essential to trust and trustworthiness such as safety, fairness, privacy, transparency, explainability, accountability, accuracy, and reliability.

The Office of the National Coordinator for Health Information Technology (ONC) at the Department of Health and Human Services: ONC advances the development health IT and the electronic exchange of health information that is critical to research, generation of scientific knowledge, and innovation.

- ONC-certified health IT supports the care delivered by more than 96% of hospitals and 78% of office-based physicians around the country. The Health Data, Technology, and Interoperability: Certification Program Updates, Algorithm Transparency, and Information Sharing (HTI-1) Final Rule⁹⁸ adopts the Decision Support Interventions (DSI) certification criterion (at 170.315(b)(11)) and establishes a definition for Predictive DSI to create an industry standard for this sector.

⁹⁶ <https://www.nist.gov/standardsgov/icsp-ai-standards-coordination-working-group-aiscwg-charter>

⁹⁷ <https://www.nist.gov/news-events/news/2023/05/nist-partners-nsf-new-institute-trustworthy-ai-law-society-trails>

⁹⁸ <https://www.federalregister.gov/documents/2024/01/09/2023-28857/health-data-technology-and-interoperability-certification-program-updates-algorithm-transparency-and>

Strategy 7: Better Understand the National AI R&D Workforce Needs

With AI technology spreading to industries throughout the economy, preparing people to contribute to these efforts is paramount. This section notes progress in describing and evaluating the AI workforce, developing strategies for AI instructional material at all levels, supporting AI higher education staff, training/retraining the workforce, exploring the impact of diverse and multidisciplinary expertise, identifying and attracting the world’s best talent, developing regional AI expertise, investigating options to strengthen the federal AI workforce, incorporating ELS implications into AI education and training, and communicating federal workforce priorities to external stakeholders.

Census Bureau–Human Resources Division

(Census HRD): As a part of the Census Bureau’s statistical data modernization and strategic workforce transformation initiative to bolster the data science capabilities of its workforce, Census HRD offers to all full-time Census Bureau staff its Data Science Training Program (DSTP).¹⁰¹

- Census HRD has successfully completed four cohorts of the DSTP. This five-month program offers course work leading to two alternative learning paths namely: Data Science Generalist or Machine Learning Specialist. The 2023 cohort had 45 successful graduates.
- Census HRD is expanding its offerings by adding on-demand multi-track 12-week Data Science Bootcamps starting in February 2024. Six independent 12-week Data Bootcamp tracks are available that include tracks for Generative AI, Machine Learning & AI, Deep Learning, Data Analysis and Visualizations, Data Science with Python, and Data Science with R, an environment for statistical analysis.

Department of Defense (DOD): The DOD establishes a unified direction for DOD cyber workforce management and, as the cyber domain continues to expand, the inclusion of emerging technology workforces.¹⁰²

- Science, Mathematics, and Research for Transformation (SMART) Scholarship-for-Service program is an educational and workforce development opportunity for STEM students, offering scholarships for undergraduate, master’s, and doctoral students pursuing a degree in one of 24 STEM disciplines, including several related to AI. SMART scholars receive full tuition, annual stipends, and guaranteed employment with the DOD after graduation.¹⁰³

AI EO 14110	AI Talent Surge ⁹⁹
<p>The Office of Personnel Management has granted flexible hiring authorities for federal agencies to hire AI talent, including direct-hire authorities and excepted service authorities. Government-wide tech talent programs, including the Presidential Innovation Fellows, U.S. Digital Corps, and U.S. Digital Service, have scaled up hiring for AI talent in 2024 across high-priority AI projects.¹⁰⁰ This effort accelerates hiring AI professionals across the federal government resulting in enhanced AI expertise in the government, more informed decision-making, strategic funding in AI research, and effective implementation of AI technologies across the government.</p>	

⁹⁹ <https://ai.gov/apply/>

¹⁰⁰ <https://chcoc.gov/content/government-wide-hiring-authorities-advancing-federal-government-use-artificial-intelligence>

¹⁰¹ <https://www.census.gov/about/census-careers/working-at-census/learning-opportunities.html>

¹⁰² <https://dodcio.defense.gov/Portals/0/Documents/Library/CWF-Strategy.pdf>

¹⁰³ <https://ai.gov/apply/>

- The DOD Cyber Workforce Strategy 2023-2027,¹⁰⁴ published in 2023, enables the DOD to stay ahead of workforce trends by applying standardized workforce analysis tools and processes; continuing to develop cyber personnel to meet current and future requirements; championing the utilization of workforce-related authorities in non-traditional ways; and building strategic relationships in support of growing, diversifying, and strengthening the cyber workforce.

Department of Education (ED): The ED Office of Educational Technology’s AI report addresses the clear need for sharing knowledge, engaging educators, and refining technology plans and policies for AI use in education.

- The AI and Future of Teaching and Learning Report¹⁰⁵ describes AI as a rapidly advancing set of technologies for recognizing patterns in data and automating actions, and guides educators in understanding what these emerging technologies can do to advance educational goals while also evaluating and limiting key risks. The recommendations aim to help educators and AI researchers and designers to build an understanding of modern learning principles to achieve educational objectives.

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Defense Programs: By harnessing collaborative efforts, the NNSA can establish innovative talent pipelines and familiarize its staff to industry best practices.

- The DOE Computational Science Graduate Fellowship (CSGF) Program cultivates the next generation of scientists and engineers in computational sciences as well as supports the Advanced Simulation and Computing (ASC) and Stockpile Modernization missions by establishing academic programs and research experiences for multidisciplinary simulation science through graduate fellowships. CSGF is jointly funded with the DOE Office of Science’s Advanced Scientific Computing Research Program.
- The NNSA Predictive Science Academic Alliance Program (PSAAP)¹⁰⁶ engages with leading U.S. institutions of higher learning that focus on development and demonstration of technologies and methodologies to solve open science and engineering application problems. PSAAP requires multidisciplinary teams to work on annual overarching simulation goals and serves as an excellent laboratory pipeline.¹⁰⁷

Department of Energy/Office of Science (DOE/SC): DOE/SC supports the growth of a talented national AI, high-performance computing, and data science workforce via fellowship programs and research funding opportunities.

- The DOE CSGF program supports students pursuing doctoral degrees in fields (such as AI) that use high-performance computing to solve complex science and engineering problems.
- The DOE Early Career Research Program provides a valuable opportunity for promising investigators to advance their careers while contributing to leading-edge research in AI and related fields within the DOE’s scientific community.¹⁰⁸

¹⁰⁴ <https://dodcio.defense.gov/Portals/0/Documents/Library/CWF-Strategy.pdf>

¹⁰⁵ <https://tech.ed.gov/files/2023/05/ai-future-of-teaching-and-learning-report.pdf>

¹⁰⁶ <https://www.nnsa-ap.us/Programs/Predictive-Science-Academic-Alliance-Program>

¹⁰⁷ <https://psaap.llnl.gov/>

¹⁰⁸ <https://science.osti.gov/early-career>

Department of Homeland Security Science and Technology Directorate (DHS S&T): DHS S&T aims to recruit experts and train its workforce to improve AI/ML competence and effectively achieve its missions.

DHS S&T aims to recruit experts and train its workforce to improve AI/ML competence and effectively achieve its missions.

- The Program to Empower Partnerships with Industry & Government (PEPI-G) program supports faculty members, research scientists, postdocs, graduate, and undergraduate students from the 16 states of the South Big Data Hub to foster collaborative relationships with the government and develop a data science and computing workforce.

AI EO 14110	Attracting AI Talent to the United States
<p>The Department of State and the Department of Homeland Security have worked together to streamline processing times of visa petitions and applications,¹⁰⁹ including by ensuring timely availability of visa appointments, for noncitizens who seek to travel to the U.S. to work on, study, or conduct research in AI or other critical and emerging technologies. This effort is a step towards attracting and retaining talent in AI and other critical and emerging technologies in the U.S. economy.</p>	

Department of Veterans Affairs (VA): The VA is enabling VA personnel and veterans to be AI ready and help build AI systems that assist veterans to build their knowledge in and apply AI.

- The VA Office of Research and Development’s All Services Personnel and Institutional Readiness Engine (ASPIRE) is a joint effort among multiple agencies, universities, non-profits, and private sector partners to create an innovative system that can assess, educate/remediate, and report on various technical and soft skills, with a focus on AI R&D at VA. ASPIRE also provides value by standardizing the definition of roles and means among the serviced workforce, better enabling efficient and reliable recruitment, retention, and transition of personnel.

National Institutes of Health (NIH): NIH is committed to developing the next generation of researchers conversant in the intersection of AI and biomedicine.

- The AIM-AHEAD¹¹⁰ program has a goal of understanding workforce needs and developing workforce talents in alignment with its overarching goals.
- SCHARE program, especially Think-a-Thons, targets diverse populations, such as underrepresented women and health disparity populations in the data science workforce.

National Institute of Justice (NIJ): The NIJ advances its workforce with AI capabilities.

- The Law Enforcement Advancing Data and Science (LEADS) Scholars Program¹¹¹ is designed to increase the research capabilities of law enforcement professionals and agencies. In recent years, NIJ has focused on empowering law enforcement to integrate research into policies and practices. The LEADS Scholars Program advances evidence-based policing by supporting the development of research-minded law enforcement professionals.
- Crime Solutions¹¹² is a central, reliable resource to help practitioners and policymakers understand what works in justice-related programs and practices. Its purpose is to assist in practical decision making and program implementation by gathering information on specific justice-related

¹⁰⁹ <https://ai.gov/immigrate/>

¹¹⁰ <https://datascience.nih.gov/artificial-intelligence/aim-ahead>

¹¹¹ <https://nij.ojp.gov/funding/national-institute-justices-law-enforcement-advancing-data-and-science-leads-programs>

¹¹² <https://crimesolutions.ojp.gov/>

programs and practices and reviewing the existing evaluation and meta-analysis research against standard criteria.

National Institute of Standards and Technology (NIST): NIST supports developing and augmenting its AI R&D workforce and outreach through a variety of mechanisms.

- NIST participates in federal initiatives for development of an AI workforce framework with OPM and other agencies.
- NIST has programs for engaging students at all levels and programs augmenting its technical workforce and extending its outreach through students, guest researchers, visiting fellows, technical liaisons and details, grant programs, technical institutes and consortia, research and standards workshops and conferences, RFIs, extension partnerships, and cooperative research and development projects.

National Science Foundation (NSF): NSF investments focus on strengthening the pipeline that supplies AI talent to national priorities.

- The Advancing Education for the Future AI Workforce (EducateAI)¹¹³ initiative was launched in December 2023 to support educators to make state-of-the-art, inclusive AI educational experiences available nationwide. To date, NSF has encouraged the submission of novel and high impact proposals that advance inclusive computing education that prepares preK-12 and undergraduate students for the AI workforce.
- The Computer and Information Science and Engineering Graduate Fellowships (CSGrad4US)¹¹⁴ program aims to increase the number and diversity of domestic graduate students pursuing careers in computer and information science and engineering fields. Students in artificial intelligence are eligible and are well represented among participants.

AI EO 14110	EducateAI
NSF’s EducateAI initiative aims to help fund educators to create high-quality, inclusive AI educational opportunities at the K-12 through undergraduate levels. It prioritizes AI-related workforce development by offering educators professional development opportunities that provide the knowledge and skills required to integrate AI into their teaching practices. In addition, the program will establish the necessary infrastructure to support AI education across diverse institutions and includes a focus on underrepresented groups in computing.	

United States Department of Agriculture (USDA): The USDA’s education and workforce development fellowship and capacity programs leverage research in AI technology to develop its next generation workforce.

- The From Learning to Leading: Cultivating the Next Generation of Diverse Food and Agriculture Professionals,¹¹⁵ also known as NextGen Program enables 1890 institutions, 1994 institutions, Alaska Native-serving institutions, Native Hawaiian-serving institutions, Hispanic-serving institutions and insular area institutions of higher education located in the U.S. territories, to build and sustain the next generation of the food, agriculture, natural resources, and human sciences

¹¹³ <https://www.nsf.gov/pubs/2024/nsf24025/nsf24025.jsp>

¹¹⁴ <https://new.nsf.gov/cise/graduate-fellowships>

¹¹⁵ <https://www.nifa.usda.gov/grants/programs/learning-leading-cultivating-next-generation-diverse-food-agriculture-professionals>

workforce; AI applied research and AI development is woven into these education and workforce programs.

- Agriculture and Food Research Initiative (AFRI) Education and Workforce Development¹¹⁶ programs and fellowships (such as predoctoral, national needs, and Hispanic-serving institutions) produce digital agriculture and AI youth leaders and entrepreneurs.

United States Patent and Trademark Office (USPTO): The development and maintenance of technical knowledge is vital to the USPTO's core mission.

- AI training is a key priority at the USPTO,¹¹⁸ with AI-related patent applications having more than doubled over the past two decades. USPTO's on-demand training related to AI has increased more than threefold since 2021, with over 150 courses currently available, and the agency's live technology training at Technology Fairs has also doubled. In addition, the USPTO has partnered with AI experts at Carnegie Mellon University to create an AI curriculum tailored to the unique needs of patent examiners.

AI EO 14110	Modernizing Schedule A to Include Consideration of Additional Occupations in STEM and Non-STEM
Department of Labor is seeking from the public any input, including data, statistical metrics or models, studies, and other relevant information, on how the Department may establish a reliable, objective, and transparent methodology for revising Schedule A to include STEM and other non-STEM occupations that are experiencing labor shortages, consistent with requirements of the Immigration and Nationality Act (INA). ¹¹⁷	

¹¹⁶ <https://www.nifa.usda.gov/grants/programs/agriculture-food-research-initiative-afri/afri-education-workforce-development>

¹¹⁷ <https://www.federalregister.gov/documents/2024/02/15/2024-03187/labor-certification-for-permanent-employment-of-foreign-workers-in-the-united-states-modernizing>

¹¹⁸ <https://www.uspto.gov/blog/director/entry/latest-updates-on-artificial-intelligence>

Strategy 8: Expand Public-Private Partnerships to Accelerate Advances in AI

The data and compute intensive nature of many recent AI methods has meant that private industry is well positioned to carry out some essential AI R&D functions that complement publicly funded efforts. This section documents progress in achieving more from public-partnership synergies, expanding partnerships to more diverse stakeholders, and improving, enlarging, and creating mechanisms for R&D partnership.

Department of Defense (DOD): The DOD is committed to establishing effective partnerships with academia, industry, and other non-federal entities.

- Through the SBIR and Cooperative Research and Development Agreements (CRADA), the DOD is currently engaged in several partnerships focused on developing AI science and technology solutions for Space.
- In 2023, DOD’s Trusted AI and Autonomy program organized a conference on Defense Technology Review, that brought industry, academia, and government together to discuss the state of the art and future of the technology area.

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Defense Programs: By committing to a high degree of collaboration with industry, NNSA can benefit from the R&D activities already taking place and fund exploration of areas unique to its mission.

- The NNSA seeks to co-design and procure hardware, testbeds, and systems with industry. The NNSA is actively engaged in the evaluation of both open and closed models and datasets to enhance its research and development efforts.

Department of Energy/Office of Science (DOE/SC): DOE/SC is actively involved in public-private partnerships to advance AI for science capabilities.

- The Trillion Parameter Consortium (TPC) aims to create trustworthy generative AI models for science via large, multi-disciplinary teams and collaborations. The TPC includes partners from various organizations such as national laboratories, research institutes, academia, and industry.

Department of Homeland Security Science and Technology Directorate (DHS S&T): Through its Small Business Innovation Research (SBIR) Office and the Silicon Valley Innovation Program (SVIP), DHS fosters partnership with all small businesses, including small disadvantaged, women-owned, veteran-owned, service-disabled veteran-owned, and socially and economically disadvantaged small business concerns, with the capability to conduct R&D for Homeland Security-related missions.

- SBIR United States Coast Guard (USCG) Hoax Detection, USCG has received an increased number of hoax calls in recent years that cost taxpayers money and put USCG responders at risks in certain situations. This effort is concerned with discerning hoax from distress calls. It is technically challenging and will require multi-modal approaches to inform Watch-stander decisions.
- Soft targets are locations that are easily accessible to large numbers of people and that have limited security or protective measures in place, making them vulnerable to attack. Critical to securing soft targets is coverage by video cameras of the areas of interest, detecting leave-behinds, determining the trajectory of an object or person of interest, and analyzing and integrating video streams from

multiple sources. The SVIP¹¹⁹ and the Securing Soft Targets¹²⁰ programs are performing research activities in this space by using and advancing AI and advanced video analytics.

Department of Veterans Affairs (VA): The VA fosters public-private partnership to develop AI systems to track and improve the health of veterans.

- The VA is participating in the NAIRR supporting across all four Pilot phases of NAIRR Open, NAIRR Secure, NAIRR Classroom, and NAIRR Software in strategy, best practices, and lessons learned around leveraging trustworthy AI approaches, governance frameworks, as well as cloud-first best practices (see Strategy #7).
- The VA continued with its International Summit for AI in Health Care in September 2023 as the second annual event. The event was joined by 1000+ participants across public and private sectors as well as international stakeholders and partners to explore how AI and ML are shaping the future of veterans' health care. Leaders in AI and health care from international governments, academia, and industry from around the world to share lessons learned, best practices, and to explore how best to accelerate safe, trustworthy, and responsible advances in AI.

National Institutes of Health (NIH): NIH looks for opportunities to engage with the private sector to establish meaningful connections and sustain R&D investments in AI.

- NIH is one of the leading agencies supporting the NAIRR Pilot.¹²¹ The NAIRR Pilot provides access to advanced computing, datasets, models, software, training and user support to U.S.-based researchers and educators and brings together several USG agencies and private sector partners to accelerate the project.
- The Team Science Leadership Scholars Program,¹²² embedded within the Accelerating Medicines Partnership® Autoimmune and Immune-Mediated Diseases (AMP® AIM),¹²³ enhances scholars' team science leadership skills through immersive, cross-sectoral collaborative experiences by working closely with AMP AIM researchers.

National Institute of Standards and Technology (NIST): NIST fosters robust engagement with industry, universities, non-profits, and other government agencies in carrying out its AI agenda using a variety of tools and resources including broad input and review of NIST reports, convening open workshops, and with AI Visiting Fellows, AI Visiting Researchers, Student Programs, and Grants.

- NIST is engaged in significant public-private collaborative AI partnership activities through the previously mentioned Trustworthy AI in Law and Society Institute with NSF, the Artificial Intelligence Safety Institute and Consortium,¹²⁴ the Generative AI Public Working Group,¹²⁵ and the

¹¹⁹ <https://www.dhs.gov/science-and-technology/svip>

¹²⁰ <https://www.dhs.gov/science-and-technology/svip-topic-call-securing-soft-targets-industry-day-webinar>

¹²¹ <https://new.nsf.gov/focus-areas/artificial-intelligence/nairr>

¹²² <https://www.niams.nih.gov/about/about-the-director/letter/announcing-inaugural-cohort-leadership-scholars-program-awardees>

¹²³ <https://www.niams.nih.gov/grants-funding/niams-supported-research-programs/accelerating-medicines-partnership-amp>

¹²⁴ <https://www.nist.gov/artificial-intelligence/artificial-intelligence-safety-institute>

¹²⁵ <https://www.nist.gov/news-events/news/2023/06/biden-harris-administration-announces-new-nist-public-working-group-ai>

Secure Trustworthy AI Program at the National Cybersecurity Center of Excellence.

- NIST promotes collaboration in its standards development and coordination leadership role with the broad stakeholder community to foster advancement of measurement science, conduct rigorous community-wide technology evaluations, develop best practices, and test methods, and contribute to voluntary consensus-based standards activities for measuring and evaluating AI.

National Oceanic and Atmospheric Administration (NOAA): NOAA fosters research partnerships as scientists work to address complex global problems like coastal resilience, food security, and climate change.

- Improving Navigation and Magnetic Field Forecasts: NOAA collaborated with the NASA Tournament Lab for a global crowdsourcing challenge, "MagNet: Model the Geomagnetic Field," aiming to enhance models predicting changes in the magnetic field due to space weather. The competition attracted over 600 participants worldwide, showcasing the capability of the data science community to develop models to surpass current systems in predicting Earth's magnetic field reactions to space weather, even without in-depth knowledge of the physics involved.
- In November 2022, Microsoft and NOAA entered a CRADA targeting several areas including the application of AI to improve NOAA's climate models for air quality, wildfire smoke and particulate pollution.¹²⁶

National Science Foundation (NSF): NSF innovates in supporting AI research through partnerships.

- The Regional Innovation Engines (Engines)¹²⁸ program supports the application of AI to a wide range of societal and economic challenges, such as advanced mobility solutions, climate-resilient food production, and cybersecurity. Seven of the 10 inaugural NSF Engines involve focus on application of AI and 15 NSF Engines development awards made in 2023 involved AI. NSF's investments in the inaugural NSF Engines have already been matched 2-to-1 by private, philanthropic, and other government sources.
- Two NSF-led programs with a substantial AI focus and significant public-private partnerships are the National AI Research Institutes program (AI Institutes) and the Resilient & Intelligent NextG Systems (RINGS)¹²⁹ program. The AI Institutes program strives to advance the research frontiers in AI in use-inspired contexts and RINGS seeks to deploy AI techniques to enhance autonomous management and operations capabilities.

AI EO 14110	National AI Research Resource (NAIRR) Pilot
<p>In January 2024, the NSF and its partners launched the NAIRR Pilot,¹²⁷ a first step towards establishment of a shared national research infrastructure for discovery and responsible innovation in AI. This NAIRR Pilot aims to connect U.S. researchers and educators to computational, data, and training resources needed to advance AI research and research that employs AI to spur innovation, increase diversity of talent, improve capacity, and advance trustworthy AI and protects privacy, civil rights, and civil liberties.</p>	

¹²⁶ <https://www.noaa.gov/news-release/noaa-microsoft-team-up-to-advance-climate-ready-nation>

¹²⁷ <https://new.nsf.gov/focus-areas/artificial-intelligence/nairr>

¹²⁸ <https://new.nsf.gov/funding/initiatives/regional-innovation-engines>

¹²⁹ <https://new.nsf.gov/funding/opportunities/resilient-intelligent-nextg-systems-rings>

The Office of the National Coordinator for Health Information Technology (ONC) at the Department of Health and Human Services: ONC advances the development health IT and the electronic exchange of health information that is critical to research, generation of scientific knowledge, and innovation.

- ONC participates in the Coalition for Health AI, which is a group tasked with defining core principles and criteria for health AI developers, end-users, and health care organizations to evaluate, monitor and report health AI systems throughout their lifecycle. The group is also focused on generating and promoting a standard labeling schema to provide transparency to health AI end-users/consumers aiming to increase credibility of health AI systems.

United States Department of Agriculture (USDA): The USDA partnerships with academic, non-profit and commercial organizations are integral to advancing its mission in AI R&D.

- The SBIR Plant Production and Protection-Engineering,¹³⁰ enhances crop production in both conventional and organic systems by creating and commercializing AI technologies that enhance system efficiency and profitability.
- The Network of User-Engaged Researchers building Interdisciplinary Scientific Infrastructures for healthy food (NOURISH)¹³¹ AI platform, in collaboration with NSF's Technology, Innovation, and Partnerships Directorate, connects local food entrepreneurs and investors, equipping them with an AI system that accelerates their efforts. NOURISH advances a novel scientific perspective that is grounded in equity research, bringing together expertise in topics like public health nutrition, food justice, regional planning, business, and addiction, with cutting-edge data science/AI.

United States Patent and Trademark Office (USPTO): The USPTO builds public-private partnerships to advance its core mission of fostering innovation in science and technology.

- The USPTO established its Artificial Intelligence and Emerging Technologies (AI/ET) Partnership,¹³² a cooperative effort between the USPTO and the independent inventors, small businesses, representatives from federal agencies, academia, industry, and nonprofits that seeks to promote greater awareness, openness, and inclusivity on the USPTO's ongoing and future AI and ET efforts, while fostering public trust by promoting trustworthy and responsible use of these technologies, and exploring various IP policy issues impacted by AI and ET.
- The USPTO also created a first-of-its-kind competition enlisting the public AI research and data science communities to help improve the state of the art in semantic similarity as applied to U.S. patent data. As of May 4, 2022, more than 1,000 competitors have submitted over 7,900 source code entries to the competition, collectively achieving an accuracy score (measured by Pearson correlation) of over 85 percent. Exposure to diverse datasets helps AI models generalize well to new, unseen data.

¹³⁰ <https://www.sbir.gov/node/2482415>

¹³¹ <https://portal.nifa.usda.gov/web/crisprojectpages/1031722-nsf-convergence-accelerator-track-j-network-of-user-engaged-researchers-building-interdisciplinary-scientific-infrastructures-for-healthy-food-nourish.html>

¹³² <https://www.uspto.gov/initiatives/artificial-intelligence/ai-and-emerging-technology-partnership-engagement-and-events>

Strategy 9: Establish a Principled and Coordinated Approach to International Collaboration in AI Research (*new*)

Many countries have recognized the importance of AI technology in furthering their national goals. There is a tremendous benefit to sharing ideas across borders and working together to solve problems of mutual interest. Note that this strategy is newly added in the 2023 Strategic Plan update, so this section summarizes initial progress in cultivating a global culture of developing and using trustworthy AI, supporting development of global AI systems, standards, and frameworks, facilitating international exchange of ideas and expertise, and encouraging AI development for global benefit.

Defense Advanced Research Projects Agency (DARPA): DARPA coordinates and collaborates with international partners on AI research topics of mutual interest.

- DARPA’s SemaFor¹³³ program participated in the 11th meeting of INTERPOL DevOps technical working group. During the week-long workshop, the AI Generated Media group employed SemaFor analytics to differentiate between AI-generated images and those depicting a real victim, important for investigations. In an evaluation on a large dataset, SemaFor analytics achieved improved levels of performance and delivered results in seconds compared to the current process of manually reviewing images that takes up to 60 minutes per image.

Department of Defense (DOD): The DOD is prioritizing ethical considerations and collaboration with international partners in its approach to developing and fielding military applications of AI.¹³⁴

- The Australia, United Kingdom, and United States (AUKUS) Partnership,¹³⁵ an enhanced trilateral security partnership is intended to strengthen the ability of each government to support security and defense interests. Through Pillar II (Advanced Capabilities), Australia, the United Kingdom, and the United States have collaborated to accelerate collective understanding of AI and autonomy technologies, and how to rapidly field robust, trustworthy AI and autonomy in complex operations, while adhering to the shared values of safe and responsible AI.¹³⁶
- The U.S. and Singapore Multi-modal Active Perception System (MAPS), a three-year project, focuses on AI-enabled assessment of building damage and human casualty presence from fused sensor data collected from heterogeneous uncrewed systems in a humanitarian assistance disaster response scenario.

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Defense Programs: ASC’s external collaborations help DOE/NNSA benefit from technical innovation in the community via partnerships with technology leaders for augmenting existing solutions to make them usable within the NNSA. ASC must develop open challenge problems and proxy applications that closely relate to NNSA’s mission space to enable focused research partnerships.

¹³³ <https://www.darpa.mil/program/semantic-forensics>

¹³⁴ <https://www.defense.gov/News/News-Stories/Article/Article/3429864/dod-committed-to-ethical-use-of-artificial-intelligence/>

¹³⁵ <https://www.defense.gov/Spotlights/AUKUS/>

¹³⁶ <https://www.defense.gov/News/Releases/Release/Article/3408870/aukus-partners-demonstrate-advanced-capabilities-trial/>

- The Mutual Defense Agreement with the United Kingdom’s Atomic Weapons Establishment (AWE),¹³⁷ is a scientific exchange that is primarily conducted among Los Alamos, Livermore, and Sandia national laboratories in the United States and the AWE in the United Kingdom.
- Memoranda of Understanding (MOUs) with France’s Alternative Energies and Atomic Energy Commission (CEA) and Japan’s Ministry of Education, Culture, Sports, Science, and Technology (MEXT) seek to develop environmentally safe, and secure sources of energy.¹³⁸

Department of Energy/Office of Science (DOE/SC): DOE/SC engages in international collaborations in areas of mutual interest to advance AI.

- The Accelerated Data Analytics and Computing (ADAC) Institute is an international collaboration that seeks to leverage the respective investments of its members. A primary goal is to increase application software readiness and expand the breadth of applications capable of running on accelerated architectures. Working groups and discussions focus on such areas as federated learning and foundation models for science.¹³⁹
- The U.S.-Japan Science and Technology Cooperation Program focuses on collaborative research projects in high energy physics. This program fosters collaboration among U.S.-Japan researchers in areas such as AI, neutrinos, rare processes, and the development of accelerator and detector technologies for science.¹⁴⁰

Department of Homeland Security Science and Technology Directorate (DHS S&T): DHS partners with international counterparts and broader agency partners as well as private sector entities and academic institutions to survey and assess current research and publications related to AI developments with the goal of assessing AI impacts specific to the homeland security mission.

- In FY23, DHS S&T hosted the largest U.S. government workshop to date in Adversarial AI (AAI), to include international partners from the European Union and Japan, with a specific panel presentation focused on international collaboration in response to AAI challenges that transcend borders and jurisdictions.¹⁴¹
- DHS S&T is working with its Swedish counterpart, Myndigheten för Samhällsskydd och Beredskap (MSB), and has established a technical exchange for calendar year 2024 focused on intelligent technologies for cyber-physical security of critical infrastructure. This exchange consists of a meeting each quarter where a research team from Kungliga Tekniska Högskolan (KTH) will present their work, and a team from DHS or its contractors will present, sharing cutting-edge results on specific topics of interest.

Department of Transportation Federal Highway Administration (DOT/FHWA): FHWA engages in international collaborations in areas of mutual related to applying and advancing AI.

¹³⁷ <https://discover.lanl.gov/publications/national-security-science/2023-spring/the-mutual-defense-agreement/>

¹³⁸ <https://www.energy.gov/node/4812957>

¹³⁹ <https://adac.ornl.gov/>

¹⁴⁰ <https://www.energy.gov/science/articles/department-energy-announces-22-million-us-japan-cooperative-research-high-energy>

¹⁴¹ <https://www.dhs.gov/science-and-technology/publication/risks-and-mitigation-strategies-adversarial-artificial-intelligence-threats>

- In FY 2024, FHWA is collaborating with six international partners, Australia, Austria, Canada, Japan, Spain, and the United Kingdom, in funding a special project on advancing and applying AI to transportation under the Permanent International Association of Road Congresses (PIARC).

Department of Veterans Affairs (VA): The VA partners with international AI researchers developing AI systems that could play an important role in serving our veterans.

- The VA continued with its International Summit for AI in Health Care in September 2023 as the second annual event (see Strategy #8) bringing international researchers, clinicians, and others to build synergy for Veteran issues.
- The VA through the ASPIRE platform (see Strategy #7) developed in partnership across public-private partners as well as other federal agencies to target key areas of opportunity to leverage AI capabilities to upskill existing workforce with key AI knowledge and skill sets. These approaches and learnings may be shared with the international community as the ASPIRE effort has already been approached by the Australian Army and the Canadian Parliament expressing interest.

National Institutes of Health (NIH): NIH seeks meaningful opportunities to advance AI research through the involvement of international researchers.

- Harnessing Data Science for Health Discovery and Innovation in Africa¹⁴² (DS-I Africa), an NIH Common Fund program, is supported by the Office of the Director and 12 NIH Institutes, Centers and Offices. The African-led hubs will apply novel approaches to data analysis and AI to address critical health issues. Academic awardees in the consortium are collaborating with over 200 partner organizations, including African governments, U.S. universities, and private sector entities such as IBM Research Africa.

National Institute of Standards and Technology (NIST): NIST works with the international AI R&D and standards community to promote international collaboration and alignment in measurement science, best practices, frameworks, and standards.

- NIST collaborates with the US-EU Trade and Technology Council, the OECD Global Partnership on AI, and a host of bilateral initiatives in Asia, Europe, and North America, and a Quadrilateral Security Dialogue Standards sub-group with India, Japan, Australia.
- A bilateral agreement with the United Kingdom resulted in the Privacy Enhancing Technologies (PETs) Challenge, which was completed in collaboration with NSF to develop solutions focusing on fostering privacy while preserving data access and use.

National Oceanic and Atmospheric Administration (NOAA): NOAA develops high level agreements to coordinate international collaboration in AI research.

- NOAA supported the 1st Korean Meteorological Administration (KMA) and NOAA Workshop on AI for Weather and Climate: From October 17-21, 2022, in Gwangju, South Korea. Topics covered included data assimilation, model physics, data driven machine learning, and interpretability of AI.

¹⁴² <https://commonfund.nih.gov/AfricaData>

- NOAA has renewed the collaboration with KMA on AI/ML for weather and climate predictions with expanded scope that includes partnerships with industry and academic sectors, which was included in the NOAA-KMA Joint Working Group-8 2023-2025 work plan.

National Science Foundation (NSF): With increasing international attention around AI, the NSF is participating in many collaborative efforts.

- The Collaborative Research in Computational Neuroscience (CRCNS)¹⁴³ program supports collaborative research projects and the sharing of data and other resources for the study of computational neuroscience, viewed by some as the inspiration for much of the progress in artificial intelligence research. Domestic and international projects are supported including bilateral projects with German, French, Israeli, Japanese, and Spanish collaborators; and other multilateral projects.
- The Responsible and Equitable AI effort under the NSF and the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO)¹⁴⁴ supports joint teams of U.S. and Australian researchers on responsible and equitable AI topics. The NSF-Italian Ministry of Universities and Research Lead Agency Opportunity on AI¹⁴⁵ effort provides a framework to encourage collaboration between the U.S. and Italian research communities on the topic of AI.

United States Patent and Trademark Office (USPTO): The USPTO builds international cooperation to advance its core mission of fostering innovation in science and technology.

- IP5 NET/AI Task Force: The IP5 is a forum of the five largest intellectual property (IP) offices representing the United States, China, Japan, the EU, and the Republic of Korea. With the task force, the USPTO and its international partners have exchanged information regarding their experiences and efforts on AI initiatives. The IP5 Offices have further developed a comprehensive roadmap for possible projects and initiatives in areas that benefit most from joint IP5 responses. In June 2023, the offices completed a comparative study on examination practices for AI-related inventions.
- The USPTO has met with foreign IP counterparts on AI issues and efforts, including sharing and exchanging policies on AI examination practices, and discussing AI initiatives in machine translation, text and image search, and classification. Multilateral discussions also included AI strategies, and AI deployment considerations such as bias, transparency, and explainability. The USPTO has remained engaged through the World Intellectual Property Organization on non-normative discussions regarding critical and emerging technology, including AI.

¹⁴³ <https://new.nsf.gov/funding/opportunities/collaborative-research-computational-neuroscience>

¹⁴⁴ <https://www.nsf.gov/pubs/2022/nsf22086/nsf22086.jsp>

¹⁴⁵ <https://www.nsf.gov/pubs/2024/nsf24055/nsf24055.jsp>

Conclusion and Next Steps

The nation's AI R&D enterprise is resilient and growing. U.S. R&D and innovation in AI is critical to maintaining American global leadership in AI. As we celebrate the accomplishments detailed in this report, it is evident that the United States needs to continue to leverage its technical strengths and sustain its support in early-stage research to drive technological breakthroughs in AI.

Looking ahead, through federal investments in AI R&D, agencies aim to advance the strategic priorities laid out in the 2023 Strategic Plan update, by fostering collaboration between federal agencies, industry and international partners, and the research community to ensure a seamless exchange of knowledge and expertise and translation of research breakthroughs into practical applications. It is imperative that pursuing AI advances by emphasizing the responsible development and deployment of trustworthy AI systems to address societal challenges and benefit Americans remain priorities.

The importance of fostering a skilled AI workforce will depend on efforts to invest in education, training, and talent development. These efforts will promote diversity and inclusivity in the AI workforce and harness a broad spectrum of perspectives to address complex challenges and drive innovation.

In summary, the progress described in this report reflects how the federal government is improving AI capabilities through R&D in a manner that is beneficial to the American people and in advancing the nine strategic priorities of the 2023 Strategic Plan update.

List of Abbreviations and Acronyms

Acronym	Definition
ACD	Automated Change Detection
ACE	Air Combat Evolution
ACT3	Autonomy Capability Team
ADAC	Accelerated Data Analytics and Computing
AEC	Atomic Energy Commission
AFRI	Agricultural and Food Research Initiative
AgAID	Agricultural AI for Transforming Workforce and Decision Support
AI	Artificial Intelligence
AI/ET	Artificial Intelligence and Emerging Technologies
AI/ML	Artificial Intelligence/Machine Learning
AI4ND	Artificial Intelligence for Nuclear Deterrence
AI-CARING	AI Institute for Collaborative Assistance and Responsive Interaction for Networked Groups
AIM-AHEAD	Artificial Intelligence/Machine Learning Consortium to Advance Health Equity and Researcher Diversity
AIPD	Artificial Intelligence Patent Dataset
AISCWG	AI Standards Coordination Working Group
AIST	Advanced Information Systems Technology Program
AixCC	Artificial Intelligence Cyber Challenge
AMP AIM	Accelerating Medicines Partnership® Autoimmune and Immune-Mediated Diseases
API	Application Programming Interface
ARPA	Advanced Research Projects Agency
ASC	Advanced Simulation and Computing
ASPIRE	All Services Personnel and Institutional Readiness Engine
AUKUS	Australia, United Kingdom, and United States
AWE	Atomic Weapons Establishment
Bridge2AI	Bridge to Artificial Intelligence
CBRN	Chemical, Biological, Radiological, and Nuclear
CEA	The French Alternative Energies and Atomic Energy Commission
Census	United States Census Bureau
CISA	Cybersecurity & Infrastructure Security Agency

2020–2024 Progress Report: Advancing Trustworthy Artificial Intelligence Research and Development

Acronym	Definition
CISE/IIS	Computer and Information Science and Engineering /Information and Intelligent Systems
COEUS	This is just a name for a Greek God for intelligence
CRADA	Cooperative Research and Development Agreement
CRCNS	Collaborative Research in Computational Neuroscience
CSGF	Computational Science Graduate Fellowship
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAACs	Distributed Active Archive Centers
DARPA	Defense Advanced Research Projects Agency
DASS	Designing Accountable Software Systems
DHS	Department of Homeland Security
DHS S&T	Department of Homeland Security Science and Technology Directorate
DNA	Deoxyribonucleic Acid
DOD	Department of Defense
DOE	Department of Energy
DOE/NNSA	Department of Energy/National Nuclear Security Administration
DOE/SC	Department of Energy/Office of Science
DOT	Department of Transportation
DOT/FHWA	Department of Transportation/Federal Highway Administration
DSI	Decision Support Interventions
DS-I Africa	Data Science for Health Discovery and Innovation in Africa
DSTP	Data Science Training Program
EAR	Exploratory Advanced Research
ECOLE	Environment-driven Conceptual Learning
ED	Department of Education
ED/IES	Department of Education Institute of Education Sciences
ELS	Ethical, Legal, and Societal Implications of AI
ExpandAI	Expanding AI Innovation through Capacity Building and Partnerships
FAIR	Findable, Accessible, Interoperable, and Reusable
FAVES	Fair, Appropriate, Valid, Effective, and Safe
FBI	Federal Bureau of Investigation
FHWA	Federal Highway Administration
FOA	Funding Opportunity Announcement

2020–2024 Progress Report: Advancing Trustworthy Artificial Intelligence Research and Development

Acronym	Definition
FY	Fiscal Year
GARD	Guaranteeing AI Robustness Against Deception
GSA	General Services Administration
HHS AI	Department of Health and Human Services Artificial Intelligence
HHS/ASPR	Department of Health and Human Services/Administration for Strategic Preparedness and Response
HHS/ONC	Department of Health and Human Services/ Office of the National Coordinator for Health Information Technology
HPC	High-Performance Computing
HRD	Human Resources Division
HTI-1	The Health Data, Technology, and Interoperability
IARPA	Intelligence Advanced Research Projects Activity
IES	Institute for Education Sciences
IIS	Information and Intelligent Systems
INA	Immigration and Nationality Act
INTERPOL	International Criminal Police Organization
IRB	Institutional Review Board
JARVIS-DFT	Joint Automated Repository for Various Integrated Simulations, Density Functional Theory
KMA	Korean Meteorological Administration
KTH	Kungliga Tekniska Högskolan (KTH Royal Institute of Technology) Sweden
LEADS	Law Enforcement Advancing Data and Science
LLM	Large Language Model
MAPS	Multi-modal Active Perception System
MCI	Mild Cognitive Impairment
MEXT	Ministry of Education, Culture, Sports, Science, and Technology
MIDRC	Medical Imaging and Data Resource Center
ML	Machine Learning
MLAI	Machine Learning and Artificial Intelligence
MLAI-SC	Machine Learning and Artificial Intelligence Subcommittee
MOU	Memorandum of Understanding
MSB	Myndigheten för Samhällsskydd och Beredskap – Swedish Civil Contingencies Agency
N3C	National COVID Cohort Collaborative
NAII	National Artificial Intelligence Institute

Acronym	Definition
NAIIO	National AI Initiative Office
NAIRR	National Artificial Intelligence Research Resource
NASA	National Aeronautics and Space Administration
NCATS	National Center for Advancing Translational Sciences
NCAI	NOAA Center for Artificial Intelligence
NESDIS	National Environmental Satellite, Data, and Information Service
NCO	National Coordination Office
NET	new emerging technologies
NexGen	From Learning to Leading: Cultivating the Next Generation of Diverse Food and Agriculture Professionals
NEXTRAC	Novel and Exceptional Technology and Research Advisory Committee
NIH	National Institutes of Health
NIJ	National Institute of Justice
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NITRD	Networking and Information Technology Research and Development
NLP	Natural Language Processing
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NOURISH	Network Of User-Engaged Researchers building Interdisciplinary Scientific Infrastructures for healthy food
NSF	National Science Foundation
NSTC	National Science and Technology Council
NTIA	National Telecommunications and Information Administration
NWS	National Weather Services
OC	Operating Conditions
OECD	Organization for Economic Co-operation and Development
OMB	Office of Management and Budget
ONC	Office of the National Coordinator for Health Information Technology
OPM	Office of Personnel Management
OSTP	Office of Science and Technology Policy
PCA	Program Component Area

2020–2024 Progress Report: Advancing Trustworthy Artificial Intelligence Research and Development

Acronym	Definition
PATTERN	Prisoner Assessment Tool Targeting Estimated Risk and Needs
PEPI-G	Program to Empower Partnerships with Industry & Government
PES	Post Enumeration Survey
PETS	Privacy Enhancing Technologies
PIARC	Permanent International Association of Road Congresses
Proto-OKN	Prototype Open Knowledge Network
PSA	Public Safety Assessment
PSAAP	Predictive Science Academic Alliance Program
PuRe	Public Reusable
R&D	Research and Development
RAI	Responsible AI
RCN	Research Coordination Network
RFC	Request for Comment
RFI	Request for Information
RINGS	Resilient & Intelligent NextG Systems
RITEL	Research on Innovative Technologies for Enhanced Learning
RMF	Risk Management Framework
SaTC	Secure and Trustworthy Cyberspace
SBIR	Small Business Innovation Research
SchARE	Science Collaborative for Health disparities and Artificial intelligence bias REduction
SemaFor	Semantic Forensics
SMART	Science, Mathematics, and Research for Transformation
STAR	Systematic Testing of Artificial Intelligence Image Recognition
STEM	Science, Technology, Engineering, and Mathematics
STN	DHS S&T Office of Standards
STRONG	Strengthening Teamwork for Robust Operations in Novel Groups
SVIP	Silicon Valley Innovation Program
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TAI	VA’s Trustworthy Artificial Intelligence Framework
TIPS	Threat Intake Processing System
TPC	Trillion Parameter Consortium
TPS	Test Pilot School

2020–2024 Progress Report: Advancing Trustworthy Artificial Intelligence Research and Development

Acronym	Definition
TRAILS	Trustworthy AI in Law & Society
USAISI	U.S. Artificial Intelligence Safety Institute
USCG	United States Coast Guard
USDA	U.S. Department of Agriculture
USDA-NIFA	U.S. Department of Agriculture National Institute of Food and Agriculture
US-EU	United States-European Union
USGS	U.S. Geological Survey
USPTO	United States Patent and Trademark Office
VA	U.S. Department of Veterans Affairs
VISTA	Variable In-flight Simulator Test Aircraft

