



UNITED STATES GOVERNMENT NATIONAL STANDARDS STRATEGY FOR CRITICAL AND EMERGING TECHNOLOGY

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Executive Summary

Strength in standards development has been instrumental to the United States' global technological leadership. Standards development underpins economic prosperity across the country and fortifies U.S. leadership in the industries of the future at the same time. Bolstering U.S. engagement in standards for critical and emerging technology (CET) spaces will strengthen U.S. economic and national security. The U.S. Government has long engaged in these standards development processes through an approach built on transparency, private sector and public sector leadership, and stakeholder engagement—a process that reflects the United States' commitment to free and fair market competition in which the best technologies come to market. Government support for scientific research and development (R&D), an open investment climate, and the rule of law have also been critical for U.S. standards leadership. America's workers, economy, and society have benefited significantly as a result, as have those of like-minded nations alongside which the United States has collaborated to forge technological progress.

Today, however, the United States faces challenges to its longstanding standards leadership, and to the core principles of international standard-setting that, together with like-minded partners, we have upheld for decades. Strategic competitors are actively seeking to influence international standards development, particularly for CET, to advance their military-industrial policies and autocratic objectives, including blocking the free flow of information and slowing innovation in other countries, by tilting what should be a neutral playing field to their own advantage.

The United States must renew our commitment to the rules-based and private sector-led approach to standards development, and complement the innovative power of the private sector with strategic government and economic policies, public engagements, and investments in CET. By supporting our unrivaled innovation ecosystem and related international standards development as part of a modern industrial strategy, we can ensure that CET are developed and deployed in ways that benefit not only the United States but all who seek to promote and advance technological progress. Strengthening the U.S. approach to standards development will lead to standards that are technologically sound, earn people's trust, reflect our values, and help U.S. industry compete on a level playing field.

This strategy outlines how the U.S. Government will strengthen U.S. leadership and competitiveness in international standards development, and ensure that the “rules of the road” for CET standards embrace transparency, openness, impartiality and consensus, effectiveness and relevance, coherence, and broad participation.



What Standards Are and Why They Matter

From computers and smartphones to cars and lightbulbs, societies rely on technology standards for everyday life. In the broadest sense, standards are the common and repeated use of rules, conditions, guidelines, or characteristics for products or related processes, practices, and production methods.¹ They enable technology that is safe, universal, and interoperable. Standards define the requirements that make it possible for mobile phones sold in different countries to communicate across the world, for bank cards issued in one country to be recognized at ATMs in another, and for cars to run on fuel purchased from any gas station. Standards also help manage risk, security, safety, privacy, and quality in the development of new innovations. In short, good standards are good for business, good for consumers, and good for society.

Standards Developing Organizations (SDOs) consist of experts from industry, academia, civil society groups, and government, all of whom share a common goal of ensuring safety, interoperability, and competition in a particular technology or technology application. In well-functioning SDOs, ideas are selected not on the basis of the nationality, employer, or personality originating them, but instead on the basis of technical merit. Six principles govern the international standards development process: transparency, openness, impartiality and consensus, effectiveness and relevance, coherence, and a commitment to participation by low- and middle-income countries.

The private sector has led U.S. engagement with SDOs for more than 100 years. An example of how this system works comes from the communications industry. Qualcomm Technologies provided the proposal in the 1990s that became the basis for all 3G standards, while NTT Docomo, a large mobile phone operator in Japan, provided the proposal that later became LTE, the predominant standard for wireless broadband communication for mobile devices and data terminals.

This private sector leadership has come with significant assistance from government and academia. In 1901, the Congress established the National Bureau of Standards—which has since become the National Institute of Standards and Technology (NIST)—as the authoritative domestic measurement science research and standards laboratory. Not long after, five engineering societies and three Federal agencies banded together to establish a national non-governmental body now known as the American National Standards Institute (ANSI). ANSI is a private, nonprofit organization that administers and coordinates the U.S. standardization system and is the sole U.S. representative to the International Organization for Standardization (ISO) and the International Electrotechnical Commission. Industry, consortia, and private-sector groups often complement the roles of NIST, ANSI, and ANSI-accredited SDOs, working together to develop standards to solve specific challenges. To date, this approach, supported by U.S. leadership, has fostered an effective and innovative system that has supercharged U.S. and global economic growth.

In an era of rapid technological transformation and global scale, standards will continue to define and drive the markets of the future. Standards for CET—advanced technologies that are

¹ https://www.whitehouse.gov/wp-content/uploads/2020/07/revised_circular_a-119_as_of_1_22.pdf



significant for U.S. competitiveness and national security - carry strategic significance.² The United States will work with all nations committed to an open and transparent standards system to lead the way in these new arenas - just as we did with previous internet, wireless communications, and other digital standards. Failing to do so will risk the United States'—and the world's—innovation, security, and prosperity.

² <https://www.whitehouse.gov/wp-content/uploads/2022/02/02-2022-Critical-and-Emerging-Technologies-List-Update.pdf>



Standards for Critical and Emerging Technology

The United States will prioritize efforts for standards development for a subset of CET that are essential for U.S. competitiveness and national security, including the following areas:

- **Communication and Networking Technologies**, which are enabling dramatic changes in how consumers, businesses, and governments interact, and which will form the basis of tomorrow's critical communications networks;
- **Semiconductors and Microelectronics, including Computing, Memory, and Storage Technologies**, which affect every corner of the global economy, society, and government, and which power a panoply of innovations and capabilities;
- **Artificial Intelligence and Machine Learning**, which promise transformative technologies and scientific breakthroughs across industries, but which must be developed in a trustworthy and risk-managed manner;
- **Biotechnologies**, which will affect the health, agricultural, and industrial sectors of all nations, and which will need to be used safely and securely to support the health of our citizens, animals, and environment;
- **Positioning, Navigation, and Timing Services**, which are a largely invisible utility for technology and infrastructure, including the electrical power grid, communications infrastructure and mobile devices, all modes of transportation, precision agriculture, weather forecasting, and emergency response;
- **Digital Identity Infrastructure and Distributed Ledger Technologies**, which increasingly affect a range of key economic sectors;
- **Clean Energy Generation and Storage**, which are critical to the generation, storage, distribution, and climate-friendly and efficient utilization of energy, and to the security of the technologies that support energy-producing plants; and
- **Quantum Information Technologies**, which leverage quantum mechanics for the storage, transmission, manipulation, computing, or measurement of information, with major national security and economic implications.

There are also specific applications of CET that departments and agencies have determined will impact our global economy and national security. The United States will focus standards development activities and outreach on these applications, which include:

- **Automated and Connected Infrastructure**, such as smart communities, Internet of Things, and other novel applications;
- **Biobanking**, which involves the collection, storage, and use of biological samples;
- **Automated, Connected, and Electrified Transportation**, including automated and connected surface vehicles of many types and unmanned aircraft systems, many of which may be electric vehicles (EVs), along with the safe and efficient integration into smart



communities and the transportation system as a whole, including standards to integrate EVs with the electrical grid and charging infrastructure;

- **Critical Minerals Supply Chains**, where we will promote standards that support increased sustainable extraction of critical minerals necessary to manufacture renewable energy technologies, semiconductors, and EVs;
- **Cybersecurity and Privacy**, which are cross-cutting issues that are critical to enabling the development and deployment of emerging technologies and promote the free flow of data and ideas with trust; and
- **Carbon Capture, Removal, Utilization and Storage**, which can build on evolving standards for CO₂ storage, and emerging standards for point source carbon capture, removal, and utilization, especially as those standards relate to monitoring and verification.



The Objectives of the Critical and Emerging Technology Standards Strategy

The lifeblood of SDOs is good-faith engagement on the technical merits. As such, this strategy focuses on increasing U.S. private and public sector engagement with SDOs that will sustain and strengthen this foundational ethos. The U.S. Government and its partners in the public and private sectors will launch new efforts to do this. In so doing, we will foster U.S. and likeminded nations' competitiveness in emerging markets and work to vigorously promote our shared values and market economies based on impartial and effective standards.

The U.S. Government will pursue the following four objectives and corresponding eight lines of effort in its strategy:

Objective 1: Investment

Science, technology, research, experimentation, and innovation have been the keys to the United States' long standing as a global leader. Continued broad bipartisan support for Federal investment in cutting-edge R&D will enable the United States to achieve the greatest aspirations of this century. Standards are substantially driven by technical contributions that flow from R&D, and greater U.S. investment in pre-standardization research and analysis helps facilitate contributions to standards-setting discussions.

Context: Novel discoveries, technical insights, and refinements are at the core of many new standards, especially in CET. Historically, the U.S. Government has facilitated this vital innovation. Government R&D investments catalyzed U.S. standards leadership and shaped successful standards that include Wi-Fi, the C computer programming language, and the suite of technologies comprising cellular communications.

Action: The U.S. Government will bolster its support for R&D in CET and further increase investment in pre-standardization research. Innovation, cutting-edge science, and translational research will remain the drivers of U.S. influence and leadership in international standards development. To this end, the Biden-Harris Fiscal Year (FY) 2024 budget funds CHIPS and Science Act discretionary investments at over 80 percent of the FY24 authorized levels.

- **Line of Effort #1: Increase R&D funding to ensure a strong foundation for future standards development.** The Administration will work with the Congress to increase funding for R&D through appropriations as requested in the Biden-Harris Administration FY24 budget. This budget features spending levels for basic and applied research that top \$100 billion. Total Federal R&D is \$210 billion, an increase of nearly \$9 billion over the FY23 level and an historic amount. As part of these efforts, we will accelerate fundamental research to drive technical contributions to international standards, fostering the translation of these research results and measurement science into globally accepted specifications and features. In addition, we will explicitly recognize as within scope SDO participation by Federal R&D grantees and funding recipients, when appropriate. For example, the National Science Foundation is currently updating its proposal and award policies and procedures to include participation in standards development activities.



- **Line of Effort #2: Support the development of standards that address risk, security, and resilience.** The U.S. Government is uniquely suited to lead standards development on topics of national security. For example, it has developed standards that support priority access for public safety and emergency services during disasters and wide-scale emergency events. U.S. Government support—including through our national labs—for standards like these will enable future innovation and development to be done in as secure and resilient a manner as possible. We will continue to support the development of standards that consider the impacts and effects of risk (comprised of threats, vulnerabilities, and consequences) and account for security concerns.

Objective 2: Participation

U.S. organizations confront difficult choices on where to focus resources in a more diversified standards landscape, at times resulting in little to no U.S. participation in potentially disruptive technological fields.

Context: Private-sector and academic innovation fuels effective standards development. New standards often start with a proposal that contains technical specifications or performance metrics that relate to companies' own products. In other cases, companies put forward proposals containing their proprietary technologies for use in products made by other firms. Where standards include patented technologies, licensing revenues allow industry to recoup R&D expenditures and re-invest in future innovations. Despite competition among technology contributors, industry collaborates in standards development because it is good for business: Widely adopted standards facilitate access and growth in new markets.

However, in some commercially competitive areas, U.S. companies may choose not to participate in standards development for a variety of reasons. For example, technology may still be under development and standardization is therefore premature. Firms also may have concerns about protecting intellectual property and proprietary information. This is particularly true for critical and emerging technologies. In other cases, a company may opt to focus limited resources on nearer-term priorities, given the sustained and often long-term investment needed for standards development. Still other firms may be new entrants to the technology market and may not be aware of opportunities to engage and influence standards development, or of the risks or opportunity costs of remaining on the sidelines. Regardless of the reason, however, reduced U.S. participation in standards development will put the United States at a strategic disadvantage.

In some cases, the need for standards begins in the public sector. This includes interoperable infrastructure like traffic signals, where there is significant public benefit, but there may be less of a business case for private sector to support sufficient voluntary engagement in standards development without some public sector assistance.

Academic and other research institutions are also critical stakeholders in international standards development. Subject matter experts and researchers make essential contributions to standards development and provide important non-vendor perspectives. Academia is also a critical partner in increasing U.S. engagement in standards and training the next generation of standards professionals. Institutions of higher education should renew a commitment to teaching and highlighting the value, development, and use of standards and standardization in a range of career fields.



Action: The U.S. Government will work closely with the private sector and academia to minimize gaps in coverage within SDOs, work collectively to address challenges to accelerate standards development in CET, bolster private-sector participation, and ensure that the government plays an active—but appropriate—role in the private sector-led system. The U.S. Government will also continue to meaningfully contribute to multilateral, treaty-based standards organizations such as the International Telecommunication Union (ITU).

- **Line of Effort #3: Remove and prevent barriers to private sector participation in standards development.** We will coordinate policy and regulations to create an environment that facilitates U.S. private sector engagement and influence in international standards. We will continue to create programs to foster U.S. stakeholders' participation in international standards development and remove barriers to involvement. For example, in 2022, the Department of Commerce revisited and revised an export control interim final rule authorizing the release of certain technology and software in the context of standards setting and development. Additionally, after receiving inputs from industry, the Department of Justice's Antitrust Division, the U.S. Patent and Trademark Office, and NIST took action to increase innovation and competitiveness in the marketplace by withdrawing their policy statement on Standards Essential Patents, which often cover breakthroughs at the core of new technologies. Taken together, these actions will strengthen the ability of U.S. companies to engage and influence international standards that are essential to our nation's technology leadership. We will also consider opportunities to promote standards meetings held in the United States in order to enable broad participation, including through reducing the wait times for visa processing for attendance at priority meetings.
- **Line of Effort #4: Improve communications between public and private sectors on standards.** We will expand communication with the private sector, including through strategic partnerships, information sharing arrangements, and other cooperative efforts between U.S. Government agencies and private sector standards stakeholders, including SDOs, industry associations, civil society, and others that participate in international standards activities. The U.S. Government will look to the private sector to inform or otherwise work with senior government leaders regarding the changing standards landscape. Together we can identify areas where the United States can propose the development of new international standards committees and prioritize areas for participation and leadership. The U.S. Government will also more clearly articulate government interest in technology areas. Finally, through public-private partnerships, we will offer roadmaps for CET, as we did with the NIST Cloud Computing Standards Roadmap and the ANSI Nanotechnology Standards Panel.
- **Line of Effort #5: Enhance U.S. Government and like-minded nations' representation and influence in international standards governance and leadership.** We will focus on expanding U.S. Government and like-minded nations' participation and leadership in standards activities where the government is the official representative, in specific technology areas where it has significant national interest as defined above, and where the government can fill representational gaps, particularly in early-stage technology and related policy development. We will elevate leadership and expand coordination across the government in support of standards activities, particularly in work with the ITU. In these efforts, we will expand science and technology diplomacy to focus



on CET standards development. We will leverage opportunities to assume leadership roles on international standards committees in CET areas. For early-stage technology development, the U.S. Government will convene experts to understand the appropriate time to promote technologically sound and impartial standards development. Furthermore, we will catalyze U.S. attendance in standards development in high priority early-stage CET areas, such as quantum information technologies, where U.S. industry is nascent but standards work is ongoing.

Objective 3: Workforce

The number of standards organizations and venues has increased significantly over the past decade, particularly with respect to CET. Meanwhile the U.S. standards workforce has not kept pace with this growth.

Context: A technically expert and standards-knowledgeable workforce, comprised of industry, academic, and government experts, is essential for success. Unfortunately, standards successes are not recognized or celebrated in the same way as traditional academic or industry achievements such as publications, patents, and awards, which makes it difficult to attract new participants. Standards work is ongoing in many fora, including formal consensus bodies, treaty organizations, and consortia. It is essential that the United States participates across the board, though too often it does not. According to data collected by NIST on a select group of standards committees in 2019, U.S. entities led participation in the Institute of Electrical and Electronics Engineers, but lagged far behind in the ITU Telecommunication Standardization Sector. The number of leadership positions, such as secretariat or editorial positions, held by the United States has also declined in certain organizations; for example, U.S.-held positions were down 10 percent in the ISO in 2021 as compared to 2016³—a trend that is beginning to reverse with the recent election of a U.S. candidate as the Secretary-General of the ITU.

Action: The U.S. Government will invest in educating and training a cadre of professionals that can effectively contribute to and drive technical standards development. We will work with the private sector to find innovative ways to educate and train those in academia and industry.

- **Line of Effort #6: Educate and empower the new standards workforce.** We will increase opportunities for engagement in standards development among additional stakeholders, such as start-ups, small- and medium-sized companies, academia, and members of civil society, through standards development information, training, and education. We will also expand efforts to develop standards-related curricula with universities and educational institutions to address technical, business, and policy aspects of standards development and focus on developing standards skillsets on CET. We will build capacity and resources for standards professionals, such as supporting a Standards Center of Excellence, to be led by non-federal entities, to engage the private sector, provide training, and assist in engagement with standards activities—particularly for small- and medium-sized companies. We will also grow the technical capacity and standards workforce within government agencies, particularly in CET areas.

³ <https://www.cisa.gov/sites/default/files/publications/Draft-NSTAC-Letter-to-the-President-on-Standards-052022-508.pdf>



Objective 4: Integrity and Inclusivity

In response to the increasing attempts of some nations to tilt the playing field to their parochial advantage, we must ensure that standards development processes are technically sound, independent, and responsive to broadly shared market and societal needs.

Context: International standards development is at an inflection point. Strategic competition, a complex global economy, and fast-moving technology trends combine to pose new challenges. In this moment of change, strategic competitors such as the People's Republic of China (PRC) seek to undermine the integrity of longstanding standards development processes, pushing top-down approaches to dominate future markets and reinforce coercive leverage. The PRC, in particular, is seen as using foreign investment and coercive economic influence to cajole or compel support for its standards proposals, and to drive standards development toward SDOs in which it is likely to wield maximum unilateral influence. Furthermore, in some sectors, the PRC, often acting through proxy companies, promotes prescriptive standards, irrespective of technical merit, designed solely to entrench market dominance. The United States, together with our allies and partners, supports broad and inclusive participation that enables global standards-setting, but participation must occur on terms that support the integrity and impartiality of the system.

Action: We will harness the support of like-minded allies and partners to promote the integrity of the international standards system and work to ensure that international standards are established on the basis of technical merit and fair-processes. We will also promote greater inclusion in the international standards system, and look to facilitate broad representation from countries across the world, in order to build inclusive growth for all.

- **Line of Effort #7: Deepen standards cooperation with allies and partners to support a robust standards governance process.** We will continue to expand coordination with partners to enhance and protect the private sector-led international standards process and seek to increase U.S. and partner leadership in SDOs. We will seek to include standards activities in bilateral and multilateral science and technology cooperation agreements. We will leverage the U.S.-EU Trade and Technology Council Strategic Standardization Information mechanism to enable information sharing on international standards development, such as sharing of best practices and lessons learned in our respective standards systems. We are joining with like-minded partners in the International Standards Cooperation Network, which will serve as a sustainable mechanism that connects government stakeholders responsible for broad standards coordination across their own government with international counterparts for inter-governmental coordination and cooperation. Trade agencies, led by the Office of the U.S. Trade Representative, will continue to promote the adoption and use of international standards, as defined in bilateral, regional, and international trade agreements on sanitary and phytosanitary and standards-related trade measures. We will also support the use of international standards through trade agreement chapter committees, technical assistance, and capacity building efforts, including by seeking funding from national, regional, and international fora to support this goal. Models of such cooperation are found in fora such as the Asia Pacific Economic Cooperation and the U.S. partnership with Association of Southeast Asian Nations. Additional vehicles to address such standards include commercial dialogues, trade missions, and other trade tools to ensure U.S. exporters can compete on even ground.



- **Line of Effort #8: Facilitate broad representation in standards development.** We will support the development of a diverse and inclusive generation of emerging economy standards professionals who can effectively participate in international standards development and promote the adoption of international standards. In partnership with the U.S. academic and private sectors, we will look to engage with influential emerging economy academic institutions or other related organizations to ensure longer-term sustainability and identify opportunities for additional training on coalition building, including through programming from the U.S. Agency for International Development. We will foster participation of small and medium enterprises, including from like-minded countries, and further advance the design and implementation of technical assistance programs to enable broad and inclusive participation in international standards organizations.



Conclusion

A proactive and sustained long-term approach is required to ensure that the United States remains a global leader in contributing to the development of fair, merit-based standards for CET. The changing international dynamics around standardization for CET require the United States to reaffirm and strengthen its private sector-led approach to standards development rather than abandon it, as many autocratic nations would like to see. Key elements to continued success in standardization include strong support for R&D in CET areas; strengthening public-private, allied, and emerging partnerships; and expanding investments in a workforce empowered to engage and lead in international standards development. These strategic investments will create new economic opportunities for U.S. industry, protect the integrity of international standards systems, and lead to CET standards that are durable and benefit communities both at home and abroad.