ASCET
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ADVANCING STANDARDIZATION FOR
CRITICAL AND EMERGING TECHNOLOGIES

Standardization Environmental Scan: Artificial Intelligence (AI)

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Contents

The research and analysis included in this document will be updated periodically to ensure the information remains relevant and reflects the ever changing landscape of this technology.

Purpose and Methodology of the Environmental Scan

This standardization environmental scan serves as a foundational step in understanding the current state of standardization for artificial intelligence (AI) as a critical and emerging technology (CET). This scan is intended to identify existing standards, key stakeholders, strategic documents, and emerging gaps to inform future activities such as CET-specific workshops, roadmap development, and prioritization of standardization efforts. These can support ASCET's broader goal of aligning standardization with national competitiveness, economic security, and innovation priorities.

This **preliminary assessment** of AI standardization activities draws on a targeted synthesis of publicly available standards databases, government and industry strategic documents, and stakeholder inputs from government, industry, and academia. The scope was intentionally constrained to focus on standards and initiatives with significant relevance to U.S. leadership in AI, including those developed or influenced by U.S.-based organizations or international bodies with U.S. participation. Emphasis was placed on identifying areas of maturity, emerging needs, and pre-standardization research gaps to guide actionable next steps. This scan represents a point-in-time assessment and may be revisited as priorities and standards evolve.

Note: This document is best viewed in Desktop/App View; endnotes and several formatting features are not compatible with Browser View.

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Artificial intelligence (AI) refers to computer systems that perform tasks typically associated with human intelligence, like reasoning, creativity, and problem-solving.[1]

AI Exists in Multiple Forms

BASED ON FUNCTIONALITY, AI CAN BE CATEGORIZED INTO:

- **Narrow AI,** which is designed to perform simple, routine tasks within a limited domain (e.g., voice assistants or recommendation systems);
- **General AI,** which is designed to perform a wide variety of tasks including reasoning, learning, and problem solving, at a level comparable to humans;
- **Super AI,** which would theoretically surpass human intelligence in virtually all aspects.

IN TERMS OF CAPABILITY, AI CAN ALSO BE CLASSIFIED AS:

- **Reactive machines,** which respond to specific inputs with predefined outputs but do not store past experiences;
- **Limited memory AI,** which can retain and learn from historical data to improve decision making over time.

Another category, Generative AI, refers to AI systems capable of creating new content (including text, images, audio, or code) based on patterns learned from training data. Relevant models, like GPT or DALL-E, use deep learning techniques to generate outputs that resemble human-created content for applications such as creating writing, design, software development, and other applications.

SOME OF THE MAIN CAPABILITIES COMPANIES ARE USING AI FOR ARE:[2]

- Data analysis and insights
- Automation
- Improved operational efficiency
- Personalized customer experiences
- Predictive analytics
- Supply chain optimization
- Natural language processing applications (chatbots, sentiment analysis, content generation, etc.)
- Innovation acceleration

Current State of the CET Topic: Artificial Intelligence

AI is rapidly transforming a wide range of industries and becoming deeply embedded in everyday life. In sectors such as healthcare, financial services, manufacturing, media, and education, AI is enabling new capabilities—from predictive diagnostics and personalized medicine to fraud detection, supply chain optimization, and adaptive learning platforms.[3,4]

Beyond commercial applications, AI is playing an increasingly strategic role in national security. As the world becomes more digitized, AI technologies—

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particularly machine learning—are enhancing the ability of governments to gather, process, and analyze vast amounts of data for intelligence, surveillance, and threat detection.[5] AI also supports autonomous systems, cybersecurity defense, and decision-support tools for military and homeland security operations.[6]

Leadership in AI is not only a matter of economic competitiveness but also of values and governance. By leading in AI development and deployment, the United States can embed democratic principles, civil liberties, and ethical safeguards into the global AI ecosystem.[7,8] This includes shaping international standards, promoting transparency and accountability, and ensuring that AI systems are aligned with human rights and societal well-being.

Standards Overview

SOME OF THE DIFFERENT TYPES OF STANDARDS FOR AI ARE THE FOLLOWING:[9]

Foundational and terminology standards for AI: These standards define key AI concepts and terminology, supporting the development of other standards and facilitating clear communication among diverse stakeholders.

Process and management standards for AI: These standards provide repeatable guidance for managing AI systems, including best practices and risk management frameworks.

Product testing and performance requirements for AI: These standards establish benchmarks for evaluating the performance, security, and reliability of AI systems.

Measurement standards for AI: These standards specify methods for assessing the performance and functionality of AI systems.

Interface and networking standards for AI: These standards promote interoperability between AI systems and products, enhancing their integration and usability across platforms.

Determining accountability for AI-related risks and incidents is challenging due to the autonomous nature of AI systems. Additionally, the scalability and global reach of AI complicate efforts by organizations to develop effective governance frameworks.[10]

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STAKEHOLDERS

The stakeholders included in the following table were selected based on their demonstrated influence on AI development, deployment, or standardization. The table captures each organization's role in advancing AI as a CET as well as their contributions to relevant standards activities.

Stakeholder	Role in CET	Role in Standardization of CET
Alphabet/Google	Google has developed a broad range of AI capabilities,including the transformer architecture, tensor processing units (TPUs), the Gemini large language model, and the TensorFlow deep learning framework. Google DeepMind has led seminal innovations, such as AlphaFold, which contributed to a Nobel Prize inChemistry in 2024.[11]	Google has contributed to ISO/IEC JTC 1/SC 42 technical standards and developed open frameworks like TensorFlow.[12,13] It is also a founding member of the Partnership on AI (PAI), which helps shape AI governance and best practices.
Amazon	Amazon applies AI across its business, including ecommerce, logistics, Alexas, and Amazon Web Services (AWS).[14] It also develops foundational models and AI services.	Amazon contributed to the development of ISO/IEC 42001 and has released a responsible AI policy for AWS.[15] Amazon has publicly committed to supporting international AI standards.[16]
Anthropic	Anthropic is an AI research and safety company focused on building LLMs with an emphasis on safety, reliability, and interpretability.[17]	Anthropic has contributed to AI standards development, including the Model Context Protocol (MCP) and AI Safety Level Standards (ASL Standards).[18,19] It is also certified under ISO/IEC 42001:2023 for responsible AI.20
IBM	IBM offers AI infrastructure, business AI models, assistants, and consulting services.[21]	IBM has established AI ethics principles and an internal AI Ethics Board.[22] IBM co-developed the Data Provenance Standards through the Data & Trust Alliance, which are "the first crossindustry standards for metadata to help describe data origin, lineage, and suitability for purpose."[23]

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Stakeholder	Role in CET	Role in Standardization of CET
Meta	Meta has developed several AI models, including LLMs and image generation tools. It integrates AI into products like smart glasses and social media platforms.[24]	Meta is a member of the PAI and has released a Responsible AI Use Guide to help shape the standards for AI technologies.[25] Meta promotes responsible AI practices and contributes to public guidance on AI development.[26]
Microsoft	Microsoft develops AI across multiple domains, including industrial applications, AI agents, and integrations into products like Office and Azure. It also maintains a strategic partnership with OpenAI.[27]	Microsoft participates in ISO/IEC standards development and influences AI policy through its scale and reach. It has also contributed to responsible AI frameworks and governance initiatives.[28]
NVIDIA	NVIDIA produces hardware critical to AI development,including GPUs (Graphics Processing Units) and TPUs (Tensor Processing Units), and plays a foundational role in the AI ecosystem.	NVIDIA has contributed to ISO/IEC standards working groups and supports MLPerf, a benchmarking suite widely used in AI performance evaluation. Their hardware benchmarks often serve as de facto standards in the industry.[29]
OpenAI	OpenAI is a research organization and technology company that has played a highly influential role in the development of modern AI, particularly in advancing large language models (LLMs), setting benchmarks in AI capabilities, and shaping public and policy discourse around AI safety and governance.[30]	While OpenAI has not directly developed formal standards, it has contributed to AI policy discussions and supported organizations involved in technical standards and frameworks. As a market leader, OpenAI sets de facto norms for AI development and deployment practices.
Tesla	Tesla applies AI in its products, particularly in autonomous driving systems. It uses neural networks trained on massive video datasets to power its Full Self-Driving (FSD) software with the goal of mimicking human perception and decision-making.[31]	No known direct involvement in formal AI standards development.

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RELEVANT STANDARDS BODIES

This section identifies the primary standards developing organizations (SDOs)—with the exception of ANSI, which is a standards body accreditor—involved in shaping the AI standards landscape. It highlights their roles, key initiatives, and contributions to AI governance, ethics, performance, and interoperability. The section summarizes the most influential organizations with direct technical contributions— ISO/IEC JTC 1/SC 42, and IEEE SA—whose initiatives span foundational terminology, risk management, ethical design, and performance benchmarking.

A3

Role in AI Standards

- **Developer of American National Standards for robot safety used in AI-enabled automation, including ANSI/A3 R15.06-2025 (IndustrialRobots and Robot Systems —** Safety Requirements), which adopts ISO 10218 Parts 1 and 2 into the U.S. framework and adds guidance relevant to collaborative robotics and cybersecurity[32,33]
- **Developer of the Industrial Mobile Robots (IMR) safety series —** ANSI/RIA R15.08-1:2020 (design requirements) and ANSI/A3 R15.08-2:2023 (system/integration requirements)—covering autonomous mobile robots and mobile manipulators deployed in industrial environments[34,35]

Key Initiatives

- **Publication of ANSI/A3 R15.06-2025 (Parts 1 & 2) and planned Part 3 for user requirements, with major updates:** Explicit functional safety requirements, consolidated collaborative robot guidance (ISO/TS 15066), new end-effector and manual load/unload content (ISO/TR 20218-1/-2), and cybersecurity guidance in safety planning[36,37,38]
- **Expansion of IMR safety via R15.08-2:2023** (integration/site deployment risk assessment) and the IMR bundle; R15.08 clarifies safety for AMRs, AGVs, and mobile manipulators where AI-based navigation and perception are common[39,40,41]
- **Safety training and conferences** (e.g., International Robot Safety Conference, live courses on mobile robotics and collaborative robot safety) and technical reports to help industry implement the standards and conduct risk assessments aligned with ANSI and ISO frameworks[42]

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American Society of Mechanical Engineers (ASME)

Role in AI Standards

- **Cross-cutting standards for model credibility (VVUQ)** that are increasingly applied to AI/ML models—ASME's VVUQ standards and community underpin verification, validation, and uncertainty quantification frameworks for computational models used in safety-critical engineering and AI-assisted simulation[43]
- **Published VVUQ standards foundational to model assessment,** such as VVUQ 1-2022 (terminology), V&V 20-2009 (CFD/heat transfer, reaffirmed 2016), and newer VVUQ 20.1/30.1-2024, providing methods and metrics relevant to evaluating ML surrogates and AI-assisted simulations[44,45]

Key Initiatives

- **VVUQ Working/Standards Committees and Symposium:** Dedicated program tracks and committee meetings on VVUQ in Machine Learning/AI (VVUQ 70), evidencing active standards and community work to assess AI/ML model credibility (Texas A&M 2024 symposium schedules and proceedings)[46,47]
- **ASME Digital Collection:** AI/ML content and VVUQ research advancing validation metrics, uncertainty quantification, and credibility assessments for ML models (e.g., surrogate model credibility, physics-guided ML)[48,49]

ANSI

Role in AI Standards

- **U.S. member body to ISO and, via the USNC, to IEC**—coordinating U.S. technical positions and participation in international AI-related committees (e.g., ISO/IEC JTC 1) through U.S. TAGs[50]
- **Accredits SDOs and approves AI-relevant standards** as ANS, ensuring due process, openness, balance, and consensus across a multiple-path U.S. standards system[51,52]
- **Advocates and aligns with U.S. policy via the U.S. Standards Strategy** and supports implementation of the U.S. Government National Standards Strategy for Critical and Emerging Technology (CET)[53,54]

Key Initiatives

- **Support and implementation partner for the U.S. Government National Standards Strategy for CET (2023) and the Implementation Roadmap (2024)**—reinforcing private-sector-led standards development in CET areas, including AI, with increased international engagement and workforce participation[55,56,57]
- **Public events and guidance** (e.g., ANSI/CSIS "U.S. Standards Strategy for the 21st Century" discussions) to mobilize industry participation in standards for AI and data-center growth and other CETs; ANSI underscores that standards are strategic assets and promotes U.S. leadership in ISO/IEC venues[58]

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– **Information resources (e.g., ANSI blog and SDO directory) to explain ANS processes** and showcase AI-relevant safety standards (such as ANSI/A3 R15.06-2025) approved under ANSI procedures— clarifying roles of SDOs versus ANSI[59,60]

CSA Group

Role in AI Standards

– **Administrator of Canada's mirror participation to ISO/IEC JTC 1/SC 42** (Artificial Intelligence), facilitating Canadian input to international AI standards and adopting them as National Standards of Canada[61]

– **Publisher/adopter of AI management and guidance standards** as National Standards of Canada (e.g., CSA ISO/IEC 42001:2025 AI management systems; CSA ISO/IEC 5339:2024 guidance for AI applications)[62,63]

Key Initiatives

– **CSA ISO/IEC 42001:2025 (National Standard of Canada):** Supports organizations in establishing, implementing, maintaining, and continually improving an AI management system to govern risks and opportunities for AI products/services[64]

– **Public review and development of sectoral AI guidance,** such as "AI readiness assessment for manufacturers" (Designation T700, draft standard) covering governance, compliance, infrastructure, data, and skills for manufacturing AI adoption[65]

– **Forthcoming national adoption effort for ISO/IEC TS 8200** (Controllability of automated AI systems), indicating active work on human oversight/control principles for AI systems (Notice of Intent)[66]

IEEE SA

Role in AI Standards

– **Global thought leader in ethical and human-centric AI standards:**[67] Globally recognized for shaping discourse on the societal, ethical, and technical implications of AI and autonomous systems

– **Collaborator with global SDOs:** Works with ISO/IEC, ITU, and NIST to align ethical AI standards with broader technical frameworks[68]

Key Initiatives

– **IEEE Global Initiative [2.0] on Ethics of Autonomous and Intelligent Systems:**[69] Promotes the ethical development and governance of autonomous and intelligent systems (AIS) including AI by advancing principles of human rights, transparency, accountability, and well-being

Ethically Aligned Design: Output of IEEE's Global Initiative that outlines ethical imperatives and practical guidance for technologists, policymakers, and organizations developing AI systems[70]

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- **IEEE 7000 series standards:**[71] Guides developers in making products and services compatible with the ethical values of the communities where they are used/implemented; provides a framework for addressing ethical concerns during the design and development of systems incorporating AI

  Key 7000 series standards include:
  - Transparency of autonomous systems[72]
  - Data privacy processes for AI systems[73]
  - Mitigating algorithmic bias[74]
  - Well-being metrics in ethical AI design[75]

- **Certification program for assessing AI ethics concerns:**[76] IEEE's CertifAIEd Program is a conformity assessment program for helping organizations demonstrate trustworthy AI practices; allows for evaluation of AI systems against ethical and technical benchmarks

- **IEEE GET program (Guidance, Education, and Tools):**[77,78] Initiative that provides free global access to several IEEE standards focused on AI ethics and governance; aims to promote trustworthy, human-centric AI by supporting developers, organizations, and regulators in aligning with ethical design principles and emerging regulatory frameworks

ISO/IEC (JTC 1/SC 42)

Role in AI Standards

- **Primary international committee for AI standardization:**[79] Serves as the first and most influential committee coordinating the global development of AI standards

- **Balanced global stakeholder representation:** Represents more than 60 countries with stakeholders including AI developers, users, regulators, and civil society members to ensure standards are inclusive and globally relevant[80]

- **Cross-sector AI integration through joint working groups (JWGs):**[81] Drives collaboration with other ISO/IEC committees to ensure AI standards are aligned with domain-specific needs in areas like health, safety, language processing, and conformity assessment, which supports system-wide consistency, interoperability, and responsible AI deployment across sectors.

Key Initiatives

- **Introduced the first AI management system standard:**[82] Established the world's first AI management standard in 2023—ISO/IEC 42001—through a management systems approach to AI governance; enables organizations to certify their AI practices, build public trust, and support responsible, ethical, and scalable AI adoption across diverse sectors

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- **Foundational AI Standards:** Introduced several foundational AI standards, including:
  - Core AI concepts and terminology[83]
  - Framework for ML-based AI systems[84]
  - Guidance on AI risk management[85]
- **Core standards for AI trustworthiness and ethics:** Introduced core standards for trustworthiness and ethical guidance in AI:
  - Trustworthiness in AI[86]
  - Ethical and societal concerns[87]
  - Guidance for bias in AI systems[88]

UL Standards & Engagement (ULSE)

Role in AI Standards

- **Developer of safety standards for autonomous, AI-enabled products,** notably UL 4600 (Standard for Safety for the Evaluation of Autonomous Products)—an ANSI-approved consensus standard[89,90]
- **ULSE's portfolio positions UL as a conformity assessment anchor** for autonomy safety (e.g., travel safety context and application of UL 4600 across autonomous vehicles and other products)[91]

Key Initiatives

- **UL 4600 Edition 3 updates for autonomous trucking:** Refined safety-case framework, post-incident behavior requirements, and use-case guidance responding to industry trends[92]
- **AI safety certification services (operationalized by UL Solutions, referencing ULSE criteria):** Launch of AI safety certification guided by UL 3115 (Outline of Investigation for Safety of AI-Based Products; published Oct 31, 2025) to evaluate robustness, reliability, transparency, accountability, privacy, fairness, safety, and security of AI-enabled products[93,94]

In addition to the organizations highlighted above, other standards developers such as ASTM International, the Consumer Technology Association (CTA), SAE International, and IETF are actively engaged in AI-related standardization, particularly in areas like safety, interoperability, and data governance.

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EXISTING STANDARDS

As of June 2025, there are 494 standards related to AI globally: 333 are AI-specific standards, and 161 are AI-enabling standards.[95]

Topics covered by these standards include bias, performance, interoperability, privacy, risk management, and system architecture, among others. Data is closely related to AI, resulting in topics like data management, data processing, and data quality being covered. Different machine learning and AI applications are covered by these standards as well, including computer vision and natural language processing. ISO has developed the most standards individually at 200, but ISO and IEC have developed 115 standards together. Individually, IEC has developed 139 and IEEE has developed 103.[96]

The standards highlighted in this section were selected based on their foundational role in AI governance, system architecture, and risk management. They reflect broad international consensus, are frequently cited in strategic frameworks (e.g., NIST AI RMF, ISO/IEC 42001), and are widely referenced by stakeholders across sectors.[97] These standards serve as key building blocks for responsible and interoperable AI development.

Standard Category/Prominent Standard		Focus Area	Description
Foundational Technical Standards: – Terminology, definitions – Reference architectures – Conceptual frameworks – System descriptions	ISO/IEC 5392:2024	Foundational Concepts	Defined reference architecture of knowledge engineering in AI and following AI technical standards
	ISO/IEC 22989:2022	Foundational Concepts	Established terminology and descriptions for AI and related concepts
	ISO/IEC 23053:2022	System Architecture	Established a framework for describing AI systems using ML technology

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Standard Category/Prominent Standard		Focus Area	Description
Governance and Risk Management: – Bias mitigation – Trustworthiness – Risk frameworks – Oversight and accountability – Lifecycle quality and safety	IEEE 7000 Series	Governance & Ethics	Introduced a suite of standards guiding the ethical design and development of AIsystems, covering areas such as transparency (IEEE 7001), data privacy (IEEE 7002), algorithmic bias (IEEE 7003), and well-being metrics (IEEE 7010), to align AI technologies with societal values.
	ISO/IEC TR 24027:2021	Governance & Ethics	Provided guidance on identifying and mitigating bias in AI systems
	ISO/IEC TR 24028:2020	Governance & Ethics	Outlined key aspects of AI trustworthiness like reliability and transparency while taking into consideration system design and deployment
	ISO/IEC TR 24029- 1:2021	System Performance	Introduced methods and metrics to evaluate the robustness of neural networks against adversarial inputs and operational uncertainties
	ISO/IEC TR 24030:2021	Application Domain	Presented a collection of AI use cases across industries to facilitate the development of best practices and standards
	ISO/IEC TR 24372:2021	System Architecture	Surveyed major computational approaches in AI (symbolic, connectionists, hybrid systems, etc.) and their associated implications for system design
	ISO/IEC 38507:2022	Governance & Ethics	Provided guidance for governing bodies to enact responsible oversight of AI adoption and risk management
	ISO/IEC 23894:2022	Governance & Ethics	Established principles and a framework to manage risks in AI systems through safety, reliability, and lifecycle risk controls
	ISO/IEC 25059:2023	System Performance	Defined quality models and requirements for AI systems throughout full lifecycle
	ISO/IEC 42001: 2023	Governance & Ethics	Established the first AI management system standard, providing a structured framework for organizations to govern AI systems responsibly, ensure compliance with ethical and legal requirements, and support certification of trustworthy AI practices.

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RELEVANT ROADMAPS AND STRATEGY DOCUMENTS

This section summarizes key national and international roadmaps, strategic plans, and policy frameworks that influence AI standardization. These documents articulate long-term priorities, identify gaps, and guide coordinated action across government, industry, and academia. Four major strategy documents are included here, each offering insights into responsible AI adoption, risk management, and global engagement.

Document: Artificial Intelligence Index Report 2025[98]

AI Index Steering Committee, Institute for Human-Centered AI, Stanford University, 2025

Focus

Tracks global trends in AI development, deployment, and impact across technical performance, responsible AI, economic integration, education, and governance—offering data-driven insights to inform policy, research, and industry decisions

Gaps

- **Limited adoption of standardized benchmarks** for Responsible AI (RAI) benchmarks precludes the ability to achieve consensus on evaluating safety, fairness, or transparency across models; standardized evaluation suites are important for ensuring reliable AI evaluation and preventing misleading conclusions about model performance
- **Persistent implicit bias in LLMs:** Models trained to be explicitly unbiased continue to exhibit racial and gender bias in subtle ways
- **Shrinking data commons:** Increasing restrictions on web data scraping are reducing the availability of diverse training data
- **Prominent benchmarks are reaching saturation:** More rigorous and comprehensive evaluations are needed to ensure improvement in frontier models
- **Model training is environmentally intensive:** Training large models consumes massive energy and emits significant amounts of carbon
- **Few organizations are taking steps to mitigate key risks of RAI,** which include risks to accuracy, regulatory compliance, and cybersecurity

Recommendations

- **Develop more robust benchmarks for factuality and truthfulness,** similar in nature to newer, more comprehensive evaluation tools such as FACTS and SimpleQA
- **Expand transparency in foundational models:** Despite increasing transparency levels tracked through the Foundation Model Transparency Index, improvement is needed by major developers to boost average transparency scores

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- **Invest in AI education and teacher training:** While most teachers agree that using AI and learning about AI should be included in a foundational computer science learning experience, fewer than half of high school teachers have the appropriate tools and training to effectively teach AI
- **Expand access to high-quality, labeled training data:** The report calls for larger, more diverse, and privacy-preserving datasets to improve AI model performance—especially in clinical settings (i.e., healthcare)

Document: Data, Analytics, and Artificial Intelligence Adoption Strategy: Accelerating Decision Advantage

U.S Department of Defense, 2023

Focus

Agile, scalable AI adoption across the U.S Department of Defense (DoD); discusses how adoption will enable "decision advantage" which would allow DoD leaders "to prioritize investments to strengthen deterrence; link cross-cutting campaign outcomes that counter our competitors' coercive measures; and deploy continuous advancements in technological capabilities to creatively address complex national security challenges in this decisive decade."

Gaps

Interoperability, data quality, governance; data infrastructure gaps; need for responsible AI practices

Recommendations

- **Invest in federated infrastructure** to support scaling data, analytics, and AI adoption, and improve interoperability
- **Remove policy barriers** to ensure responsible behavior, processes, and outcomes while accelerating the pace of adoption for data, analytics, and AI technologies across the Department
- **Improve foundational data management** by increasing quality and availability of relevant DoD data
- **Enhance/generate business analytics and warfighting capabilities** for improved decision advantage outcomes
- **Strengthen partnerships** (intergovernmental, academic, industry, international) to enable data, analytic, and AI technology adoption
- **Increase workforce capacity** through hiring, training, and retention for critical AI work roles

Introduces AI Hierarchy of Needs

- Quality data
- Insightful analytics and metrics
- Responsible AI

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Document: Driving U.S. Innovation in Artificial Intelligence: A Roadmap for Artificial Intelligence Policy in the United States Senate[99]

The Bipartisan Senate AI Workshop Group,2024

Focus

Outlines legislative priorities for AI, focusing on responsible innovation, preparing an AI-ready workforce, national security, and protecting individual privacy and civil rights;

Priorities referenced include

- Testing
- Transparency
- Explainability
- Privacy
- Interoperability
- AI testing and evaluation infrastructure

Gaps

- **Bias mitigation:** AI systems trained on biased data can produce discriminatory outcomes
- **Workforce impacts:** Preventing disruptive workforce displacement requires upskilling, retraining, and immigration reform to support the AI workforce
- **National security:** AI poses both strategic opportunities and risk related to adversarial threats, export controls, and uncertainties associated with general purpose AI systems achieving artificial general intelligence (AGI)
- **Liability and accountability:** Unclear legal frameworks make it difficult to assign responsibility for AI-caused harm
- **Transparency and explainability:** Opaque “black box” systems challenge oversight and user trust
- **Civil rights and disparate impact:** AI may disproportionately affect different populations

Recommendations

- **Funding the National AI Research Resource (NAIRR) Pilot** to ensure all 50 states can participate in the AI research ecosystem
- **Establishing a federal data privacy law/framework** to protect personal information
- **Developing capabilities-based AI risk framework** to encourage testing, red-teaming, and evaluation standards tied to AI system capabilities
- **Supporting workforce training and immigration reform:** Encourage immigration of high-skilled STEM talent
- **Funding AI testing infrastructure and the U.S. AI Safety Institute at NIST:** Invest in AI testing and evaluation infrastructure

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- **Advancing AI use in healthcare with guardrails:** Support innovation while ensuring transparency, safety, and equitable access
- **Developing export control and classification frameworks for powerful AI systems:** Prevent adversaries from acquiring powerful AI capabilities

Document: A Plan for Global Engagement on AI Standards100

National Institute of Standards and Technology (NIST), April 2025

Focus

- Outlines the federal government's approach to international engagement on AI standards
- Positions NIST as the lead federal coordinator for AI standards and discusses the importance of multilateral cooperation and consensus-based standards
- Offers guidance based on the principles of NIST AI Risk Management Framework (AI RMF) (i.e., "to better manage risks to individuals, organizations, and society associated withAI")

Gaps

- **International AI standards development is fragmented:** Many countries are developing AI standards that may be driven by national or regional priorities, leading to multiple uncoordinated approaches
- **Lack of diverse global participation in standards engagement:** Many low- and middle-income countries and underrepresented stakeholders are not meaningfully included in AI standards processes
- **Slow pace of standards development:** Traditional processes may not keep up with the rapid evolution of AI technologies and applications
- **Limited awareness and capacity among stakeholders:** Many organizations lack the knowledge, resources, or incentives to engage the development or adoption of AI standards
- **Disconnect between standards and real-world implementation:** Feedback loops between standards developers and adopters are weak or nonexistent, reducing relevance and usability

Recommendations

- **Promote multistakeholder and international collaboration:** Broaden participation in AI standards development to include diverse global voices and perspectives
- **Invest in pre-standardization research:** Support foundational work to accelerate readiness for standardization in priority AI areas
- **Develop implementation tools and guidance:** Create datasets, benchmarks, and conformity assessments to support AI standards adoption

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- **Align sectoral and horizontal standards:** Encourage interoperability and reduce duplication by harmonizing crosssector and domain-specific standards
- **Leverage diplomatic and technical partnerships:** Integrate AI standards into bilateral and multilateral engagements to build global consensus and trust

Gaps and Emerging Needs

This section identifies areas where AI standards are lacking, insufficient, or fragmented. It captures both technical and policy-related gaps, including issues such as bias mitigation, explainability, benchmarking, and sector-specific needs. Gaps were identified through analysis of government reports, roadmaps for AI technologies and standards, academic research, and stakeholder inputs.

AREAS LACKING STANDARDS

Benchmarking practices for AI are fragmented: Standardized benchmarking is essential for reliably evaluating and comparing AI models. Research done by BetterBench found that some benchmarks are poorly constructed, lack reproducibility, and suffer from issues related to statistical rigor and real-world relevance.[101]

Inadequate standards for addressing bias in AI systems: Despite AI development taking potential bias in account, AI models still exhibit some biases that are prevalent in society, such as racial and gender biases. Comprehensive and enforceable standards are lacking and adoption is inconsistent; however, NIST has published guidance outlining practical steps for "identifying, understanding, measuring, managing, and reducing bias" in AI systems.[102]

Insufficient standards for data provenance: Transparent and accountable development of AI systems requires traceable data regarding its origin, quality, and transformation.[103] Comprehensive standards for data lineage across the AI lifecycle remain underdeveloped. In 2024, NIST published a guidance document[104] that begins to address synthetic content and provenance tracking.[105]

Lack of formalized standards for synthetic content detection and provenance: The prevalence of generative AI creates an urgent need for standards that enable detection, labeling, and provenance tracking of synthetic content. While not yet formalized, early proposals for taxonomies, watermarking, and metadata tagging are outlined in NIST's Zero Drafts Pilot Project.[106]

Lack of standardized approaches for explainability and interpretability: There are no widely adopted standards that define what constitutes a sufficiently interpretable model.[107] NIST's existing framework on explainable AI principles[108] provides guidance but does not offer enforceable or domain-specific standards.

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Lack of standardized RAI benchmarks for LLMs: There are no widely accepted frameworks for evaluating LLMs against RAI principles like safety, transparency, and fairness. Emerging benchmarking efforts like HELM Safety and AIR-Bench 2024 are beginning to address this gap.[109]

Need for human-AI interaction and trust calibration standards: There is a need for standards that guide human-AI interaction (e.g., how humans interact with, interpret, and respond to AI outputs) as AI systems are increasingly used in decision-support roles.[110] This includes trust calibration (i.e., ensuring users neither over-rely on nor dismiss AI recommendations), standardized approaches to user interface design, and human-in-the- loop oversight. IEEE's Ethically Aligned Design framework (focused on ethical and human-centric design principles for autonomous and intelligent systems) begins to explore this area.[111]

Need for standards for AI system documentation, transparency artifacts: The increasing complexity of AI systems brings a growing need for standardized documentation practices (including model cards, data sheets, and system cards) that describe how models were trained, validated, and intended to be used. NIST's Zero Drafts Pilot Project offers initial guidance, but formal standards are still in development.[112]

No standards for environmental impact and sustainability of AI: There are no established standards for measuring or mitigating the environmental impacts associated with training and deploying large AI models, which require substantial computational resources and energy.[113] Despite the lack of standards, there are several tools available for estimating the carbon emissions of AI workloads.[114]

No standards for synthetic data generation and use: Synthetic data is increasingly used to augment training datasets and protect privacy, but there are no widely accepted standards for its generation and evaluation. NIST has acknowledged this gap in its publication on synthetic content and provenance data tracking.[115]

Sector-specific gaps: AI can be applied to a wide range of domains and industries. Consequently, specific sectors where AI is applied may require standards for those specific applications. However, sector-specific standards often lag behind the development of more general-purpose AI standards.

- **Healthcare-specific gaps in AI standards:** The NIH has identified several healthcare-specific gaps in how AI is applied in healthcare. These include "low adoption of DICOM[116] standards for imaging, a lack of a shared common data model for ophthalmic electronic health record (EHR) data, and lack of standards for interfaces and algorithmic outputs."[117]

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GENERAL/CROSS-CUTTING CHALLENGES

Breadth of AI applications: AI is a uniquely multi-faceted technology that can be applied across nearly every industry. Furthermore, the diversity of applications—such as computer vision, natural language processing, and audiovisual generation—makes it difficult to determine what should be regulated and standardized. For example, standards for computer vision may not apply to speech recognition.[118]

European Regulatory Influence on AI Decision-Making: European AI regulations have had a significant impact on how organizations approach responsible AI. According to a McKinsey survey of organizations using AI, most report being more influenced by European regulations than by American ones. For example, 66% and 41% of organizations cite the EU General Data Protection Regulation (GDPR) and EU AI Act, respectively, as influencing their AI decision-making. In contrast, only 21% and 19% cite the OECD AI Principles (developed in part by the United States) and the U.S. Presidential Executive Order on AI.[119] European standards organizations such as the European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC) have recommended that international standards bodies like ISO align their standards with recent European AI legislation, such as the EU AI Act.[120] Despite the United States' strengths in AI—such as R&D investment and talent—the lack of regulation limits its global influence.

Gaps Between AI Risks and Mitigation: According to a McKinsey survey of organizations in 2024, organizations recognize that AI presents risks in many areas, but there is a significant gap between awareness and action. For example, 66% of organizations see risks related to AI in cybersecurity, but only 53% have actively addressed these risks. New standardization efforts could provide a more consistent framework for mitigating AI risks.[121] The main obstacles cited include knowledge and training gaps, budgetary and resource constraints, regulatory uncertainty, and technical limitations.

Self-regulatory approach of tech industry: AI development is largely led by tech companies that have been prominent for many years, such as Microsoft and Meta, or by organizations composed of individuals with long-standing experience in the tech sector, such as OpenAI and Anthropic. The tech industry has thrived by exploiting regulatory gaps and slow-moving government oversight, as seen with social media platforms. Some in the tech industry advocate self-regulation, but critics argue this approach prioritizes profit over ethics and could lead to privacy violations, increased market concentration, manipulation of users, and other harms.[122]

Speed of AI progression: Since the release of ChatGPT-3 in late 2020, investment in and advancement of AI technologies have accelerated rapidly. Standards

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organizations may struggle to keep pace with this rapid evolution, especially as benchmarks shift and new applications emerge.

Undercounting of AI incidents: AI incidents are generally tracked through publicly available media reports. As a result, many incidents caused by AI are not reported, leading to significant underreporting. Without comprehensive reporting, it becomes more difficult to identify specific areas where AI is causing harm and, consequently, to determine which standards need to be developed to mitigate those risks. Examples of AI incidents include misidentification by facial recognition technology and deep-fake intimate images.[123] The most commonly cited AI-related incidents, according to an Accenture survey conducted in 2024, include adversarial attacks, privacy violations, unintended decision-making, model bias, and performance failures.

GAPS REQUIRING PRE-STANDARDIZATION R&D

Conformity assessment with other standards: Conformity assessments have not yet been established because existing practices are still evolving and lack clear definitions to support consistent evaluation. As a result, further maturation of standards is necessary before reliable conformity assessments can be developed.[124]

Energy consumption of AI models: Standardized methods and metrics for measuring the energy usage of AI systems remain a gap in current standardization efforts. Prestandardization R&D is needed due to a general lack of foundational understanding of relevant metrics, methodologies, and influencing factors.[125] AI's growing computational demands are increasing model-level energy consumption and driving a surge in data center electricity use. Global data center power requirements are projected to rise by 165% by 2030 due in large part to AI workloads; this is placing strain on grid infrastructure and forcing major upgrades to accommodate hyperscale facilities. Some of these facilities consume as much electricity as 80,000 homes annually.[126,127,128]

Human-AI configuration: Establishing effective interaction between AI systems and humans, organizations, or businesses depends on metrics related to performance, bias, and trust. Once defined, these metrics can support the development of standards for training, testing, and evaluating human-AI collaboration.[129]

Interpretability and explainability: Understanding how AI systems generate outputs remains a significant challenge. Foundational research is still required to advance the field of AI interpretability before formal standards can be developed. Consensus techniques for interpretability must be established along with clearer definitions of when and how interpretability is useful.[130]

Measurement of AI hardware performance and resource use: AI systems rely on specialized hardware such as neural processing units and tensor processing units.

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However, ongoing experimentation with novel architectures and technologies has outpaced standardization. Until great consensus is reached, it will be difficult to develop standards that enable consistent comparisons of performance and resource use across hardware platforms. Future standards may need to include procedures, metrics, and benchmarks tailored to emerging hardware.[131]

Testing and evaluation datasets: The absence of consensus on appropriate datasets hinders the development of standardized testing and evaluation protocols. Moreover, there is no agreement on how AI systems should be tested or evaluated. Datasets used for these purposes are often subject to other standards, such as those governing data integrity and data formats.[132]

Ongoing and Emerging Standardization Efforts

This section highlights current initiatives and working groups that are actively developing or piloting AI standards, and includes efforts by standards bodies, industry consortia, and public private partnerships that are shaping the future of AI governance, safety, and interoperability. The section also includes pre-standardization activities and draft standards that signal emerging areas of focus.

ACTIVE WORKING GROUPS

ASME AI/ML Technical Committee (TC): Hosted within ASME's Computers and Information in Engineering (CIE) Division, this committee explores the integration of AI and ML into engineering systems, with a focus on design, simulation, and lifecycle data management. The committee is actively contributing to the identification of standardization needs for AI/ML applications in mechanical engineering, including potential frameworks for model validation, data interoperability, and ethical deployment.

ASME VVUQ 70 Computational Modeling AI and ML:[133,134] Operating under ASME's Verification, Validation, and Uncertainty Quantification (VVUQ) Standards Committee, this group is developing guidance for applying VVUQ principles to AI ML-enabled computational models. Its work supports emerging standards that assess the credibility and risk of AI-driven simulations in safety-critical domains such as medical devices and nuclear systems.

ATARC AI Working Group:[135] The ATARC AI Working Group comprises industry, academic, and government leaders and focuses on advancing the responsible and effective use of AI in the U.S. federal government. It consists of Project Teams that address key AI topics including ethics and responsible AI, autonomous systems, conversational AI, standard data, Internet of Things (IoT), robotic process automation, predictive analytics, and value proposition.

IEEE Standards Association: IEEE's committee on AI works with standards that enable governance and practice of AI and focuses on compatibility and performance within specific sectors. As of mid-2024, the group had completed three AI-related standards while having 21 drafted.[136]

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– **IEEE Computational Intelligence Society | TC on AI:**[137] The TC on AI focuses on advancing computational intelligence technologies, including neural networks, fuzzy systems, and evolutionary computation. It contributes to the development and application of AI through technical activities such as working groups, task forces, and conference sessions that support emerging standards and best practices.

International Organization for Standardization / International Electrotechnical Commission: Subcommittee 42 of the Joint Technical Committee 1 (JTC 1 / SC 42) leads standardization efforts in AI within ISO and IEC. Their work is coordinated and chaired by ANSI. The Subcommittee developed and updated 20 AI-related standards between 2022 and 2023.[138]

International Telecommunication Union (ITU): ITU primarily conducts prestandardization activities in AI using focus groups, such as baseline research for needs and options for future standards. As of mid-2024, the union had three active groups working in AI: AI for digital agriculture, AI for national disaster management, and AI for health. Two completed AI-related groups are environmental efficiency for AI and AI for autonomous and assisted driving, which both completed in 2022.[139]

Linux Foundation's OpenSSF AI/ML Security Working Group:[140,141] The AI/ML Security Working Group develops best practices and draft standards for securing AI/ML pipelines in the open-source ecosystem, including security risks, model signing, and supply chain integrity.

NIST Interagency Committee on Standards Policy (ICSP) – AI Standards Coordination Working Group (AISCWG):[142] The AISCWG, chaired by NIST, promotes effective and consistent federal policies leveraging AI standards, coordinates government and private-sector positions on international AI standards activities, and fosters agency use of AI to inform standards development.

Open Worldwide Application Security Project (OWASP): OWASP is a nonprofit foundation that supports open-source projects and global communities focused on improving software and application security. Through its AI-focused working groups, OWASP is actively contributing to the development of AI security standards by engaging practitioners, researchers, and regulators in collaborative efforts to shape global policy and technical guidance.[143]

RAI Institute:[144] The RAI Institute is a global nonprofit organization founded in 2016 that partners with policymakers, industry leaders, and technology providers to develop RAI benchmarks, governance frameworks, and best practices. They provide independent conformity assessments, expert-led training, and implementation toolkits to "help organizations strengthen AI governance, enhance transparency, and scale innovation responsibly."

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ACTIVE STANDARDS INITIATIVES

Anthropic's AI Safety Levels (ASL) and Responsible Scaling Policy (RSP):[145] RSP is Anthropic's comprehensive risk governance framework for managing the development and deployment of increasingly capable AI systems. Within the RSP, ASL serve as a tiered classification system (modeled after the U.S. government's biosafety level [BSL] standards) that defines escalating safety, security, and operational requirements based on a "model's potential for catastrophic risk, with higher ASL levels requiring increasingly strict demonstrations of safety."

IEEE 7000 series standards:[146] IEEE's 7000 Series Standards are a suite of standards that address ethical design, transparency, privacy, and bias in AI systems.

IEEE CertifAIEd Program:[147] IEEE's CertifAIEd Program is a conformity assessment program for helping organizations demonstrate trustworthy AI practices. It allows for evaluation of AI systems against ethical and technical benchmarks.

IEEE GET program (Guidance, Education, and Tools):[148,149] An initiative that provides free global access to IEEE standards focused on AI ethics and governance. It supports developers, organizations, and regulators in aligning with ethical design principles and emerging regulatory frameworks.

IEEE Global Initiative 2.0 on Ethics of Autonomous and Intelligent Systems:[150] A multi-stakeholder initiative advancing ethical design and governance of AI and autonomous systems. It supports workstreams on generative AI, safety-by-design, and proactive governance; currently forming a community of "AI Safety Champions" to guide responsible AI development.

NIST AI Standards "Zero Drafts" Pilot Project:[151] NIST's Zero Drafts pilot project is a pre-standardization initiative that develops preliminary, stakeholder-informed "zero drafts" for submission to SDOs, laying the groundwork for formal standardization.

OWASP AI Exchange Project:[152] OWASP's flagship initiative, the AI Exchange Project, brings together security professionals to contribute directly to international AI security standards. They have formal liaison partnerships with CEN/CENELEC153 and have contributed more than 70 pages of expert content to ISO/IEC 27090 (i.e., the "global standard on AI security guidance") and 40 pages of content to the EU AI Act security standard.

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OWASP Gen AI Security Project:[154,155] OWASP's Gen AI Security Project contributes to emerging AI security benchmarks and regulatory frameworks, and develops open-source tools, threat models, and best practices to secure generative and agentic AI systems.

- **OWASP Agentic Security Initiative (ASI):**[156,157] Under the Gen AI Security Project, OWASP launched the Agentic Security Initiative to address the unique risks of autonomous AI agents and lay the foundation for collaborative research aimed at developing actionable guidance and best practices to secure the evolving architectures and use cases of agentic LLM and generative AI applications.

OWASP Large Language Model Security Verification Standard (LLMSVS) Project:[158,159] LLMSVS is an open security standard for systems using LLMs that offers guidance for secure design, developing, and testing robust LLM-backed applications. It supports audits, penetration testing, and the establishment of security benchmarks for LLM-based applications.

RAISE Pathways Program (RAI Institute): The Responsible AI Institute's RAISE Pathways Program is a structured, milestone-based initiative that helps organizations operationalize responsible AI. It aligns with over 1,100 curated AI controls and 17 global standards, including NIST (via AI RMF), ISO (via ISO/IEC 42001), OWASP, and the EU AI Act.[160] The program offers verification badges, governance tools, and a peer network to support AI maturity across machine learning, generative AI, and agentic AI systems.

DRAFT STANDARDS

This section highlights draft standards currently under development by leading SDOs such as ISO and IEEE. These draft standards reflect emerging priorities in AI governance, system architecture, explainability, and sustainability, and indicate where formal standardization is likely to evolve in the near future. The AI Standards Hub provides a searchable database of AI-related standards including drafts.[161]

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SDOs	Draft Standard	Focus Area	Standard Title
IEEE	P3119	Governance & Ethics	Standard for the Procurement of Artificial Intelligence and Automated Decision Systems
IEEE	P3187	System Architecture	Guide for Framework for Trustworthy Federated Machine Learning
IEEE	P3123	Foundational Concepts	Standard for Artificial Intelligence and Machine Learning (AI/ML) Terminology and Data Formats
IEEE	P7005	Governance & Ethics	Standard for Transparent Employer Data Governance
IEEE	P7011	Governance & Ethics	Standard for the Process of Identifying and Rating the Trustworthiness of News Sources
ISO	ISO/DIS 13482	Application Domain	Robotics — Safety requirements for service robots
ISO	ISO/DIS 19178-1 ISO 19178-1 Geographic Information	Data & Inputs	Training data markup language for artificial intelligence. Part 1. Conceptual model
ISOIEC	ISO/IEC CD 29794-5.3	Application Domain	Information technology — Biometric sample quality — Part 5: Face image data
ISO/IEC	ISO/IEC AWI 42007[162]	Governance & Ethics	Information technology — Artificial intelligence — High-level framework and guidance for the development of conformity assessment schemes for AI systems
ISO/IEC	ISO/IEC DIS 12792 ISO/IEC NP 12792	Governance & Ethics	Information technology — Artificial intelligence Transparency taxonomy of AI systems
ISO/IEC	ISO/IEC CD TS 6254	Governance & Ethics	Information technology — Artificial intelligence — Objectives and approaches for explainability of ML models and AI systems
ISO/IEC	PD ISO/IEC/TR 20226 PD ISO/IEC/TR 20226	Sustainability	Information technology — Artificial intelligence — Environmental sustainability aspects of AI systems
ISO/IEC, BSI	ISO/IEC DIS 42005 BS EN ISO/IEC 42005	Governance & Ethics	Information technology — Artificial intelligence — AI system impact assessment
ISO/IEC, BSI. CEN	ISO/IEC 42006 BS EN ISO/IEC 42006	Governance & Ethics	Information technology — Artificial intelligence — Requirements for bodies providing audit and certification of artificial intelligence management systems

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NATIONAL AND INTERNATIONAL STRATEGIES

This section provides an overview of national and international strategies that guide AI development and standardization. These strategies comprise high-level policy frameworks that articulate goals, principles, and priorities for AI governance, and often serve as the foundation for technical standards. They also influence the direction of standards development by shaping regulatory expectations, funding priorities, and stakeholder engagement.

American AI initiative: Launched in 2019, the American AI Initiative is a national strategy aimed at maintaining U.S. leadership in AI. It directed resources toward AI research and development, federal data access and modeling, the creation of an AI Center of Excellence, and workforce development programs.[163]

CHIPs and Science Act: The CHIPs and Science Act allocated $9 billion to NIST, including funding for AI standards development. The Act calls for technical standards and guidelines that "promote safe and trustworthy artificial intelligence systems," including improvements in accuracy, explainability, privacy, reliability, robustness, safety, security, and mitigation of harmful bias.[164]

Global Partnership on AI: A global initiative created by Canada and France, the Global Partnership on AI (GPAI) bridges the gap between theory and practice in AI. While it does not directly develop AI governance or standards, GPAI produces analyses on the impacts and future risks of AI that may influence the direction of standards-setting.[165] The group includes over 25 member countries, including the United States.

IEEE Global Initiative 2.0 on Ethics of Autonomous and Intelligent Systems: The IEEE Global Initiative 2.0 seeks to guide the ethical design, development, and governance of AI and autonomous technologies.[166] It emphasizes scientific integrity, safety-by-design, and international collaboration to address the societal impacts of technologies such as generative AI, LLMs, and autonomous systems.

NIST AI Risk Management Framework: NIST developed the AI Risk Management Framework to improve the management of risks associated with AI through a collaborative process that included public comments and multiple workshops.[167] The framework provides a foundation for the development and adoption of technical standards.

OECD AI Principles: The Organisation for Economic Co-operation and Development (OECD) developed a set of AI principles to promote the innovative use of AI while balancing trustworthiness, human rights, and democratic values. Originally established in 2019 and updated in 2024, these principles help countries shape AI-related policies or serve as the foundation of standards developed by SDOs.[168]

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2025 U.S. Executive Order: Removing Barriers to American Leadership in Artificial Intelligence: This executive order revoked existing AI policies to enable greater private sector innovation. It underscores the importance of U.S. dominance in AI to ensure economic competitiveness and national security.[169]

U.S. Government National Standards Strategy for Critical and Emerging Technology Implementation Roadmap:[170] Developed in 2024, this roadmap outlines the federal government's strategy for strengthening U.S. leadership in standards development for CETs, including AI. It emphasizes the importance of pre-standardization research and stakeholder engagement and discusses the role of frameworks like NIST's AI Risk Management Framework in addressing the socio-technical aspects[171] of AI development. The roadmap calls for increased investment, inclusive participation, and strategic coordination to ensure AI standards reflect U.S. values and support innovation, security, and global competitiveness.

United Nations Secretary-General's High-level Advisory Body on AI: Launched in 2023, this multistakeholder body published its final report, Governing AI for Humanity, in 2024.[172,173] The report outlines a blueprint for globally inclusive AI governance. It emphasizes international cooperation, human rights, and agile governance mechanisms to keep pace with AI's rapid evolution, and includes seven recommendations[174] to address gaps in current frameworks.

INDUSTRY CONSORTIA OR PUBLIC-PRIVATE PARTNERSHIPS

AI Applied Consortium: The AI Applied Consortium brings together academic institutions, technology organizations, and industry leaders to collaboratively shape the future of AI research and application. Activities include joint research projects, training programs, and AI Ideation Labs. Partners include Penn State, Netflix, and Amgen.[175]

Chief Digital and Artificial Intelligence Office (CDAO) AI Partnerships: The CDAO, a division within the DoD, forms partnerships to accelerate the adoption of data, analytics, and AI across all levels of defense to enhanced deterrence and reduce bureaucratic barriers.[176] CDAO has partnered with several leading AI organizations, including OpenAI, to develop frontier AI defense applications.[177]

- **AI Partnership for Defense (PfD):** The CDAO also leads the AI PfD, a multilateral initiative involving 16 allied nations focused on advancing responsible AI practices and standards in the context of international military cooperation.[178,179]

Empire AI Consortium: Launched in 2024 by New York Governor Kathy Hochul, Empire AI is a partnership of New York universities working to establish a state-of-the-art computing center at SUNY University of Buffalo. It is the first consortium of public and private research institutions focused on "advancing AI research for the public good at this scale."[180] Empire AI comprises multiple New York universities including NYU, Cornell, and Columbia.[181]

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Institute for Experiential AI at Northeastern University: This institute focuses on advancing responsible, human-centric AI through applied research, education, and cross-sector collaboration.[182] The Institute partners with industry, government, and academia to address high-impact challenges in areas such as health, life sciences, climate and sustainability, responsible AI, and generative AI.

MITRE's AI Assurance & Discovery Lab:[183] MITRE operates this public-private partnership to identify, evaluate, and mitigate critical risks in AI-enabled systems across sectors such as defense, healthcare, and transportation. The lab supports the development of safe, effective, and trustworthy AI technologies through independent testing, AI red-teaming, LLM model evaluation, human-in-the-loop experimentation, and assurance plan development for government and private-sector organizations.

New Mexico AI Consortium: Organizations across New Mexico have joined together to form a consortium to strengthen the ability to harness AI for solving science and security problems. With a wide range of expertise and resources, the consortium is positioned to develop advanced AI capabilities. Members include Los Alamos National Laboratory, Sandia National Laboratories, and New Mexico State University.[184]

NSF-funded National Applied AI Consortium (NAAIC): Using an NSF grant, Miami Dade College is partnering with Houston Community College and Maricopa County Community College District to establish a consortium for AI education in community and technical colleges. The consortium will help scale access and improve the quality of AI education and workforce development at the community college level. Objectives include promoting an AI business and industry leadership team model as a best practice, integrating ethical AI into courses and credentials, and developing faculty capacity to teach AI.[185]

Partnership on AI (PAI): PAI is a global nonprofit coalition of more than 125 partners from industry, academia, and civil society that develops best practices for AI governance, fairness, transparency, accountability, and safety.[186] PAI has published guidance on the creation and sharing of synthetic media[187] (i.e., AI-generated or modified audio/visual content), responsible publication of AI research,[188] and documentation of ML systems.[189]

The Stargate Project: Launched in 2025, Stargate is a $500 billion public-private partnership focused on building AI infrastructure across the United States. This includes hyperscale data centers, compute clusters, and AI-ready cloud platforms.[190,191] Stargate is led by OpenAI in partnership with Oracle and NVIDIA. Its goal is to secure long-term U.S. dominance in AI by enabling sovereign compute capacity, reducing reliance on foreign supply chains, and supporting AI innovation across sectors.

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U.S. Artificial Intelligence Safety Institute Consortium (AISIC): Led by NIST, AISIC brings together over 280 organizations from industry, academia, and civil society to develop science-based guidelines, benchmarks, and standards for AI safety. Focus areas include red-teaming, content authentication tools, criteria for AI workforce skills, and other safety-related domains.[192]

U.S. FEDERAL AGENCY ROLES

This section outlines the roles and contributions of key U.S. federal agencies in advancing AI standardization. It highlights how agencies such as NIST, NSF, DoD, DOE, NASA, and OSTP are supporting AI through technical leadership, policy development, research funding, and interagency coordination. These efforts help shape national and international standards, promote responsible AI adoption, and align AI innovation with U.S. strategic priorities.

National Aeronautics and Space Administration (NASA)

Key Role
AI for autonomous systems, robotics, and space exploration

Contributions
Maintains an AI Use Case Inventory, which documents active and emerging AI applications including but not limited to autonomous navigation for Mars rovers, mission planning tools, environmental monitoring systems, air traffic control optimization, and space exploration[193,194]

Implements the NASA Framework for the Ethical Use of Artificial Intelligence, which outlines six principles— fairness, explainability, accountability, safety, human-centricity, and scientific robustness—to guide the responsible development and deployment of AI across its missions

National Institute of Standards and Technology (NIST)

Key Role
Lead technical agency for AI standards coordination and development[195]

Contributions
Facilitates interagency collaboration and aligns federal priorities:
- **Leads the AI Standards Coordination Working Group (AISCWG)** to promote effective and consistent federal policies related to AI standards[196]

Chairs the Interagency Committee on Standards Policy (ICSP) to facilitate federal agency coordination on AI standards development and use through its AISCWG[197]

Leads the U.S. Artificial Intelligence Safety Institute Consortium (AISIC) which convenes more than 280 organizations focused on AI safety standards, red-teaming, and workforce criteria[198]

Publishes foundational documents on explainable AI (AI Risk Management Framework;[199] NISTIR 8312[200])

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Published the AI RMF Roadmap companion roadmap to the AI Risk Management Framework, which identifies priority activities, gaps, and collaborative opportunities to advance trustworthy and responsible AI standards development

Leads the Zero Drafts pilot project—a consensus-based, stakeholder-informed approach for drafting voluntary consensus standards[201]

Coordinates global engagement through "NIST AI 100-5: A Plan for Global Engagement on AI Standards," which adopts principles from its AI RMF and the United States Government National Standards Strategy for Critical and Emerging Technology[202,203]

Contributes to global AI governance efforts through international forums and technical collaborations to shape interoperable standards and promote alignment on ethical and risk-based AI frameworks[204]

Publishes guidance on bias in AI systems including identifying, understanding, measuring, managing, and reducing bias[205]

Issues technical guidance on synthetic content and data provenance through NIST AI 100-4, which includes approaches to digital content transparency and provenance data tracking[206]

Develops evaluation methods and benchmarks for generative AI though the NIST GenAI Initiative[207]

National Science Foundation (NSF)

Key Role
Infrastructure and research funding for AI innovation and education

Contributions
Leads the national pilot program, the National AI Research Resource (NAIRR) Pilot, which brings together federal agencies to contribute computational, data, and training resources for AI research[208]

Funds foundational and applied AI research; several projects are focused on trustworthy and responsible AI

- **An estimated 10-15% of annual AI funding supports trustworthy AI research areas** including interpretability, robustness, privacy-preservation, and fairness[209]

Funds AI workforce development efforts:
- **EducateAI:** Accepts proposals for curriculum development, teacher training, educational pathways for K-12 and higher education, and cross-organization partnership efforts[210]
- **National AI Research Institutes:**[211] Cutting-edge AI research, education, and workforce development through: **Training programs** for students/professionals; **Curriculum development** for AI literacy and specialization; **Community**

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engagement to broaden participation; **Partnerships** with academia, industry, and government to ensure real-world impact

- **AI-ready test beds initiative (NSF 24-111):** Provides planning grants for scalable AI-ready test beds for designing, testing, and evaluating AI systems[212,213]
- **Technology, Innovation and Partnerships (TIP) Directorate:**[214] Provides funding for AI education and workforce development initiatives, including the ExLENT Program (Experiential Learning for Emerging and Novel Technologies), which provides up to $1M over 3 years to support hands-on learning in AI, mentorships, and cohort-based training[215]

Office of Science and Technology Policy (OSTP)

Key Role
Federal AI policy leadership

Contributions
Leads development of the AI Action Plan: A national strategy intended to guide AI policy, standards, and innovation[216,217]

Advises the President on AI-related executive orders including: *The 2025 Executive Order on Removing Barriers* to American Leadership in AI[218]

The "Golden Standard Science" initiative, which encourages agencies to use AI to improve research reproducibility, detect bias in peer reviews, quantify uncertainty, and standardize transparent data reporting practices[219,220]

U.S. Department of Defense (DoD)

Key Role
Operational and applied AI development with a focus on national security

Contributions
Participates in the NAIRR pilot led by NSF

Designated the Chief Digital and Artificial Intelligence Office (CDAO), which is responsible for accelerating the adoption of data, analytics, and AI within the DoD[221]

- **Published the RAI Strategy & Implementation Pathway** (RAI S&I Pathway) as a framework for leading the promotion of AI standards and norms[222]
- **Contributes the RAI Toolkit,** a key deliverable of the RAI S&I Pathway and outcome of its participation in NSF's NAIRR pilot program, providing AI technology developers with a way to assess the potential risks and ethical considerations of AI projects throughout their product lifecycles[223,224,225]

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U.S. Department of Energy (DOE)

Key Role
High-performance computing and AI for scientific discovery and energy systems

Contributions
Supports AI research through the national labs:[226,227]

- **Develops foundational AI models** for applications including grid optimization, climate forecasting, biological research, high precision measurement devices, and materials discovery
- **Leads the Frontiers in AI for Science, Security, and Technology (FASST) initiative,** which seeks to advance foundational AI capabilities for national security, energy, and scientific discovery[228]
- **Maintains an Annual AI Use Case Inventory** across its 17 national labs and program offices, which reports on human rights- and safety-impacting use cases[229]

Publishes and updates AI governance policies aligned with the Office of Management and Budget (OMB) Memorandum M-24-10, including the DOE Generative AI (GenAI) Reference Guide and the AI and Risk Management Playbook (AI RMP), which incorporates NIST's AI RMF[230]

Convenes the DOE AI Advancement Council (AIAC) which coordinates AI strategy, governance, and partnerships across DOE, and oversees working groups on cybersecurity, rights impacting AI, and AI use case inventories[231]

Opportunities/ Recommendations

This section identifies actionable opportunities for advancing AI standardization, drawn from the findings of this environmental scan. The recommendations are based on observed gaps, emerging needs, and stakeholder priorities identified throughout the report, including input from key government documents, industry roadmaps and strategic initiatives, and academic research. These opportunities are intended to inform future planning, guide strategic engagement, and support ASTM's role in shaping responsible and effective standards for AI technologies.

Adopt an agile approach to AI standards development: Due to the rapidly progressing nature of AI, conventional standardization methods may be too slow. ASCET could advocate for and implement agile standardization practices. Agile development is already used by many AI companies, and applying similar methods to standards development would help SDOs keep pace. Agile approaches may be particularly well-suited for pre-standardization R&D.[232]

Develop techniques for AI interpretability aligned with standards: Techniques to explain the decision-making process of AI systems are not yet well established. ASCET is well-positioned to contribute to the development of interpretability techniques that align with existing and emerging AI standards. If these techniques

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are designed to reflect responsible AI values and standards, they could set a precedent for how AI systems are evaluated and judged.

Encourage agile, testbed-driven standards development: ASCET could promote agile, testbed-based approaches to pre-standardization research and evaluation to allow for iterative testing and refinement of standards in real-world conditions.[233]

Establish sector-specific standardization priorities: AI has a wide breadth of applications, including several different sectors. ASCET can assess which sectors most urgently need tailored standards, based on factors such as risk exposure, current AI adoption, and feasibility of standardization. ASCET is also well-positioned to engage industry experts to identify and prioritize sector-specific standardization needs.[234]

Expand access to high-quality, labeled training data: ASCET could support initiatives to improve access to representative datasets in sectors like healthcare, as better data would enhance model performance and reduce bias.[235]

Expand training for AI red-teaming and risk evaluation: Red teaming refers to cybersecurity professionals acting as adversaries against systems to evaluate security and test vulnerabilities.[236] There is currently a shortage of trained professionals in this area.[237] ASCET could expand training programs for red teaming and other AI risk evaluation methods. Training non-specialists—such as journalists, researchers, and ethical hackers—could provide a third-party testing alternative for AI startups.[238] A group of AI researchers has also recommended standardized reporting of AI flaws and incentives for sharing this information, which would improve testing methods and inform future regulations.

Knowledge management and training for AI risk mitigation: Knowledge and training gaps are cited as the primary reason organizations do not implement responsible AI measures according to a McKinsey survey.[239] ASCET is well-positioned to provide knowledge management and training focused on AI-related risks and standards. Doing so would significantly help organizations implement protective measures. By leading in this area, ASCET could influence which standards are most widely adopted.

Support development of factuality and trustworthiness benchmarks: AI systems continue to generate inaccurate or misleading outputs. ASCET could support the development and adoption of standardized benchmarks to evaluate factual accuracy and truthfulness, which would improve model transparency and help define minimum performance thresholds for responsible AI.[240]

Endnotes and References

This section contains all document endnotes and is primarily included for organizational wayfinding in the digital document.

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174 **Recommendation 1** An international scientific panel on AI: Establish an independent, multidisciplinary panel of experts to provide impartial, science-based assessments of AI capabilities, risks, and opportunities, including annual reports, thematic digests, and ad hoc analyses to inform global governance.

Recommendation 2 Policy dialogue on AI governance: Launch a twice-yearly, inclusive intergovernmental and multi-stakeholder forum under the UN to share best practices, discuss AI incidents, and promote interoperable governance approaches grounded in human rights.

Recommendation 3 AI standards exchange: Create a global clearinghouse for AI standards that brings togethers SDOs, companies, civil society, and researchers to harmonize definitions, evaluate existing standards, and identify gaps in AI measurement and evaluation.

Recommendation 4 Capacity development network: Build a UN-aJiliated global network of AI capacitycenters to provide training, access to computational resources, and data resources to researchers, public officials, and entrepreneurs, especially in underserved regions.

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Recommendation 5 Global fund for AI: Establish an independently governed fund to support equitable access to AI enablers—such as compute, data, and training—through financial and in-kind contributions from public and private sources, with a focus on Sustainable Development Goals (SDG)-aligned applications.

Recommendation 6 Global AI data framework: Develop a global framework to define principles, standards, and mechanisms for AI training data governance, including data trusts, marketplaces, and model agreements to promote interoperability, rights protection, and inclusive AI ecosystems.

Recommendation 7 AI oPice within the Secretariat: Create a small, agile AI oJice reporting to the Secretary-General to coordinate and support implementation of the UN report's seven recommendations,serve as a central hub for UN system-wide AI engagement, and advise on emerging AI issues.

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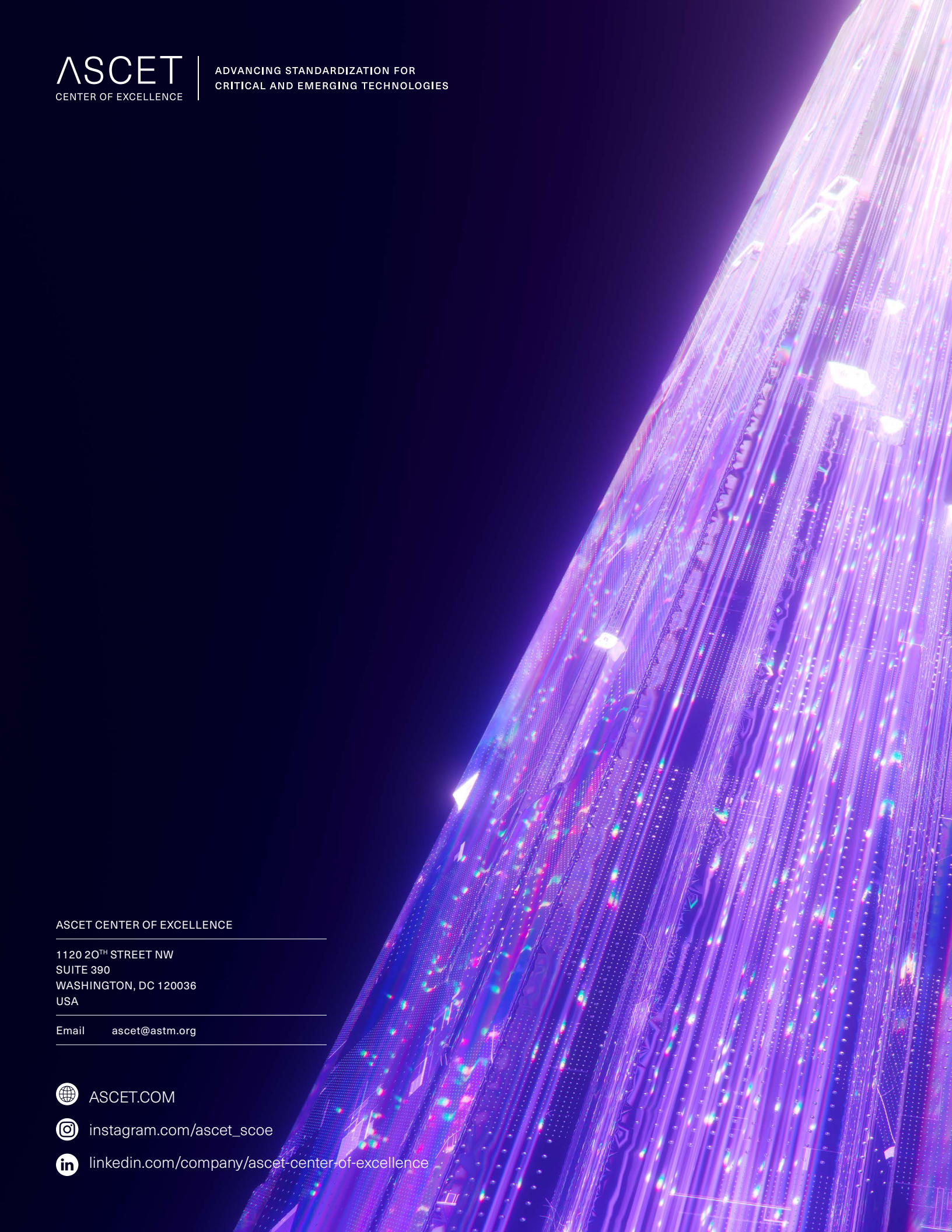

ASCET CENTER OF EXCELLENCE

1120 20TH STREET NW
SUITE 390
WASHINGTON, DC 120036
USA

Email ascet@astm.org

ASCET.COM

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