2023 Annual Report

Visiting Committee on Advanced Technology
of the
National Institute of Standards and Technology

U.S. Department of Commerce

April 2024

Executive Summary

During 2023, the Visiting Committee on Advanced Technology (VCAT) concluded that the ability of the National Institute of Standards and Technology (NIST) to meet its unique mission is at immediate risk from two factors:

1. The lack of adequate funding to address failing facilities that contribute to a 10% to 40% loss of productivity, as well as attrition of key scientists, and
2. NIST requiring adequate funding to meet the expansion of the agency's mission. U.S. competitiveness is bolstered by enabling NIST to support the significant technology and manufacturing developments required by the CHIPS and Science Act, the artificial intelligence Executive Order, the cybersecurity Executive Orders, and securing next generation mobile communications technologies.

The VCAT sees these factors as a threat to U.S. global competitiveness. Congress should authorize and appropriate adequate funding to enable NIST to "meet the moment" that is being demanded of it by Congress, the White House, U.S. academic institutions, civil society, and industry.

The VCAT members are deeply impressed with NIST's leaders, as they have consistently made the hard decisions to reallocate resources to address the most exigent needs. Yet, the VCAT recognizes that the limits of such flexibility have been reached, risking both core and new responsibilities. Congress should be seeking to enhance, rather than detract from, current NIST responsibilities such as:

- Core measurement sciences and measurement and reference material production that underpin almost all sectors of the U.S. economy;
- Provision of a national time standard that provides time to Wall Street to underpin all securities trading, as well as all real-time database applications;
- Significant contributions to the safety of our nation's buildings, national resilience to disasters, and the support of international collaborations with like-minded countries; and
- The central role that NIST plays in the rapid expansion and adoption of critical and emerging technologies such as artificial intelligence, semiconductor advanced manufacturing, biotechnologies, cybersecurity, cryptography, and quantum technologies.

The VCAT also acknowledges the NIST Director's prioritization and support for the safety of NIST employees. The Director and her team have addressed safety at every level of the organization, introduced essential process and procedure changes, redirected funds for essential physical plant safety improvements, and maintained executive sponsorship and attention to this issue.

NIST is a world-class, one-of-a-kind asset for the Nation and plays an essential role in the U.S. economy. If the United States is to meet its ambitious global technology leadership goals, NIST needs to have the allocation of resources necessary to meet those demands while enhancing its ability to attract and retain top talent.

Summary of VCAT Recommendations

The VCAT recommends the following:

1. **NIST's role in critical and emerging technologies (CETs)**
   - Recommendation 1a – *Future CET priorities*: As NIST plans to grow the breadth of their CET focus areas, the VCAT recommends relating NIST's mission and research strengths to develop new priority areas that have the highest level of impact, focusing on the fundamental technologies that drive the future of measurement. This will require developing an understanding of the timeline for each of identified technology and resisting the urge to work only on short-term efforts. It is also vital to note that each CET domain has differing needs and therefore is critical that NIST adapt its work to the domains in which it is engaging.
   - Recommendation 1b – *Intersection of CETs*: NIST should consider the intersection of CETs as a growth area for future research; for example, AI and cybersecurity, or biosecurity and AI. NIST should also consider exploring a more generalizable application of the AI RMF, including for the wider software environment.
   - Recommendation 1c – *Increased visibility of NIST CET efforts*: NIST is making great strides in research on their CET focus areas, but a better outreach campaign to show how NIST work is integrated in everyday lives could help NIST disseminate its work and recruit new talent. NIST should consider building a storytelling infrastructure – specifically for AI – through working with YouTubers who focus on science education or, at a higher technical level (for example, VCAT members) a "mini brochure" of what NIST does. NIST's informational websites about CHIPS, AI, and others would benefit from reorganization to make the information more publicly accessible. The VCAT notes that recent retirements of NIST communications staff have made this more difficult.

2. **Strengthening U.S. manufacturing leadership**
   - Recommendation 2a – *Visibility*: With increasing efforts from CHIPS, it is vital that the public is made aware of all CHIPS efforts and NIST's role in the program implementation. The CHIPS website should provide regular updates, be easily accessible, and the information published should be shared widely.
   - Recommendation 2b – *Interagency collaboration*: Interagency collaboration is recommended to keep CHIPS/NIST efforts aligned with other entities to avoid duplication, like the Department of Defense's Microelectronics Commons.

3. **Ensuring U.S. leadership in international standards**
   - Recommendation 3a – *Visibility*: With a multitude of standards-related activities, the VCAT suggests increasing the visibility of NIST's work as part of the U.S. Government National Standards Strategy for Critical and Emerging Technology (USG NSSCET) on standards.gov. Specifically, NIST should increase communication about ways to engage on the strategy implementation to communities of interest.
   - Recommendation 3b – *Establishing pre-standardization materials*: NIST should include pre-standardization contributions as an additional objective outcome from its foundational sciences and public-private partnerships in CETs.

4. **NIST Budget**
   - Recommendation 4a – *Construction of NIST Facilities Funding*: The VCAT has tracked and noted the status of NIST facilities and infrastructure over the last several years. It is clear that the condition of NIST facilities is hampering productivity and poses a risk to the safety of staff. The conditions are also an active disincentive for leading scientists to work at NIST. Therefore, the committee greatly recommends a continual push for increased funding to support the construction of NIST research facilities. Insufficient funding will continue to put the safety of staff at risk, limit NIST's ability to deliver on its mission, and negatively affect retention and recruitment of talent.
   - Recommendation 4b – *Sufficient funding for Congressional demands*: Over the last few years, NIST has been in the forefront of multiple Congressional demands. Although NIST is generally equipped to tackle these deliverables technically, NIST needs to ensure sufficient funding to both support the completion of these deliverables and also to sustain lasting priorities and focus areas.
   - Recommendation 4c – *Special hiring authorities to help with private sector competition*: As NIST is tasked with fulfilling the aims of the CHIPS and Science Act and the extensive goals within the AI Executive Order, NIST would benefit from additional flexible hiring authorities, including special pay authorities, to better compete with the private sector for top talent.

5. **Expanding and strengthening NIST's safety culture**
   - Recommendation 5a - *Increase in-person safety training*: With the shifting needs of staff, plus flexible work schedules, the majority of NIST's safety training has been converted to a virtual format. However, for some, virtual training platforms can be less effective. NIST should consider increasing the number of trainings that are available as in-person trainings to gain hands-on safety instruction.
   - Recommendation 5b - *Increase onsite responders across all campuses*: During an emergency situation, it's vital to have a quick response time across all campuses. NIST should consider increasing the number of trained responders onsite to respond to situations immediately, so there is a quick response and intervention before local responders arrive.
   - Recommendation 5c - *The VCAT reiterates the need for NIST to address its maintenance backlog*: For NIST to excel in meeting its mission, it must be fully resourced to address its failing infrastructure, be competitive when recruiting and retaining talent, and execute mission projects fully and safely.

6. **Recruiting and retaining a diverse and talented workforce**
   - Recommendation 6a – *Ensure accessibility principles are applied to NIST-required software*: The VCAT emphasizes the need for NIST-required software to follow accessibility principles.
   - Recommendation 6b – *Increase communication of metrics in the first phase of the DEIA Strategic Plan*: In addition to efforts to sincerely listen to staff needs towards solidifying the NIST culture, an increased visibility of progress metrics would allow staff to see results.
   - Recommendation 6c – *Increase outside awareness of NIST DEIA efforts, including through CHIPS efforts*: The VCAT can help to relay the efforts in DEIA, internally and externally, to others across the U.S., but would need additional insights into the efforts to have the awareness to do so.

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Introduction

In 2023, the VCAT focused their efforts and discussions on the following priority themes to ensure NIST is fully supporting America's competitiveness in the global economy and adequately equipped to carry out their mission:

1. NIST's role in critical and emerging technologies (CETs)
2. Strengthening U.S. manufacturing leadership
3. Ensuring U.S. leadership in international standards
4. NIST Budget
5. Expanding and strengthening NIST's safety culture
6. Recruiting and retaining a diverse and talented workforce

In addition to these main themes, the circular relationship between safety, recruitment and retention of staff, and the ability for NIST to carry out its mission with the current status of their facilities continued to surface and will be a major focus point of this report. Despite this major challenge, which the National Academies of Science, Engineering, and Medicine (NASEM) suggest in their 2023 assessment of NIST facilities results in a loss of efficiency of 10-40%, NIST has had tremendous movement and accomplishments in all of their programs, which was made clear during the past year's VCAT discussions and will also be highlighted in this report.

To further support priority 3, Dr. Locascio established one new VCAT subcommittee, with all other priorities being addressed through regular VCAT efforts:

U.S. International Standards Development Activity, Chaired by Mr. Jason Matusow. This subcommittee was charged to report to the VCAT and make recommendations to Dr. Locascio on the following, among other related topics:
- Barriers to U.S. participation in standards development activity, and opportunities for knowledge and resource sharing to ensure U.S. equities from the private and public sector are supported — especially in potentially disruptive, fast-moving technology areas;
- Opportunities to increase the number of professionals in CET sectors engaged in standards development activities, particularly in small- and medium-sized enterprises (SMEs); and
- Opportunities for NIST to work effectively with private-sector stakeholders to foster greater U.S. investment in pre-standardization research that is essential to standards development activities.

The VCAT received detailed programmatic briefings in all listed areas within this section. This report summarizes the VCAT's work, observations, and recommendations related to these topics along with NIST efforts. The specific topics covered in this year's VCAT meetings are highlighted in **Table 1** below:

Table 1. NIST VCAT Meetings and Topics Covered in this Report

June 13, 2023 (hybrid)	October 24, 2023 (virtual)	February 14, 2024 (virtual)
NIST Director's Update	NIST Director's Update	NIST Director's Update
Safety Update	Safety Update	Safety Update
Discussion with VCAT on Supporting the NIST Workforce Culture	Conversation with the NIST Diversity, Equity, and Inclusivity Office Director	Ethics Briefing
Reentry to Campus	CHIPS Updates	DEIA Update
Budget Overview	CHIPS and Science Act	CHIPS R&D Update
CHIPS Updates	Update for Subcommittee on US International Standards Development Activity	Report and Recommendations of Subcommittee on US International Standards Development Activity
U.S. Government National Standards Strategy for Critical and Emerging Technology (USG NSSCET)	Discussion with VCAT on CETs: Biotechnology	
Kickoff of Subcommittee on US International Standards Development Activity	Selecting New Strategic CETs for NIST	
Update of VCAT Recommendations from Subcommittees on Visibility, Manufacturing Alignment, and Workforce		
Discussion with VCAT on CETs: Artificial Intelligence		

1. NIST's Role in Critical and Emerging Technologies

Throughout the past year, the VCAT was briefed by NIST on significant contributions that the laboratories made in the advancement of critical and emerging technologies (CETs). Despite the challenges being faced, NIST continues to excel in their research programs and emerge as leaders. Currently, NIST focuses on seven CETs:

- Advanced Communications
- Artificial Intelligence
- Biotechnology
- Cybersecurity and Privacy
- Energy Technologies
- Quantum Information Science
- Semiconductors

These are important technologies for the Nation and the VCAT notes that NIST plays a unique role in America's economic competitiveness. Noteworthy examples and the future of CETs at NIST are highlighted in the sections below.

1.1. Artificial Intelligence (AI)

Following the release of the NIST AI Risk Management Framework (AI RMF) in January 2023, NIST has continued to be a global leader in several efforts to champion the design of responsible, trustworthy, and safe AI.

In the June 2023 meeting, NIST provided several updates from NIST's AI program. In May, the Institute for Trustworthy AI in Law and Society (TRAILS) was announced, co-funded by NIST and the National Science Foundation (NSF). TRAILS focuses on transforming the practice of AI from one driven primarily by technological innovation to one that is driven by ethics, human rights, and input and feedback from marginalized communities. In May, NIST's AI Resource Center (AIRC) was launched during the President's Summit for Democracy. The AIRC is a "one-stop-shop" where users can interact and engage with content, like the NIST AI RMF playbook, and find resources on responsible AI development.

NIST also provided an in-depth overview of NIST's AI program, specifically detailing NIST's foundational research efforts, NIST AI Risk Management Framework development and engagement efforts, and NIST's AI standards leadership. NIST emphasized the importance of the development of the AI RMF in an open, transparent, collaborative process with stakeholders, and noted that the AI RMF has been well-received by the community. Microsoft, Google, and other entities have been promoting its use for advancing Trustworthy and Responsible AI, and NIST has been working with colleagues across the Federal government to help them understand and use the AI RMF as part of their operations. It has been received well internationally and translated already into Arabic, Spanish, French, and Japanese. The VCAT notes that key strengths of the AI RMF are that it is voluntary, rights-preserving, non-sector-specific, and use-case agnostic, providing flexibility to organizations of all sizes and in all sectors and throughout society to implement the approaches in the Framework. The AI RMF, like other frameworks NIST has developed, is very valuable for analyzing and evaluating risks. NIST should consider how the process and approach of the AI RMF may be applied in other applications in the future.

The VCAT notes the success of the AI RMF and sees it as an excellent start to the work needed to develop international technical AI standards. The VCAT also notes that NIST has developed an AI RMF roadmap outlining next steps for NIST's research, development, and stakeholder engagement. In addition to aligning the AI RMF with international standards, a crucial gap NIST intends to address is in testing and evaluating AI systems. The VCAT emphasizes that NIST should continue to pursue work aligned with these goals, leveraging the work of the AI RMF.

The VCAT was encouraged to see NIST quickly leveraging the AI RMF to apply it to new topics in AI and to continue collaborative relationships with industry to ensure that NIST's AI work stays current. For example, the NIST-led Generative AI Public Working Group in July of 2023 was assembled to explore managing risks associated with generative AI, building on NIST's AI RMF. The VCAT encouraged NIST to continue developing processes for responding quickly to new topic areas and continuing collaborative efforts.

The VCAT also noted the productivity of the National AI Advisory Committee (NAIAC), for which NIST is the Secretariat. NAIAC had an eventful second year, through holding numerous public meetings, publishing several non-decisional documents, and realigning efforts into new focus areas. This realignment allows the working groups to explore impacts of AI on workforce, equity, society, and other areas. The VCAT notes that NAIAC's second year has shown an increase in tempo and output and applauds the NAIAC for its responsiveness in contributing to this Administration's interest and requests for timely work on AI. The VCAT also acknowledges NIST's continued international leadership, including in the Organization for

Economic Co-operation and Development and U.S.-EU Trade and Technology Council (TTC), and the VCAT recognizes that this work will help build the standards and specifications needed for the AI systems of the future to be trustworthy and responsible.

The VCAT notes that NIST has an opportunity to build critical mass to identify overlaps and explore connections between NIST's AI research and its other research programs, such as cybersecurity, biotechnology, and privacy. The VCAT also suggested the opportunity for NIST to harmonize its AI efforts across the Institute and to build on the AI RMF, such as examining computational resources, policies for platforms and services, and cross-laboratory implementation of AI models and the AI RMF. The VCAT also discussed the great potential for NIST to develop guidelines for understanding the risks of generative AI and was encouraged that NIST proposed the development of a new AI institute as part of the FY 2024 President's Budget Request.

In October 2023, NIST was named in several deliverables as part of the President's Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence. NIST was directed to develop a variety of guidelines and practices to promote consensus industry standards that help ensure the development and deployment of safe, secure, and trustworthy AI systems. The VCAT realizes this is an opportunity for NIST to continue its leadership role, strengthen connections with stakeholders, and expand NIST's AI testing and evaluation work. The VCAT also notes that NIST has already demonstrated progress toward the assignments in the Executive Order, for example, in releasing the Initial Public Draft Guidelines for Evaluating Differential Privacy Guarantee and a Request for Information seeking stakeholder feedback on NIST's assignments.

NIST has launched the U.S. AI Safety Institute (USAISI) to build the science necessary for safe development and use of trustworthy AI. NIST also launched the USAISI Consortium, including an initial cohort of over 200 member companies and organizations to ensure that the Institute's research and testing work is integrated into the broad community of AI safety around the U.S. and the world.

While the USAISI and Consortium will be valuable to help inform NIST's efforts in the short term as part of the Executive Order efforts, the VCAT foresees the greatest value of the USAISI and Consortium over the next 3-5 years as the fundamental science and state of the art for AI as it continues to progress.

1.2. Biotechnology

Biotechnology exploits complex biological processes to create products and treatments that were never attainable through chemistry alone. By leveraging the natural machinery of life, we can manufacture new cancer treatments, develop new vaccines faster than ever, and produce sustainable products to bolster our supply chain. Because of the promise of these new technologies and to prevent the U.S. from slipping behind our foreign competitors, NIST was tasked with key responsibilities through the Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy, and the National Biotechnology and Biomanufacturing Initiative (NBBI), which were recapped for the VCAT. NIST led the development of a bioeconomy lexicon to help support measurements and risk assessments of the bioeconomy, which was released in December 2022. The lexicon provides a common language and definitions with the goal of helping to enable the development of measurements and measurement methods for the bioeconomy that support uses such as economic measurement, risk assessments, and the application of machine learning and other AI tools. Additionally, NIST staff authored the DOC report titled "Biotechnology and Biomanufacturing R&D to Further Supply Chain Resilience" which

outlined the potential for biotechnology to prevent supply chain shortages and deliver products to the American public, as part of a report compilation titled "Bold Goals for U.S. Biotechnology and Biomanufacturing: Harnessing Research and Development to Further Societal Goals." The Office of Science and Technology Policy (OSTP) released the report in March 2023. In this report, NIST and other agencies discussed the need to translate research into practice for a competitive bioeconomy and using new tools in bioscience to develop a resilient supply chain for the U.S. economy.

Highlights in biotechnology work included NIST's role in biosecurity and biodefense. These areas are garnering Congressional attention, and NIST's development of platform technologies and reference materials for biothreat training will help prepare the U.S. for future biological events. NIST released a new yeast cell reference material for biothreat mitigation procedures. This yeast, which has been genetically tagged to distinguish it from wild yeasts, is a living organism that can be used as a surrogate for harmful biological agents, such as anthrax, creating a safe test material for training exercises and performance assessments of first responders. Also, NIST is developing a database of sequences of concern to standardize the protocols for identifying and preventing the production of oligonucleotide sequences that could unintentionally or intentionally cause harm to human health and public safety. With the increasing use of AI for sequence design and the speed and portability of gene synthesizers, having an agile, thorough, and reliable database and screening method to detect potentially dangerous sequences is a necessary step to protect the American public from intentional or unintentional release of a harmful biological material.

NIST's role in advancing biotechnology was discussed in a special session in October 2023 and an update in February 2024. Many efforts were presented, including the development of next-generation tools for quantitative measurements in biology, engineering biology, documentary standards for leadership in biotechnologies, and development of new reference materials to harmonize and advance biotechnology industries and research, all of which position the United States to be a global leader that sets the standards in biotechnology. NIST also emphasized leadership activities in public-private partnerships through NIST-led consortia to coordinate and develop pre-competitive strategies that advance the biotechnology landscape and do the foundational work necessary to advance the industry as a whole. Among those highlights was the NIST-FDA joint workshop on regenerative medicine, focused on gene delivery systems, genome editing, and flow cytometry, to provide a unique opportunity for intense engagement across academia, government, and industry to accelerate development and get products into the hands of the American public faster. NIST also discussed NIST's Manufacturing USA partnerships to advance R&D and prepare the biotechnology workforce to ensure we have the necessary talent to create and produce the latest technologies. Promotion of these activities will help to bring more biotechnology and biomanufacturing to the United States and position the Nation to respond to international competition. Finally, NIST announced plans for a new Center for Biomeasurement and Biomanufacturing Innovation (CBBI) at the Institute for Bioscience and Biotechnology Research (IBBR) to become a nationally recognized research center for advancing measurements, standards, and data to accelerate development and pharmaceutical biomanufacturing of biotechnology products.

In a special announcement, The NIST Director shared that four NIST scientists received the Department of Commerce's Ron Brown Excellence in Innovation Award for their work in advancing the biotechnology known as flow cytometry. Through the efforts of this team, this technique, used in medical diagnostics and therapy selection, had a 10,000-fold improvement in detecting rare circulating tumor cells, meaning earlier and better cancer diagnoses and getting people the treatments they need sooner. The VCAT applauded the work of the scientists and expressed the desire to increase the visibility of the stellar staff at NIST and

their accomplishments.

The VCAT had an in-depth discussion of NIST's efforts in biotechnology and provided helpful recommendations on future actions. It was noted that there is a need to continue to engage with industry about reference materials for standards and provide an ongoing dialogue because of the rapid progress in biotechnology. The VCAT recommended improved communications surrounding NIST reference materials to ensure that startups and industry know about the reference materials and standards. Desire to improve communication and awareness of companion materials was discussed, noting that consortia are open and welcome arenas to help develop and promote solutions. This continued engagement with industry will also prevent NIST from duplicating efforts in areas where the private sector is conducting research. NIST's focus is always to share best practices to enable technology development, but not to compete. It was also noted that there is a need for international commitment and consensus around responsible and ethical application of technologies, of which NIST should remain aware.

1.3.   Other Notable NIST Activities in Critical and Emerging Technologies

NIST has many notable achievements and activities that were featured in the VCAT meetings encompassed in this report. A few highlights include:

- *Advanced Communications:* NIST hosted the Wireless Spectrum Research and Development Workshop centered around identifying challenges associated with obtaining, disseminating, and using data about spectrum technologies. The purpose was to improve analysis and modeling to inform future spectrum research and policies. NIST also partnered with the First Responder Network Authority to host the Public Safety Innovation Summit in San Diego, bringing together public safety, academic, government and industry leaders to discuss the current state of public safety communications technology and drive forward advancements. NIST also is collaborating with the National Telecommunications and Information Agency to identify areas of collaboration to execute the actions identified in the National Spectrum Strategy. NIST will build on the 2023 Wireless Gaps Report, which identifies crucial technology and research opportunities that could propel innovations in wireless communications over the next two decades, and complete five strategic roadmaps to guide future advanced communications research, standards development, and technology efforts. Finally, NIST also laid the groundwork for Future Ultra-Precise Timing Links to Geosynchronous Satellites. NIST researchers published two Nature articles, encompassing (1) a ground-breaking approach that combined the accuracy and precision of frequency combs with quantum-limited sensitivity, and (2) a demonstration of optical time transfer of 10,000x higher performance than traditional microwave techniques. These new techniques pave the way for space-based global clock networks and have significant potential impacts for NIST, the Department of Defense, and foundational science, as a global clock network would enable the re-definition of the second, serve as a sensor for dark matter, test general relativity, and provide ultra-precise navigation and timing signals.
- *Climate and Environment:* NIST and the National Oceanic and Atmospheric Administration are incorporating forward-looking climate data and projections into standards for buildings and infrastructure, which will help establish climate resilience for the United States. Extensive research related to wildfires and wildland-urban interface with the California Department of Forestry and Fire Protection (CAL FIRE) is underway. A report was released to describe how far flammable

structures, such as sheds, should be away from homes to limit damage. NIST also published the first-ever engineering-derived tornado wind speed maps for the contiguous United States— implementing a recommendation of the National Construction Safety Team investigation of the 2011 Joplin, Missouri, tornado devastation. Subsequently, provisions for tornado-resistant design have been incorporated into the 2024 International Building Code, providing the first-ever protections for conventional buildings against tornadic winds. Finally, NIST is also taking frequency-comb technology from the controlled conditions of the laboratory to the harsh conditions of the real world. A recent NIST study using a new fieldable, robust frequency-comb found that methane emissions from agriculture, specifically concentrated animal feeding operations, were 1.5 times higher than expected, creating better data on gas emissions for policy makers to craft better-informed policies.

- ***Quantum Information Science:*** NIST researchers continue to advance the technologies and fundamental science needed to expand quantum applications. NIST researchers and collaborators at University of Maryland, College Park, demonstrated an integrated architecture for deployable atomic clocks. Additionally, NIST and JILA Fellow Dr. Ana Maria Rey and Dr. Paul Julienne, Emeritus Fellow of the Joint Quantum Institute (JQI) of NIST, were both elected to the National Academy of Sciences.

- ***Cybersecurity and Privacy:*** NIST continues to be a leader in research and development efforts to produce standards, guidelines, and other resources needed to strengthen U.S. supply chains, better protect Federal agencies and the economy, and help U.S. industry be more competitive in global markets. This includes NIST's efforts related to the security and integrity of the software supply chain under Executive Order 14028, Improving the Nation's Cybersecurity. In March of 2023, the White House announced the National Cybersecurity Strategy, which highlights the importance of NIST work in developing research, guidelines, and standards for cybersecurity and privacy. NIST also participated in the launch of the White House's internet of things (IoT) security labeling initiative, Cyber Trust Mark. This program is led by the FCC, with NIST's expertise and resources being leveraged in this effort. NIST has been specifically tasked to define cybersecurity requirements for consumer-grade routers. In December 2023, NIST held a Forum attended by more than 25 organizations to discuss NIST's preliminary draft IoT Cybersecurity Profile for Consumer Grade Routers and a Discussion Essay on IoT Product Component Requirements. NIST also hosted an event in March 2023 on the National Cybersecurity Center of Excellence (NCCoE) renewal and announced the launch of the Small Business Cybersecurity Community of Interest. Additionally, the Cybersecurity Framework (CSF) is being updated to version 2.0 and will be released in February 2024; international connections are a key part of the Cybersecurity Framework, and international standards will likely also be updated. NIST is additionally updating the Digital Identity Guidelines through stakeholder engagement with an expected update in 2024. NIST will also release the first set of final versions of the Federal Information Processing Standards for Post-Quantum Cryptography. The goal of the standards is to resist future attacks by quantum computers. Finally, winners of the Privacy-Enhancing Technology Prize Challenge were announced at the Summit for Democracy, which was funded via a partnership with the NSF and OSTP. The goal was to discover novel solutions and global challenges that address issues relating to privacy.

The VCAT notes that there is a danger of regulators applying the cybersecurity framework in ways they were not intended, which could also be the case for the AI RMF. While the AI RMF is not, by design, a regulatory document, its use within a structured management systems approach could lead to the

presumption of conformity. The VCAT also encourages NIST to continue engagement to drive awareness of the CSF for adoption in international standards.

1.4. Future Directions for Critical and Emerging Technologies

NIST has worked extensively to maintain U.S. leadership in the CET focus areas it has identified. NIST leadership also recognizes, however, that it is important to scan the horizon for other emerging technologies that are poised to become important drivers to the U.S. economy and can be advanced through the NIST mission. The VCAT notes the increasing importance of interdisciplinary work and believes that the intersection of CETs is a growth domain for future priority areas, including computational derivatives of all of the CETs noted. NIST is in a unique position to advance new fields of research in these intersectional areas because of its technical depth in so many varied CETs and its mission focused on measurement science. Instead of developing a whole new priority or focus area, the VCAT encourages continued research into new spaces that merge aspects of their current list of CETs. For example, currently, AI and cybersecurity seem to be separate entities, but they can overlap; the intersection of biosecurity and AI is of increasing importance. Additionally, the convergence of AI with the goals of CHIPS could result in better design and understanding of semiconductors and advanced packaging devices. The VCAT also notes that increasing requests from Congress and the White House in these areas has put a strain on NIST's resources.

Recommendations

The VCAT recommends NIST take the following steps to ensure that the Institute's expertise and capabilities are best used to make significant contributions on CETs:

- *1a. Future CET priorities:* As NIST plans to grow the breadth of their CET focus areas, the VCAT recommends relating NIST's mission and research strengths to develop new priority areas that have the highest level of impact, focusing on the fundamental technologies that drive the future of measurement. This will require developing an understanding of the timeline for each of identified technology and resisting the urge to work only on short-term efforts. It is also vital to note that each CET domain has differing needs and therefore is critical that NIST adapt its work to the domains in which it is engaging.
- *1b. Intersection of CETs:* NIST should consider the intersection of CETs as a growth area for future research; for example, AI and cybersecurity, or biosecurity and AI. NIST should also consider exploring a more generalizable application of the AI RMF, including for the wider software environment.
- *1c. Increased visibility of NIST CET efforts:* NIST is making great strides in research on their CET focus areas, but a better outreach campaign to show how NIST work is integrated in everyday lives could help NIST disseminate its work and recruit new talent. NIST should consider building a storytelling infrastructure – specifically for AI – through working with YouTubers who focus on science education or, at a higher technical level (for example, VCAT members) a "mini brochure" of what NIST does. NIST's informational websites about CHIPS, AI, and others would benefit from reorganization to make the information more publicly accessible. The VCAT notes that recent retirements of NIST communications staff have made this more difficult.

2. Strengthening U.S. Manufacturing Leadership

NIST continues to work with the Department of Commerce to implement the Creating Helpful Incentives to Produce Semiconductors (CHIPS) Act of 2022, a $50 billion investment through the Department of Commerce CHIPS for America Fund. This act supports strengthening the U.S. semiconductor industry, including research, development, and manufacturing, and investing in workforce development, ultimately protecting U.S. national and economic security. In addition to CHIPS for America, NIST continues to support U.S. manufacturing through NIST Laboratory Programs' research underpinning measurement methods and standards to advance manufacturing, the Manufacturing USA program and the DOC-sponsored National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), and the Hollings Manufacturing Extension Partnership (MEP).

2.1. CHIPS and Science Act Implementation

NIST has continued to implement the CHIPS and Science Act and support the growth of domestic semiconductor manufacturing through the CHIPS Program Office (CPO) and the CHIPS Research and Development Office (CRDO). CPO is tasked with distributing $39 billion in incentives to develop semiconductor manufacturing facilities and equipment in the United States and began announcing its first awards in Winter 2023-2024. CRDO is tasked with investing $11 billion to bolster domestic semiconductor R&D and has made key steps in standing up signature programs such as the National Semiconductor Technology Center (NSTC) and the National Advanced Packaging Manufacturing Program (NAPMP).

Workforce development is a priority for all of the CHIPS for America programs. For example, in February 2024, the Historically Black Colleges and Universities (HBCU) CHIPS Network kicked off with an event at DOC. This event is consistent with the CHIPS overall workforce development principle that recruiting, training, and retaining a large, skilled, and diverse workforce will be critical to strengthening the U.S. semiconductor ecosystem. Critically, this must include significant investments to create opportunities for Americans from historically underserved communities, including people of color, people from rural communities, veterans, and women. Companies seeking CHIPS funding are required to submit workforce development plans for the workers who will operate their facilities. The plan must have the following five elements: (1) a workforce needs assessment, including an assessment of job types, skills, and workers required over time; (2) strategies for worker recruitment and retention, including plans to address well-known workplace barriers; (3) the applicant's approach to meeting the Good Jobs Principles published by the Departments of Commerce and Labor; (4) commitments to provide workforce training and wraparound services, including programming for training and job placement for economically disadvantaged individuals; and (5) the core milestones the program aspires to achieve, as well as metrics and processes to measure, track, and report publicly on these goals and commitments. The plan should also detail the applicant's engagement with strategic partners.

In the past year, CPO has paved the way for distributing incentives by implementing rules that clarify the national security guardrails on incentives and began announcing investments. CPO has released three Notices of Funding Opportunities (NOFOs), including for commercial fabrication facilities and for small-scale supplier projects. Industry interest in CPO incentives was significant, resulting in more than 550 statements of interest and nearly 150 pre-applications, full applications, and concept plans. In December 2023, the U.S. Department of Commerce (DOC) and BAE Systems Electronic Systems, announced the first preliminary memorandum of terms (PMT), approximately $35 million in federal incentives to support the

modernization of the company's Microelectronic Center. A second PMT was announced in January 2024 to provide approximately $162 million in federal incentives to support the onshoring of Microchip Technology Inc's semiconductor supply chain.

CPO manufacturing incentives are complemented by CRDO's focus on enhancing R&D efforts, which is driven by three goals: U.S. technology leadership, accelerated ideas to market, and a robust semiconductor workforce. To achieve this vision, CRDO is implementing four core programs:

1. National Semiconductor Technology Center (NSTC)
2. National Advanced Packaging Manufacturing Program (NAPMP)
3. Manufacturing USA Institute(s)
4. NIST Metrology Program

Each of these entities includes a focus on, and funds for, workforce development.

The NSTC is a planned public-private consortium to fund R&D in key problem areas for the U.S. semiconductor ecosystem. CRDO has made significant progress in setting up the NSTC in the last year, including publishing an NSTC vision and strategy paper in Spring 2023. An initial agreement with Natcast, a purpose built non-profit to run the NSTC, was also announced and the entity hired its first Chief Executive Officer in January 2024. CRDO also released a vision for the NAPMP in November 2023 and initial packaging programs and funding opportunities are expected to begin rolling out in the first half of 2024, including a $3 billion investment to drive U.S. leadership in advanced packaging. A Request for Information regarding the Manufacturing USA Institute(s) was also released to solicit public input on the potential topics for the new institutes. After receiving extensive public input, CHIPS for America determined that a single large institute with both regionally focused programs and meaningful cross-region participation will best meet the CHIPS R&D program goals of strengthening U.S. technology leadership, accelerating ideas to market, and realizing a robust semiconductor workforce. On February 1, 2024, NIST published a Federal Register Notice of Intent for a new Manufacturing USA Institute open competition focused on the topic of digital twins for semiconductor manufacturing, packaging, and assembly. CHIPS for America is investing at least $200 million to create the first-of-its-kind digital twin institute to lead the world in revolutionizing semiconductor and advanced packaging manufacturing. Additionally, the NIST Metrology Program published a gaps report that included a vision and strategy and identified seven grand challenges, three of which have funding opportunities that commenced. The vision and strategy papers are available at https://www.nist.gov/chips/publications.

Related to CHIPS, NIST has continued efforts to support the semiconductor industry through the development of standards and metrology. In September 2023, the CHIPS R&D Interagency Semiconductor Standards Group hosted a Standards Summit with more than 200 attendees in person and 400 attendees online. A report is forthcoming with findings to address the need to coalesce around international standards for semiconductors. The VCAT acknowledges the difficulties and challenges associated with managing $50 billion in funding for the CHIPS program, but noted that NIST has been especially thoughtful in ensuring that CHIPS funds are being spent appropriately. Discussions included the overall perception of CHIPS and the role NIST will play in the CHIPS R&D space alongside other federal entities. Additionally, how the U.S. compares with global competitors in the international market was discussed along with global coordination efforts. Finally, the intent for CHIPS support of all sectors, including academia, was noted.

2.2. Other NIST Manufacturing Initiatives

Manufacturing USA's Workforce, Education and Vibrant Ecosystems (WEAVE) program accepted proposals in Fall 2023 for public service awards of $11 million, with announcement of awards forthcoming. This funding is intended to be used for existing Manufacturing USA institutes to provide vibrant and inclusive advanced manufacturing ecosystems. Manufacturing USA also supports the DOC-funded NIIMBL eXperience program, which offers Black, Latinx, and Indigenous students an all-expenses paid biopharmaceutical manufacturing immersion program, with the goal to diversify the school-to-industry pipeline. Additionally, NIST released a summary of public comments solicited to inform the design of, and requirements for, potential Manufacturing USA institute(s) that would strengthen the semiconductor and microelectronics innovation ecosystem in such areas as design, fabrication, advanced test, assembly, and packaging capabilities.

In 2023, the Manufacturing Extension Partnership (MEP) invested $20 million in cooperative agreements with all 51 MEP centers to establish the Supply Chain Optimization and Intelligence Network (SCOIN). MEP also published an interactive map, allowing manufacturers to find workforce-related programs and services at MEP centers across all 50 states and Puerto Rico and a strategic plan for 2023-2027. Additionally, MxD, the digital manufacturing and cybersecurity institute, announced a partnership with MEP to advance digital adoption by small and medium-sized manufacturers. This five-year collaboration will help strengthen America's manufacturing base and increase competitiveness by delivering tailored support to small and medium-sized manufacturers.

Recommendations

The VCAT supports NIST's focus on advanced manufacturing and provides the following suggestions to strengthen the ongoing efforts:

- **2a. Visibility:** With increasing efforts from CHIPS, it is vital that the public is made aware of all CHIPS efforts and NIST's role in the program implementation. The CHIPS website should provide regular updates, be easily accessible, and the information published should be shared widely.
- **2b. Interagency collaboration:** Interagency collaboration is recommended to keep CHIPS/NIST efforts aligned with other entities to avoid duplication, like the Department of Defense's Microelectronics Commons.

3. Ensuring U.S. leadership in international standards

The White House launched the U.S. Government National Standards Strategy for Critical and Emerging Technology (USG NSSCET) on May 4, 2023. The strategy aligns to ANSI's (American National Standards Institute) U.S. standard strategy and will build a foundation to safeguard U.S. technology leadership and competitiveness in international standards development. The Strategy has four objectives:

- Objective 1: Investment
- Objective 2: Participation
- Objective 3: Workforce
- Objective 4: Integrity and Inclusivity

NIST leads the execution of developing a cross-Agency implementation plan for the USG NSSCET. To ensure the USG NSSCET is correctly aligned to the U.S. private sector-led standards system, the implementation plan will be based on input received from various stakeholder communities. Feedback has been received through a Request for Information (RFI), a series of government listening sessions, and the establishment of the VCAT Subcommittee on International Standards Development Activity.

The RFI was announced in September 2023, seeking public input on how to best implement the Strategy. The RFI specifically requested input related to the four lines of effort in the strategy in addition to questions related to benefits, risks, challenges faced by small- and medium-sized enterprises, and integrity and inclusivity. NIST received 70 relevant submissions and comments were received by organizations and individuals representing industry, academia, government, Standards Developing Organizations (SDOs), professional and civil societies, nonprofits, small business, international companies, and a private citizen.

NIST also engaged directly with stakeholders through geographically distributed events across the United States. NIST hosted over 100 stakeholder engagements and held 10 listening sessions and business roundtables with stakeholder groups (e.g., auto industry, SDOs, investment community, academia, etc.). Some events were conducted by NIST, but most were co-hosted with partners like ANSI, Columbia University, the U.S. Patent and Trademark Office, and the Federal Bureau of Investigation. The goal of these events was for NIST to listen to feedback from the community on behalf of the U.S. government and also bolster the community's awareness of the USG NNSCET.

The RFI submissions and feedback from the listening sessions resulted in over 785 specific themes and topics captured for further analysis. Key findings included the need for workforce messaging and training on the standards development innovation ecosystem, research and development coordination, and international coordination. Listening sessions highlighted that the U.S. government should be an active stakeholder in the standards process and can contribute in unique ways. For example, the feedback highlighted there are opportunities for the U.S. government to coordinate with the community, including a wide range of stakeholders such as those in industry, academia, and civil society.

NIST is now working to integrate the themes and topics into a tracker and is also using a landscape analysis. NIST will align feedback in a way that directly addresses the lines of effort in the USG NSSCET. The mapped feedback will also be cross referenced to the VCAT's recommendations and together inform a draft implementation plan to be released from public comment in 2024.

The VCAT encourages NIST to continue its efforts to understand the dynamics between research, standards development, regulations, and implementation within the standards development innovation ecosystem to inform the implementation plan for the USG NSSCET. The VCAT also highlights the specific challenge with getting those in academia involved in standards-related activities and encourages NIST to consider this challenge in its workforce implementation efforts.

The VCAT supports NIST's leadership in international standards development efforts, including participation in standards fora such as the U.S.-EU Trade and Technology Council (TTC), Quadrilateral Security Dialogue (Quad), Indo-Pacific Economic Framework for Prosperity (IPEF), and the Organization for Economic Co-operation and Development (OECD). The VCAT also supports NIST's continued engagement in traditional international SDOs and consortia, such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), 3rd Generation Partnership Project (3GPP), and the Internet Engineering Task Force (IETF).

3.1.   VCAT Subcommittee on U.S. International Standards Development Activity

The objective of the International Standards Subcommittee is to develop specific recommendations for deliberation of the full VCAT that assess the opportunities to enhance NIST's engagement in and coordination of policy efforts in support of international standards development activity. The Subcommittee is charged to report to the VCAT and make recommendations on the following, among other related topics:

- The barriers to U.S. participation in standards development activities, and opportunities for knowledge and resource sharing to ensure U.S. equities from the private and public sector are supported -- especially in potentially disruptive, fast-moving technology areas;
- Opportunities to increase the number of professionals in CET sectors engaged in standards development activities, particularly in small- and medium-sized enterprises (SMEs); and
- Opportunities for NIST to work effectively with private-sector stakeholders to foster greater U.S. investment in pre-standardization research that is essential to standards development activities.

The Subcommittee is Chaired by Mr. Jason Matusow and is comprised of nine additional members from standards development organizations and other stakeholder organizations. In 2023, the Subcommittee held eight listening session and developed visiting expert written findings to inform version 1 of a report to the VCAT. The report included 37 specific recommendations to improve coordination across agencies, increase engagement in CET standardization, build capacity at executive and staff levels, and promote an innovation-forward agenda that expands U.S. competitiveness and effectiveness globally. The VCAT approved the report at its February 2024 meeting. In the first half of 2024, the subcommittee will work with NIST staff to integrate the findings of the subcommittee with the RFI materials and listening sessions findings to further support the implementation of the NSSCET.

Recommendations

- **3a. Visibility**: With a multitude of standards-related activities, the VCAT suggests increasing the visibility of NIST's work as part of the USG NSSCET on standards.gov. Specifically, NIST should increase communication about ways to engage on the strategy implementation to communities of interest.
- **3b. Establishing pre-standardization materials**: NIST should include pre-standardization contributions as an additional objective outcome from its foundational sciences and public-private partnerships in CETs.

Additional recommendations from the VCAT Subcommittee on U.S. International Standards Development Activity are available in a more comprehensive report.

4. NIST Budget

As described in the 2022 VCAT annual report, the passage of the CHIPS and Science Act included significant programmatic growth for NIST, authorizes funding levels that gradually increase over five years to $2.28 B, and would nearly double the total NIST budget if appropriated by Congress.

The VCAT recognizes that the passing of multiple continuing resolutions has made budgetary and programmatic planning challenging for FY 2024 and beyond, particularly as NIST implements the CHIPS and Science Act as well as the multitude of deliverables associated with the AI Executive Order and the USAISI. The VCAT notes the FY 2025 President's Budget Request of $1,498.5 M, an increase of $38.5 M over FY 2024 enacted funding to address critical facilities needs, grow funding for critical mission areas such as AI and quantum technologies, and fully fund inflationary adjustments to current programs. The high-level differences in the FY 2023 enacted funding levels, compared to the troubling core budget reductions enacted in FY 2024, and the improved posture in the FY 2025 President's Budget Request are shown in **Table 2** below. Note that the community projects (including community construction projects) are one-time directed funding to be spent outside of NIST, not within NIST's intramural scientific and research programs or for NIST's facilities. The VCAT cautions the interpretation of the growing NIST budget when it contains these one-time community project funds. These community project funds do not increase the base funding for NIST and, when directed without additional funding for management and execution of these activities, pull resources from execution of NIST's core mission. For NIST to sustain and grow their scientific capabilities to accomplish the implementation of legislated priorities and advance U.S. competitiveness, base funding must be increased.

Table 2. NIST Budget (dollars in millions)

Activity	FY 2023 Enacted*	FY 2024 Enacted	FY 2025 President's Budget Request
Scientific & Technical Research Services (STRS)	**953.0**	**1,080.0**	**975.0**
Laboratory Programs (STRS)	890.5	857.2	975.0
Community Projects (STRS)	62.5	222.8	
Industrial Technology Services (ITS)	**212.0**	**212.0**	**212.0**
Construction of Research Facilities (CRF)	**462.3**	**168.0**	**311.5**
Construction of Research Facilities (CRF)	130.0	87.8	311.5
Community Construction Projects (CRF)	332.3	80.2	
Total, NIST Discretionary	**1,627.3**	**1,460.0**	**1,498.5**

Excludes one-time supplemental funds.

The FY 2025 President's Budget Request specifically includes:
- A $47.7 M increase compared to FY 2024 enacted funding to advance artificial intelligence (AI) research, standards and testing to meet national needs as described in E.O. 14110 and the launch of the USAISI;
- A $13.9 M increased compared to FY 2024 enacted funding to advance quantum information science and technology readiness, including post-quantum cryptography (PQC) and research to scale-up quantum systems;
- A $178.3 M increase over FY 2024 enacted funding for the modernization of the Radiation Physics Building (Building 245) to resume full delivery of reliable radiation measurements in support of security, healthcare, energy and research; and

- A $45.4 M increase over FY 2024 enacted funding for the safety, capacity, maintenance, and major repairs (SCMMR) of NIST facilities including IT modernization, repair and revitalization of NIST facilities, maintenance backlogs, and infrastructure improvements.

The VCAT is pleased to see these overall requested increases to NIST programs included in the FY 2025 Presidential Budget Request, which mirrors the recommendations given by the committee, including a focus on CETs, supporting the U.S. supply chain, strengthening mission delivery, and for revitalization of NIST facilities. However, the Committee would like to see more funding for the repair and modernization of NIST facilities and in core CET areas to meet the increased demand while simultaneously increasing funds for other core competencies and priority areas, such as metrology and measurement services.

Recommendations

- *4a. Construction of NIST Facilities Funding*: The VCAT has tracked and noted the status of NIST facilities and infrastructure over the last several years. It is clear that the condition of NIST facilities is hampering productivity and poses a risk to the safety of staff. The conditions are also an active disincentive for leading scientists to work at NIST. Therefore, the committee greatly recommends a continual push for increased funding to support the construction of NIST research facilities. Insufficient funding will continue to put the safety of staff at risk, limit NIST's ability to deliver on its mission, and negatively affect retention and recruitment of talent.
- *4b. Sufficient funding for Congressional demands*: Over the last few years, NIST has been in the forefront of multiple Congressional demands. Although NIST is generally equipped to tackle these deliverables technically, NIST needs to ensure sufficient funding to both support the completion of these deliverables and also to sustain lasting priorities and focus areas.
- *4c. Special hiring authorities to help with private sector competition*: As NIST is tasked with fulfilling the aims of the CHIPS and Science Act and the extensive goals within the AI Executive Order, NIST would benefit from additional flexible hiring authorities, including special pay authorities, to better compete with the private sector for top talent.

5. Expanding and Strengthening NIST's Safety Culture

NIST's success relies on its people, first and foremost, but it also needs a safe working environment and world-class facilities. Safety is multi-faceted, with roots that extend into NIST's ability to recruit and retain staff, and is hindered not only by the overall safety culture but also by the condition of NIST facilities. This section highlights the efforts NIST has taken this past year on ensuring safe work environments and strengthening the safety culture while also emphasizing actions that need to be taken to ensure safety among NIST staff.

5.1. Facilities Conditions and Alignment to Safety

For NIST to effectively fulfill its mission, be competitive when recruiting and retaining talent, and execute mission projects fully and safely, it must be fully resourced to address its failing infrastructure. The NIST Safety Commission Report also had one recommendation centered around facilities and infrastructure.

This recommendation is to implement an overall capital investment and infrastructure improvement plan, as many buildings and facilities need significant renovations or replacement to address both research and safety issues. **An additional note suggests that safety issues alone should justify funding and guide all designs and implementations.**

NIST continues to prioritize improving the laboratories and NIST facilities in budget requests, as well as in NIST's internal budget. **The VCAT notes that there is an intersection of under-investment in facilities and challenges with safety.** Poorly maintained facilities may lead directly to hazards such as flooding, but addressing safety issues related to facilities may take funding away from research or require costly workarounds by the researchers that reduce the impact and timeliness of their work. These issues together fuel a continuous challenge between NIST completing its mission in a timely and effective manner and ensuring the safety of its staff.

5.2. Safety Updates

NIST has implemented several improvements following two serious safety incidents at NIST laboratories in 2021 and 2022. In December 2022, NIST commissioned a Federal Advisory Committee, the NIST Safety Commission, consisting of a panel of seven experts on safety policies; safety management systems, practices, and performance; and safety culture. In August 2023, the Safety Commission issued a final report that provided 17 recommendations to improve safety across NIST, which NIST has prioritized and is working to implement. NIST also visited Department of Energy laboratories to benchmark best practices and worked with consultants to conduct a workshop on Workplace Safety in Hybrid Federal Laboratories. Additionally, any NIST staff member whose work is covered by a Hazard Review/Job Hazard Analysis (JHA), which is required for any hazardous work, was required to reassess the hazard review and ensure adequacy. Refresher safety training is also now being required along with the basic safety training assigned as part of the onboarding process and annual training, and a safety culture improvement plan has been developed.

In 2024, NIST plans to have a complete and fully functional Safety Management System and to issue an audit program. Additionally, NIST is setting performance metric goals, including numerical goals, and building a dashboard for metric tracking. Weekly summaries are also being sent out to NIST leadership on the incidents reported and the statuses of incident responses, including serious incidents and finding common root causes to help mitigate future safety concerns and hazards.

The structure, roles, and responsibilities of NIST's Office of Safety, Health, and Environment (OSHE) are also being reevaluated and strengthened, including by external contractors. It was noted that the ratio of safety staff to staff at NIST is insufficient when being compared to other government-funded laboratories. To begin addressing this gap, NIST has approved, and has begun, the hiring of 12 new safety staff, including six embedded safety staff within the Laboratory Operating Units. Additionally, in the next two years, $9 million will be spent to improve fall hazard assessment for all buildings on both campuses, including roof rail installation for all buildings where rooftop work occurs to avoid a serious incident or fatality. Approximately $1 million has also been invested for safety consultation services to evaluate the improvement action plan(s) and timeline(s).

Recommendations

- *5a. Increase in-person safety training*: With the shifting needs of staff, plus flexible work schedules, the majority of NIST's safety training has been converted to a virtual format. However, for some, virtual training platforms can be less effective. NIST should consider increasing the number of trainings that are available as in-person trainings to gain hands-on safety instruction.
- *5b. Increase onsite responders across all campuses*: During an emergency situation, it's vital to have a quick response time across all campuses. NIST should consider increasing the number of trained responders onsite to respond to situations immediately, so there is a quick response and intervention before local responders arrive.
- *5c. The VCAT reiterates the need for NIST to address its maintenance backlog:* For NIST to excel in meeting its mission, it must be fully resourced to address its failing infrastructure, be competitive when recruiting and retaining talent, and execute mission projects fully and safely.

6. Recruiting and Retaining a Diverse and Talented Workforce

NIST needs its people more than ever to deliver on critical mission efforts, and it needs to create an environment where staff can feel safe to innovate and thrive. It is not enough to recruit top talent, but the environment at NIST must be inclusive in order for people to not only be retained, but also to excel. Employees must feel safe physically and mentally while in the office and laboratory to create an environment conducive to innovation and creative problem solving. Employees of different backgrounds, perspectives, and skill sets must be valued. Fostering a sense of community, whether virtual or in-person, is vital to the engagement and health of the NIST workforce.

Dr. Locascio stressed that efforts to improve workplace culture need to continue, and this includes community-building activities. The VCAT gave recommendations on ways to demonstrate that people are a "core value" at NIST including increased visibility, events, and recognition. Another theme was increasing communication through employee stories via blogs and general press, conducting employee engagement surveys, or starting affinity groups/forums to discuss both challenges and successes. Additionally, the VCAT suggested that NIST encourage healthy work-life balance, noting return-to-office adjustments and building community after the pandemic would be a part of these conversations. The committee noted that often exhaustion, cynicism, and perceived lack of accomplishment can lead to burnout and attrition, while conversations around how to help employees see their work as meaningful can invigorate employees. To create more community opportunities, NIST should also consider providing mentorship for new employees and developing culture-based conversations to discuss diversity with management and staff.

The VCAT commends NIST for the multi-pronged efforts undertaken to date to build a robust NIST community, including flexible telework policies and scheduled events meant to bring staff together.

6.1. Diversity, Equity, Inclusion, and Accessibility

In October, the VCAT was introduced to the new NIST Director of the Diversity, Equity, and Inclusivity Office (DEIO), Ms. Janelle Johnson. Ms. Johnson discussed her vision for NIST DEIA, which includes an aligned vision to create a common goal set to strengthen the NIST community. Building and sustaining an organizational commitment to DEIA is critical because it is established that groups composed of people with diverse backgrounds, experiences, and expertise tend to be more productive. The vision for success

at NIST includes an institutionalized inclusion - backed by measurement and data-driven approaches. A holistic approach to making sure NIST is a people-first culture is key to a successful organization.

In February, the VCAT received an update on the work the DEIO has completed and plans to enact. More than half of the DEIA Strategic Plan is complete, and a Community of Practice was established with an Executive Council forthcoming. Currently the DEIO is focused on listening to the community to gather information on what NIST culture needs to become in order for the institute to be high performing and inclusive. NIST is currently working on developing the principles outlined in the federal-wide competency guide to develop a workplace with clearly defined principles and the skills and behaviors needed to support an environment of dignity and respect. Ms. Johnson emphasized that listening to staff and providing them with opportunities for feedback is critical to assess the metrics of progress. Currently, NIST has several listening sessions and facilitated discussions proposed for the coming year that focus on areas that would benefit NIST greatly, including multigenerational diversity, microaggressions and implicit bias, and psychological safety, to give NIST staff opportunities to be heard and the tools to create an inclusive environment that fosters innovation and productivity.

The VCAT appreciates that NIST recognizes how DEIA principles, when appropriately implemented, extend to positive outcomes for the overall culture and effectiveness of the organization.

Recommendations

- *6a. Ensure accessibility principles are applied to NIST-required software*: The VCAT emphasizes the need for NIST-required software to follow accessibility principles.
- *6b. Increase communication of metrics in the first phase of the DEIA Strategic Plan*: In addition to efforts to sincerely listen to staff needs towards solidifying the NIST culture, an increased visibility of progress metrics would allow staff to see results.
- *6c. Increase outside awareness of NIST DEIA efforts, including through CHIPS efforts*: The VCAT can help to relay the efforts in DEIA, internally and externally, to others across the U.S., but would need additional insights into the efforts to have the awareness to do so.

Appendix

About the VCAT

The Visiting Committee on Advanced Technology (VCAT, or the Committee) of the National Institute of Standards and Technology (NIST, or the Institute) was established in its present form by the Omnibus Trade and Competitiveness Act of 1988 and updated by the America COMPETES Act in 2007 and the American Innovation and Competitiveness Act of 2017. The VCAT is a Federal Advisory Committee Act (FACA) committee, and its charter includes reviewing and making recommendations regarding general policy for NIST, its organization, budget, and programs within the framework of applicable national policies as set forth by the President and the Congress. This 2023 annual report covers the period from March 2023 through February 2024.

The Committee reviews the Institute's strategic direction, performance, and policies, and provides the Secretary of Commerce, Congress, and other stakeholders with information on the value and relevance of NIST's programs to the U.S. science and technology base and to the economy. At the first meeting of each year, the Director of NIST proposes areas of focus to the Committee and agreement is reached on a program for the year.

The Committee reviews a significant portion of NIST programs through direct discussion with NIST leaders, scientists, and engineers. Committee members present candid feedback to NIST senior management and other attendees at each meeting and encourage continuous dialogue. This feedback encourages continuous improvement in key areas in the overall operation of the Institute. The Committee periodically visits various NIST laboratories and satellite facilities to discuss research projects directly with NIST technical staff. These laboratory visits and associated tours help the Committee to assess the impact of NIST research, progress towards achieving research goals, the quality of the staff, institutional culture – especially related to safety and security – and how effectively the existing facility infrastructure meets the needs of the NIST mission. During this period of performance, meetings were both hybrid and virtual.

Under the Committee charter, the Director of NIST appoints the VCAT members. Members are selected on a transparent, standardized basis, in accordance with applicable Department of Commerce (DOC) guidance. Members are selected solely on the basis of established records of distinguished service; provide representation of a cross-section of traditional and emerging U.S. industries; and are eminent in fields such as business, research, new product development, engineering, labor, education, management consulting, organizational culture, safety, the environment, and international relations; and shall be selected in accordance with applicable DOC guidance. No employee of the Federal Government can serve as a member of the Committee. Members are appointed for staggered three-year terms.

During this reporting period, two new VCAT members, Dr. Mark Pierpoint of Keysight Technologies and Prof. Monisha Ghosh of University of Notre Dame, were appointed.

This report highlights the Committee's observations, findings, and recommendations. Detailed meeting minutes and presentation materials are available on the NIST website at www.nist.gov/director/vcat.

VCAT Members during the Period Covered by this Report

Dr. Mehmood Khan, Chair
Hevolution Foundation
Term: November 13, 2018 – November 12, 2024

Dr. Dana (Keoki) Jackson, Vice Chair
MITRE Corporation
Term: May 22, 2018 – May 21, 2024

Dr. Vinton G. Cerf
Google
Term: December 21, 2018 – December 20, 2024

Ms. Katharine Ku
Wilson Sonsini Goodrich and Rosati
Term: May 22, 2018 - May 21, 2024

Mr. George Fischer
T-Mobile
Term: May 22, 2018 – May 21, 2024

Mr. Jason Matusow
Microsoft
Term: September 14, 2022 – September 13, 2025

Dr. Monisha Ghosh
University of Notre Dame
Term: April 1, 2023 – March 31, 2026

Dr. Michelle Parker
Boeing
Term: January 14, 2022 – January 13, 2025

Dr. Anthony M. Johnson
University of Maryland Baltimore County (UMBC)
Term: October 4, 2021 – October 3, 2024

Dr. Mark Pierpoint
Keysight Technologies, Inc.
Term: April 1, 2023 – March 31, 2026

Dr. Eric Kaler
Case Western Reserve University
Term: December 21, 2018 – December 20, 2024