VISITING COMMITTEE ON ADVANCED TECHNOLOGY (VCAT or Committee)
MINUTES OF THE TUESDAY, OCTOBER 29, 2024, HYBRID MEETING

*virtual attendance

ATTENDANCE:

Visiting Committee Members Attending
Cerf, Vinton
Fox, Glenn
Ghosh, Monisha
Holland, Michael
Kaler, Eric*
Khan, Mehmood*
Matusow, Jason
Murray, Cherry*
Parker, Michelle*
Pierpoint, Mark

Designated Federal Officer
Shaw, Stephanie

NIST Leadership Board
Barrett, Claire
Beers, Kathryn
Boehm, Jason
Brockett, Del
Brown, Essex*
Chin, Joannie
David, Lindra*
Fangmeyer, Robert (Bob)*
Folk, Alex*
Fraser, Gerald (Jerry)
Gloster, Gerald (Jerry)*
Johnson, Janelle*
Lin, Eric*
Locascio, Laurie
Mackey, Elizabeth (Liz)
Midzor, Melissa
Molnar, Michael (Mike)
Neumann, Dan
Olthoff, James (Jim)*
Rao, G. Nagesh
Romine, Charles (Chuck)
Stine, Kevin
Szakal, Christopher
Wixon, Henry*

NIST Staff
Allocca, Clare*
Averill, Jason
Ayala, Melissa*
Barbosa, Nicholas*
Bardini, Mark*
Blum, Megean*
Boeckl, Kaitlin (Katie)
Britt-Crane, Michael*
Buchanan, Kerrianne
Campbell, Mara
Carnahan, Lisa*
Chang, Walter*
Chukran, Melinda*
Coolbroth, Dana*
Corwin, Kristan*
Dickson, Jessica*
Dohne, Kirk*
Dowell, Marla*
Golmie, Nada
Hardis, Jonathan*
Hauk, Kandy*
Hildebrand, Jacqueline*
Hoehler, Matthew
Hooker, Stephanie
Huergo, Jennifer
Ivy, Nahla*
Jahanmir, Said*
Jones, Christina*
Kagan Guthrie, Benjamin
Kuchilla, Julia*
Lamboy, Jorge*
Lane, Anne*
Lequin, Wiza*
Long, Joseph*
Mahn, Amy*
Malhotra, Jyoti*
Martin, Natalia*
McAllister, Therese
Moody, Dustin
Morrow, Jayne
Moylan, Shawn
Nadal, Maria*
Newhouse, William
Nobleman, Andrew*
Peña-Alcantara, Amnahir
Phillips, Brandyi*
Pollack, Charles*
Pollard, Shelly*
Polyakov, Sergey
Prebil, Mike*
Press, Rich*
Rapp, Kathleen (Katie)*
Reidy, Kari*
Rigosi, Albert
Rogers, Kelley*
Rosa, Jennifer*
Ryan, Christopher*
Santos, Danielle
Sberegaeva, Anna
Schlenoff, Craig*
Sedgewick, Adam*
Seiler, David*
Shriner, Julia
Shyam-Sunder, Sivaraj*
Snowden, Hope*
Sofka, Holly
St. Pierre, James (Jim)*
Stoffel, Nancy*
Stosz, Conrad
Strickler, Jessica*
Szuchyt, April*
Tabassi, Elham*
Tran, Kimmai*
Vanek, Anita
Vewessee, Stella*
Wilkinson, Richard*
Yao, Jue*

Others
Bommisetty, Venkat – Princeton Plasma Physics Laboratory*
Broz, Joseph – IBM VCAT Candidate*
Cook, Jeremy – U.S. Department of Veterans Affairs*
Harder, Josh – Lewis-Burke Associates LLC*
Heyman, Mat – NIST Consultant*
Jillavenkatesa, Ajit – Apple*
Katz, Max – Office of U.S. Senator Martin Heinrich of New Mexico*
Luckett, Mia - Lewis-Burke Associates LLC*
Meszaros, Jacqueline – Formerly National Science Foundation, VCAT Candidate
Mulberry, Karen – IEEE* Standards Association*
Saunders, Mary – American National Standards Institute*
Stevens, Mandy - U.S. Department of Veterans Affairs*
Stiggers, Bridget - U.S.

Department of Veterans Affairs*
Updyke, Craig - ASTM INTERNATIONAL*
Wai, Zoe - NASA Goddard Institute for Space Studies*
Webber, Naomi – Lewis-Burke Associates LLC*
Zhang, Clare – AIP Science Policy News

Tuesday, October 29, 2024

SESSION I: NIST OPERATIONAL UPDATES

Call to Order – *Mr. Jason Matusow, VCAT Chair*

Mr. Matusow called the meeting to order at 9:00 a.m. He thanked the outgoing VCAT members - Dr. Mehmood Khan, Dr. Eric Kaler, and Dr. Vinton Cerf for their contributions and welcomed new member Dr. Michael Holland. He then reviewed the meeting logistics and took roll call before turning the meeting over to Dr. Laurie Locascio.

Welcome Remarks & VCAT Meeting Pre-read – *Dr. Laurie Locascio, Under Secretary of Commerce for Standards and Technology and NIST Director*

Dr. Locascio gave a brief update on selected NIST highlights. She welcomed new VCAT member, Dr. Michael Holland, and gave a farewell to departing VCAT members—Dr. Mehmood Khan, Dr. Anthony Johnson, Dr. Eric Kaler, and Dr. Vinton Cerf—who have contributed significantly throughout their term(s). Dr. Locascio mentioned that Dr. Jacqueline Meszaros, who was in attendance, is currently being vetted to become a VCAT member prior to the February meeting.

On NIST leadership changes, key appointments are: Ms. Hannah Brown as the NIST Chief Information Officer (CIO) and the Director of the Office of Information Management Systems (OISM), pending Department of Commerce approval, and Dr. Melissa Midzor as the Director of the Communications Technology Laboratory (CTL), pending the Office of Personnel Management (OPM) approval. Dr. Eric Lin is also stepping in as Acting Associate Director for Innovation and Industry Services, following Ms. Mojdeh Bahar's departure. Dr. Locascio also announced that Dr. Jayne Morrow, Chief Advisor on Standards, and Chief Counsel, Mr. Henry Wixon would be departing from NIST and wished them well.

For research highlights, Dr. Locascio mentioned exciting work is ongoing at the Joint Institute for Laboratory Astrophysics (JILA) where scientists have developed an atomic clock more precise and accurate than any clock previously created and also demonstrated key elements of a nuclear clock. NIST also developed an approach to precise timekeeping system on the moon, helping to extend a GPS-like navigation in cislunar space.

NIST has also awarded two new Centers of Excellence and announced an open competition for a new Manufacturing USA Institute focused on the use of AI to increase the resilience of U.S. manufacturers. The CHIPS for America Program also has released many announcements and has begun finalizing awards. Finally, NIST participated in a White House summit in July to discuss the new implementation roadmap for the U.S. Government National Standards Strategy for Critical and Emerging Technology (USG NSSCET)

Dr. Locascio stated that, in addition to the change in Administration, she will be leaving her political role as the Under Secretary of Commerce for Standards and Technology and the NIST Director to join the American National Standards Institute (ANSI) as Chief Executive Officer (CEO), and she reflected on the historic role NIST has played and its impact on AI, quantum technology, and other emerging fields.

For more information, see Dr. Locascio's presentation and pre-read material.

Discussion. The group discussed the following topics:

- The $50 billion CHIPS for America program compared to the budget of the Department of Commerce;
- National Academy of Sciences, Engineering, and Medicine (NASEM) report that reinforces VCAT recommendation on capital investment needed for maintenance of the Information Technology Laboratory (ITL); and
- Administrative costs built into the CHIPS Act being a benefit for managing the program.

Discussion on Safety at NIST – *Panel Discussion with OU Directors – Dr. Joannie Chin, Director of Engineering Laboratory (EL), and Dr. Jerry Fraser, Deputy Director of Physical Measurement Laboratory (PML)*

Dr. Joannie Chin and Dr. Jerry Fraser shared insights on the NIST's evolving approach to workplace safety following previous incidents. They emphasized the importance of a culture shift towards proactive observation and addressing hazards in real-time rather than relying solely on paperwork-based safety reviews. Some main initiatives include:

1. *Enhanced Observation*: Moving beyond documentation to actively observing safety practices during experiments to catch overlooked hazards.
2. *High-Risk Focus*: Prioritizing significant injury and fatality (SIF) potential activities. This includes outsourcing high-risk tasks, like tower climbing, to experienced contractors and reassessing the use of ladders and hazardous equipment.
3. *Comprehensive Experiment Phases*: Treating construction and deconstruction phases of experiments with the same safety focus as experimental activities, recognizing them as potential hazard zones.
4. *Training and Tools:* Implementing training programs like Krause Bell to heighten hazard awareness, installing cameras and card readers in machine shops to ensure proper use of dangerous equipment by qualified people, and enforcing protocols on Level 3 hazard reviews.

These efforts aim to foster a safety-focused culture, addressing both minor risks and serious hazards more comprehensively.

Discussion. The group discussed the following topics:

- Management observation process (MOP) methodologies utilized in operational units (OUs);
- Focus on externality of safety event consequences in addition to injuries and fatalities;
- Careful planning on emergency responses to rare events need to be practiced;
- Written procedures and standard operating procedures (SOPs) need to continue to be in place;
- Fewer workers in labs because of teleworking;
- Manifesting change in sharing outcomes of high-hazard reviews throughout the organization;
- Leadership support of safety practices helps increase awareness of safety;
- Safety being an integral part of NIST's commitment to a culture of excellence;
- PML joint institutes are reaching to NIST for help in improving safety;
- Prioritization of risks, e.g., people in labs doing science, construction sites, electrical work;
- Use of safety tabletop exercises; and
- Assimilating guest researchers on safety culture.

SESSION II: PROGRAMMATIC UPDATES

Intersections of AI Work at NIST – A Discussion with VCAT, *Dr. Laurie Locascio, Under Secretary of Commerce for Standards and Technology and NIST Director*

Dr. Locascio provided an overview of NIST's AI initiatives, focusing on three primary programs: NIST AI Innovation Lab (NAIIL); U.S. AI Safety Institute (AISI), and AI in Measurement Science and Services. NIST is committed to advancing the safe and efficient integration of AI across various sectors through a structured approach based on research, collaboration, and stakeholder engagement. The initiative gained momentum prior to the recent Executive Order, particularly with the release of the AI Risk Management Framework (AI RMF). This foundational work has set the stage for the establishment of the AISI, which is actively expanding its capabilities.

Key points provided by Dr. Locascio were as follows:

1. *NIST's AI Vision and Structure*. NIST aims to foster safe, trustworthy AI through research, measurement science, and community engagement. Efforts emphasize creating tools and guidance for safe AI adoption, balancing safety and trustworthiness with innovation.
2. *NIST AI Innovation Lab (NAIIL).* Housed within the NIST Information Technology Laboratory, provides foundational research to support evaluation and testing for AI, anchored by the AI Risk Management

Framework, to enhance AI functionality and trustworthiness. Recent efforts include AI research evaluation programs and a partnership Carnegie Mellon University.

3. *U.S. AI Safety Institute (AISI).* Established in response to Executive Order 14110, the AISI focuses on developing the testing, evaluations, and guidelines that will help accelerate the safe deployment of AI, including through collaboration with private companies and global organizations to advance AI safety.
4. *Broad Integration of AI at NIST.* Various NIST programs leverage AI for specific fields like manufacturing, communications, biology, and materials science, underscoring AI's role in modernizing NIST's services and enhancing collaboration across sectors.
5. *Policy and Security Directives.* NIST's role was emphasized in recent U.S. government actions, including in Executive Order 14110 and a recent AI National Security Memorandum (NSM), which place NIST at the forefront of setting guidelines and engaging with private sectors on AI safety.
6. *Community Engagement and Future Plans:* NIST values broad stakeholder input and hosts various AI-related events, working groups, and initiatives to keep evolving AI frameworks and guidance.

NIST is focused on balancing innovation with stringent safety measures, while fostering a collaborative, standards-driven AI environment. NIST's AI initiatives represent a comprehensive effort to harmonize safety, adoption, and innovation in AI technologies, all while fostering a culture of collaboration and active engagement with stakeholders. This holistic approach not only ensures the development of effective standards but also champions the responsible growth of AI across various industries.

Dr. Locascio said methodology is built on robust research and measurement science, essential elements of NIST. Through extensive research, NIST is developing taxonomy, terminology, and technical methods to measure AI capabilities and assess associated risks. This foundational work enables NIST to create empirically backed tests and evaluations that cater to the unique contexts in which AI technologies operate.

For more information, see Dr. Locascio's presentation.

Discussion. The group discussed the following topics:

- Sources of risk presented by complex models, many of which result from emergent behavior;
- Explanations for complex models and resultant counterfactual output;
- Stakeholder engagement and fundamental research being key to ensuring the trustworthiness and responsible development and use of AI;
- Finding the value-added AI endeavors NIST can bring to many fields, including social science;
- Huge distribution in quality of data available to train against in the chemistry/biology space;
- AISI partnership evaluations with large language models and frontier model developers;
- Defending against NIST becoming a regulatory force versus evaluation mechanism;
- NIST, as a non-regulatory agency for its science mission, develops basic criteria through other, non-certification mechanisms;
- NIST reaching diverse parts of the AI community through the AI Safety Consortium;
- Forming a more formal coordination mechanism along with developing Memoranda of Understanding (MOUs) to stay in sync with other agencies;
- NIST could help others understand what the properties are of the statistics used for machine learning;
- Better outreach being needed for some of the smaller companies;
- Criticality of NIST leadership team to maintain a left-to-right view on AI activities;
- Thinking about AI practice as a discipline while working on external taskings; and
- Tools being needed to address domain-dependent and dual-use problems in model systems.

Discussion on Global Standardization – *Dr. Jayne Morrow, Senior Advisor for Standards Policy, and Dr. Stephanie Hooker, Director of Standards Coordination Office (pending confirmation)*

Dr. Morrow said the U.S. standards system is led by the private sector, with the government playing a unique supportive and stakeholder role. A new strategy was released in May 2023, targeting critical and emerging technologies, emphasizing pre-standardization research and development (R&D), workforce participation, and inclusivity and integrity in standards development.

Implementation Roadmap Highlights (Published in July 2024)
Immediate Actions:

- Greater investment in pre-standardization research;
- Enhanced participation from underrepresented groups in standards development;
- Coordination of workforce development efforts; and
- Strengthened integrity of the global standards system amidst geopolitical tensions.

Strategic Outcomes:

- Sustained support for a diverse and holistic U.S. standards system; and
- Better alignment across government, industry, and academia to support emerging technologies.

Extensive feedback was gathered from over 150 stakeholder engagement sessions, listening tours, and a formal Request for Information (RFI). Included in the VCAT Annual Report were 37 recommendations, influencing the Implementation Roadmap.

Key Government Initiatives

- Standards Inclusion in Small Business Innovation Research (SBIR) Program at NIST: Standards are now included as an option for implementing SBIR.
- RFI for Sustained engagement: An ongoing RFI ensures continuous input from private and public sectors to refine strategies.
- Prize Recognition Challenge: Partnership between multiple agencies highlighting significant contributions to standards excellence without monetary prizes.
- Standards Forum by NIST: Fostered communication and shared information among stakeholders.

Center of Excellence for Standardization
Dr. Hooker said ASTM International was selected to lead the Center of Excellence for Standardization, with a broad network of over a dozen partnerships. Some of the goals are to develop generalizable tools in many different technical fields for rapid standards development, leveraging existing NIST programs, creating an information hub, pre-standardization engagement, workforce capacity building, and promoting small business participation in standards processes.

Collaborative pilots in CET areas to assess private-sector engagement is ongoing, particularly among small businesses along with improved tracking of government investments and effectiveness in standards activities. Additionally, strategies are in place to shorten the timeline for standards development in critical technologies.

Key Challenges:

- Sustaining long-term investments in pre-standardization research and promoting early adoption of standards.
- Bridging gaps between rapid technological advancements and the traditionally slower standards-setting process.

Dr. Hooker emphasized the significance of fostering public-private partnerships, supporting small businesses, and engaging in international coordination to maintain the U.S.'s leadership in global standards development for critical and emerging technologies.

For more information, see Dr. Morrow's & Dr. Hooker's presentation.

Discussion. The group discussed the following topics:

- Inclusion of the work from other standards bodies beyond ASTM (e.g., Internet Engineering Task Force, World Wide Web Consortium);;
- Getting academics to realize the importance of being engaged in standards;
- Potential National Science Foundation (NSF) funding program, in collaboration with NIST, focused on standards development activities critical to incorporate the idea of standards into the broader impact statement;
- Collaborative pilots providing opportunities to advocate and measure successes;
- Industry groups and NIST working together to articulate standards in a common voice;
- Attracting interest from academia by offering supplemental awards for standards and engagement;

- ASTM International working in partnership with the International Organization for Standardization (ISO) and European standards bodies;
- NSF and the U.S. Economic Development Administration (EDA) including standards in regional tech hubs and NSF innovation engine programs;
- A boot camp for academics on standards training;
- The multiple ways that "standard" is being used;
- Provide a forum for standards developing organizations (SDOs) to engage with a wider group when forming standards;
- NIST should not overreach and keep the standards development open;
- The Implementation Roadmap stressing communication and coordination;
- Standards making process varying from one organization to another;
- Awareness that open source and standardization, including for CETs, are complementary but different; and
- VCAT recommendations put into action in the Implementation Roadmap.

SESSION III: PROGRAMMATIC FOCUS ON CETS

Part I: Research Updates

Post-Quantum Cryptography and Cybersecurity – *Dr. Duston Moody, Mathematician, Information Technology Laboratory*

Dr. Moody gave an update on Post-Quantum Cryptography (PQC) initiatives led by NIST. Quantum computers could break current cryptographic standards, prompting the need for new quantum-resistant algorithms and new standards to replace vulnerable ones.

On the development of PQC standards, over the past decade, NIST has managed a collaborative process involving global experts to develop and evaluate PQC algorithms. NIST's role was not to design the algorithms but to manage a process that brings in experts to design them, evaluate the algorithms internally, help facilitate external analysis, and then select algorithms for standardization. In August, NIST published its first Federal Information Processing Standards (FIPS) for PQC.

Algorithms Standardized:

- FIPS 203: ML-KEM (KYBER): A key-encapsulation mechanism based on CRYSTALS-KYBER.
- FIPS 204: ML-DSA (DILITHIUM): A signature scheme based on CRYSTALS-DILITHIUM suitable for most applications.
- FIPS 205: SLH-DSA (SPHINCS+): A signature scheme based on SPHNICS+ and hash-based cryptography, with less favorable performance when compared to the lattice-based algorithms.
- FIPS 206: FN-DSA (Falcon): A signature scheme based on Falcon and a mathematically complex algorithm with smaller signatures compared to Dilithium (algorithm under development).

Evaluation of additional algorithms for standardization, in areas like digital signatures, is ongoing, as well as collaboration with global organizations to facilitate adoption of and transition to PQC standards. The United States goal is to transition to PQC standards and new algorithms by 2035. Industry collaboration, testing, and guidance are underway to support the adoption.

Future work includes enhancing "crypto agility" to enable easier transitions to future cryptographic algorithms as well as continued updates to NIST guidance and documents. The initiative is seen as a crucial step toward preparing for quantum computing's impact on security infrastructure, and more information can be found at the NIST Information Technology Laboratory (ITL) webpage or PQC forum.

For more information, see Dr. Moody's presentation.

Discussion. The group discussed the following topics:

- Known and unknown attacks and threat profiles of PQC algorithms;
- PQC standards at the cryptographic primitive level;

- Clarification being needed on bridging the gap for the two uses of the word "standard";
- Kyber, Dilithium, FALCON algorithms being lattice-based;
- SPHINCS+ being based on hash-based cryptography;
- Classic McEliece, BIKE, and HQC being based on code-based cryptography;
- SIKE being based on isogeny-based cryptography;
- No common implementation of multiple algorithms creates issues;
- VCAT should recommend finding a process to assure implementations work properly;
- The development of algorithm being a collaborative process; and
- Algorithms being publicly available.

Advanced Communications – *Dr. Melissa Midzor, Director of Communications Technology Laboratory (CTL), and Dr. Nada Golmie, NIST Fellow*

Dr. Midzor provided an update on NIST's advanced communications research, emphasizing the evolving terminology, with a focus on what is now termed "integrated communications and network technologies." The discussion highlighted key advancements, strategic priorities, and partnerships driving innovation in communication systems, with particular emphasis on wireless networks, public safety, and the future of 6G.

There has been an e*volving* focus with a shift from traditional "pipes" of how data is transmitted to broader areas including chip advancements, public safety ,and smart systems. New emphasis on integrated sensing and communications (ISAC) to combine communication infrastructure with sensing capabilities is in place.

The Next-Generation Wireless R&D Gaps Analysis was recently completed in collaboration with NSF, Department of Defense (DoD), and others and identifies technical gaps that are crucial to sustain innovation in post-5G wireless systems. NIST is also listed in the National Spectrum Strategy's Implementation Plan in three of the four pillars as a contributing stakeholder. This strategy aims at promoting innovation in the public and private sectors to maintain U.S. leadership in wireless technologies, with NIST contributing in multiple ways along with many partner agencies. Both strategies are being used to guide and inform NIST's work in these areas.

NIST is also working with CHIPS for America to improve chip-level measurements and evaluate the new chip platforms. NIST is working to develop a development of traceable reference materials for semiconductor chips to reduce cross-lab measurement discrepancies. Contributions to global standards, such as IEEE and 3GPP, to enhance traceability in communication and quantum systems is another area of study that is ongoing.

NIST's research supporting first responders through innovative technologies like indoor mapping, wearable augmented reality, virtual reality technologies, and unmanned aerial vehicles (UAVs) for remote connectivity will improve public safety. Additionally, on spectrum studies, NIST, along with the Department of Energy, are working on a semi-long-term study to help understand how aggregate emissions work in the 6 to 8 gigahertz region for future sharing.

On 6G and AI integration, 6G will improve connectivity, speed, and sensing capabilities, and add AI-native applications and ubiquitous connectivity. NIST's work on radio frequency (RF) propagation and data modeling to advance sensing within communication systems is in development. There have also been partnerships and collaboration with organizations, like FirstNet Authority, for studying technologies for first responders. NIST also collaborates with the NIST firefighting department and will soon be building a firefighting training and test facility near Boulder, Colorado.

For more information, see Dr. Midzor's and Dr. Golmie's presentation.

Discussion. The group discussed the following topics:
- Expanding the study area beyond radio frequencies important for CET fields;
- A skyward emissions study looking at aggregate emissions to satellites;
- Satellite communications as a NIST growth area;;
- Making better use of spectrum by growing the portfolio on connectivity;
- Changes in estimates of interference with propagation models;
- Integral location capability utilizing an external source other than GPS;

- Z-axis testing for location capability in progress at a Boulder campus building stairwell; and
- Common alert protocol proposals on standardized emergency alerts.

CHIPS Metrology Program – *Dr. Marla Dowell, Director of CHIPS Metrology Program and NIST Boulder Laboratory*

Dr. Dowell said the CHIPS Metrology Program is one of the four R&D programs within CHIPS for America as part of CHIPS and Science Act implementation, and advances NIST's measurement science to support the microelectronics industry. The vision for the CHIPS for America program is to ensure economic security, national security, and position the United States for future innovation, and to do that, the United States needs to have a vibrant R&D system, with metrology being critical to such an R&D system.

The CHIPS and Science Act provided $50 billion to the Department of Commerce (DOC) to support incentives, which $39 billion designated to bring manufacturing facilities back to the United States and $11 billion for the CHIPS R&D programs. The $11 billion is distributed across four programs:

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

NIST held a series of workshops in 2022 bringing together over 800 external stakeholders from industry, academia, and other government agencies to identify R&D gaps in metrology for the semiconductor industry. It identified seven Grand Challenges in metrology aligned with the industry ecosystem.

A Small Business Innovation Research(SBIR) program funding opportunity devoted to CHIPS metrology themes was conducted last year. Additionally, the CHIPS Metrology Community was launched, bringing together people inside and outside of NIST to support metrology for semiconductor manufacturing.

The CHIPS Metrology R&D program has funded over 40 NIST project teams in the amount of over $190 million across six of the seven Grand Challenges. These projects are aimed at helping develop new measurement instruments, methods, and measurement-informed models and simulations for advanced microelectronics design and manufacturing.

The SBIR program was developed within five months. Topics were sourced by industry and aligned with gaps in the commercial ecosystem for metrology tools. Open and closed topics were aligned with the seven Grand Challenges addressing specific gaps in industry roadmaps. It was a fast-tracked SBIR program doing Phase 1 and Phase 2 simultaneously, resulting in companies only having to submit one proposal.

Under the SBIR program, the size of the small businesses that are eligible to compete is proportional to the size of the companies in the ecosystem that is being targeted. For semiconductor manufacturing, that means businesses as large as 500 employees could apply under this funding opportunity.

The CHIPS Metrology Community was established so engagement groups can work closely with NIST on topics aligned with the seven Grand Challenges. The goal is to facilitate collaborations to help improve data and knowledge sharing across stakeholders and to inform industry standards.

The Metrology Exchange to Innovate Semiconductors (METIS) launched in September 2024. It will make research and data available in a manner that guards intellectual property, protects U.S. security interests, and is aligned with the approach used by NIST for access to research results. It is self-sustaining to meet future needs.

Dr. Dowell said the Joint Automated Repository for Various Integrated Simulations) (JARVIS) is a project funded under the metrology program under METIS. This project leverages NIST's existing efforts on data sharing and data collection by funding the team to look at digital products and data to address gaps in the semiconductor industry. The team published their first results in May, and as of September, the data had been downloaded 25,000 times, which illustrates the impact this effort is having.

For more information, see Dr. Dowell's presentation.

Discussion. The group discussed the following topics:

- Some chip communication programs will soon be listed on the website;
- Timelines for progress and gaps in the overall program;
- Quarterly reviews by project teams showing that progress is advancing quickly;
- Firefighters' failure analysis techniques and a JARVIS Leaderboard being examples of program success;
- Gaps needing further work being hardware, supply chain security, and documentary standards;
- Information on standards accelerators/incubators can be found in the Standards Summit report;
- Progress report(s) to VCAT on how $190 million was spent on projects and Grand Challenges; and
- The first CHIPS Metrology Community event in November at the IEEE PAINE conference.

Part II: Future Opportunities

Opportunities for Convergence within CETs – A Discussion with VCAT – *Dr. Laurie Locascio, Under Secretary of Commerce for Standards and Technology and NIST Director, and Dr. Chuck Romine, Associate Director for Laboratory Programs*

Dr. Locascio defined NIST CET focus areas to include AI, biotechnology, cybersecurity, quantum, and energy technologies, noting the many discussions regarding the convergence of critical and emergency technology areas over the past few years. Dr. Romine said the Laboratories are working collaboratively across different disciplines to achieve important outcomes, including the incorporation of AI into many key fields.

For more information, see Dr. Locascio's and Dr. Romine's presentation.

Discussion. The group discussed the following topics:

- Collaboration among different Laboratories at NIST, along with external stakeholders and collaborators;
- Context matters with regard to how privacy standards are applied;
- Genomic cybersecurity collaboration with external stakeholders at the National Cybersecurity Center of Excellence (NCCoE);
- Providing useful guidelines for protection when using genomic data;
- Collaboration between the Physical Measurement Laboratory (PML), Information Technology Laboratory (ITL), and Communications Technology Laboratory (CTL) in quantum information science;
- Using a quantum computer with quantum chemistry code to generate training data for AI systems;
- Quantum informatics and computing informs advancing capabilities in chemistry;
- NIST benefitted greatly from the Office of Science Computer Capabilities in the past;
- Serendipity of NIST employees networking in a low-key environment like the cafeteria;
- Having NIST technical leaders sit together and chart out opportunities in CET convergence;
- Differences in combinatory technologies, dependency technologies, and adversarial technologies;
- Lab-wide programs given to staff to explore AI;
- Data becoming the foundation of value principle for advancement in CETs;
- Putting resources together to produce metrics to measure energy consumption of AI;
- Data should be placed on the same pedestal as algorithms; and
- Providing guidance on using information constructively while promoting trust.

SESSION IV: SPECIAL TOPIC HIGHLIGHT

Special Topic Highlight: Disaster Resilience

Disaster and Failure Studies – *Jason Averill, Deputy Director of Engineering Laboratory*

Mr. Averill mentioned how a disaster investigation in 1904 in Baltimore, Maryland burned a quarter to a third of the city, and NIST, having just been founded in in 1901, found that the firefighters couldn't connect their hoses because there were different hose coupling standards. Now, there are only two hose coupling standards. Since

then, NIST has conducted disaster investigations from many different hazards, including earthquakes, hurricanes, fires, and building collapses.

Past disaster investigations completed by NIST included the 2001 attack on the World Trade Center. NIST released reports on the Towers investigation, followed by a report on the collapse of World Trade Center 7. Two other disasters investigated by NIST were the Station Nightclub fire resulting in 100 fatalities in West Warwick, Rhode Island, and the EF-5 tornado that hit the town of Joplin, Missouri in May 2011. A report was issued on how the built environment responded to the tornado.

Two ongoing disaster investigations are the impact of Hurricane Maria on Puerto Rico, looking at how the built environment responded to that specific hurricane along with the infrastructure, and the Champlain Towers South building collapse in Surfside, Florida in June 2021, which resulted in 98 fatalities. The investigations create opportunities for changes to building codes and standards to help prevent incidents like these from happening again. Additionally, Dr. Long Phan and Dr. Marc Levitan were awarded the Service to America Medal recognizing their efforts to implement standards and building codes to make structures more resistant to tornadoes.

Fire Research and Wildland-Urban Interface Fire – *Dr. Matt Hoehler, Chief of the Fire Research Division in the Engineering Laboratory*

Dr. Hoehler said Congress enacted the Federal Fire Prevention and Control Act in 1974, which came in response to alarming findings, including that the United States had the highest per capita death and property loss rates of any industrialized nation, in the 1973 report, "America Burning." This was instrumental in creating the Center for Fire Research at NIST and helped to redouble NIST's efforts in this area. Guidelines have been developed for performance and location of fire alarms in homes, instrumentation used for oxygen consumption calorimetry, and computational software for building fire predictions to help reduce deaths from fire.

Strategic core goals for fire research are as follows:

- Cultivate world-class fire expertise,
- Advance fire measurement and experimental techniques,
- Drive innovation in fire science, engineering, and model development, and
- Deliver fire data and promote the development of codes and standards.

New challenges related to fire hazards are the transition from natural materials to more polymer-based materials in furnishings and construction, which cause fires to burn more rapidly and intensely. Due to climate impacts and changing demographics, wildfires present more threats to people and infrastructure. A focus has been on computational capability to compute high-performance computing clusters, with the goal of getting to centimeter-scale resolution for kilometer-scale problems, which is important for more complex fire chemistries and solid-phase combustion.

NIST has been doing post-fire investigations in the wildland-urban interface (WUI) for almost two decades. Studies begin with a detailed fire timeline, working with local and regional first responders and response organizations, and include an extensive mining of electronic data. Dr. Hoehler gave an example of a case study result of the 2018 Camp Fire, where it was possible to quantify and show temporary fire refuge areas saved lives. The WUI fire is a multidimensional problem, so NIST is identifying issues, characterizing problems, and understanding that the response also includes the community's response.

With the California Department of Forestry and Fire Protection (CAL FIRE) and the Insurance Institute for Builiding and Home Safety (IBHS), NIST created a hazard mitigation methodology (HMM), which is a performance-based framework that helps communities look at structures, parcels, and community-level fire protection. NIST is working actively with the U.S. Fire Administration to make this HMM concept part of the National Wildfire Response Strategy, and the International Building Code is planning on implementing the basic principles underlying the HMM into the 2027 International Wildland Urban Interface Code.

Forward-looking Building Codes – *Dr. Terri McAllister, Deputy Chief, Materials and Structural Systems Division in the Engineering Laboratory*

Dr. McAllister said the Forward-Looking Building Codes is a relatively new program started in Fiscal Year 2023. She defined resilience as the ability to prepare for threats and hazards, adapt to changing conditions, and withstand and recover rapidly from adverse conditions and disruptions. The definition of hazards is changing from past models to include future climate impacts.

The global climate models are based on mean values and have confidence intervals. Regional and local models are downscaled from global models, which further increases the uncertainty. Current engineering standards are based on the tails of stationary distributions, and future hazards require new reliability models to account for non-stationary processes.

NIST has been collaborating with the National Oceanic and Atmospheric Administration (NOAA) and the American Society of Civil Engineers (ASCE) in a partnership that began in late 2021, with support from the University of Maryland. The scope was to identify the needs of the civil engineering community, especially regarding weather and climate information in support of codes and standards. Three workshops were hosted by NIST, NOAA, and ASCE to support the use of climate projections for community resilience planning.

Dr. McAllister said the ASCE 7 is a standard issued every six years and is adopted by the International Building Code (IBC). In 2025, NIST will host four workshops to collect data that will assist NIST in developing a roadmap for advancing building and infrastructure codes.

For more information, see Mr. Averill's, Dr. Hoehler's and Dr. McAllister's presentation.

Discussion. The group discussed the following topics:

- Engaging with the Housing and Urban Development (HUD) agency on building codes;
- Examining changes in building practices and materials;
- Efforts to have 3D-printed concrete replace formed concrete construction;
- Working with the American Institute of Architects (AIA) on creative design works;
- Analyzing incentive structures created by better building codes;
- Proposals backed by science and cost-benefit studies from the applied economics team;
- Concentration of urban and rural habitats on building codes and city layouts;
- Requirements of sprinkler systems in housing;
- Research ongoing about mobility devices starting battery fires in housing;
- Insurance companies trying new ways to model rates instead of being based on broad assumptions; and
- NIST-sponsored Center for Community Resilience developed a tool for modeling the infrastructure, population, and the economy at community scale.

Day 1 Closing Session

There were no public comments. Mr. Matusow thanked the members for attending and staff for making the meeting successful.

Adjournment

The meeting was adjourned at 5:00 PM.

I hereby certify that to the best of my knowledge; the forgoing minutes are accurate and complete.

Ms. Stephanie Shaw, Designated Federal Officer, NIST Visiting Committee on Advanced Technology
Mr. Jason Matusow, Chair, NIST Visiting Committee on Advanced Technology