

VISITING COMMITTEE ON ADVANCED TECHNOLOGY (VCAT or Committee)
MINUTES OF THE February 12th and 13th, 2020 MEETING
GAITHERSBURG, MD

ATTENDANCE:

**Visiting Committee
Members Attending**

Adler, Allen
Alexander, Jay*
Brooks, Rodney
Cerf, Vinton
Fischer, George
Ishak, Waguih
Jackson, Keoki
Khan, Mehmood
Ku, Katharine
Prafullchandra, Hemma*
Sizer, Theodore (Tod)*
Vasko, David (Dave)
Wasserman, Gail

Designated Federal Officer

Shaw, Stephanie

NIST Leadership Board

Boehm, Jason
Brockett, Del
Brown, Essex
Copan, Walter
Dimeo, Rob
Dowell, Marla
Fangmeyer, Bob
Harary, Howard
Jenkins, George
Kimball, Kevin
Kushmerick, James (Jim)
Lin, Eric
Mackey, Elizabeth
Molnar, Mike
Olthoff, James
Romine, Charles
Sastry, Chandan
Singerman, Phillip
Thomas, Carroll
Vaughn, Robert (Skip)
Wixon, Henry

NIST Staff

Acierito, Linda

Andrade, Dorianna
Barbosa, Nick
Bedner, Mary
Bender, Avi
Bittman, John
Carnahan, Lisa
Chin, Joannie
Connelly, Craig
Dodson, Donna
Dohne, Kirk
Eskandari, Tara
Espinal, Laura
Evans, Heather
Fasolka, Michael
Gerskovic, Leon
Gillerman, Gordon
Goldstein, Barbara
Golmie, Nada
Greene, Jeff
Greer, Chris
Griffor, Edward
Hardis, Jonathan
Hendricks, Jay
Hight-Walker, Angela
Holbrook, Dave
Hooker, Stephanie
Huergo, Jennifer
Ivy, Nahla
Jahanmir, Said
Kim, Yekyung (Jennie)
Martin, Natalia
McBride, Timothy
Na, Chuck
Nadel, Larry
Navarro, Magdalena
Porter, Gail
Reidy, Kari
Rimmer, Kate
Rogers, Kelley
Rudnitsky, Robert
Sberegavaeva, Anna
Schlenoff, Craig
Sedgewick, Adam
Seiler, David
Shyam-Sunder, Sivaraj
Silverthorn, Courtney

St. Pierre, Jim
Stieren, David
Stine, Kevin
Strychalski, Elizabeth
Swenson, Gayle
Tabassi, Elham
Tarlov, Mike
Wang, Tom
Weiss, Brian
Wilkinson, Richard
Williams, Carl
Zangmeister, Rebecca
Zielinski, Paul
Zimmerman, Neil

Others

Ambrose, Mitch – American
Institute of Physics*
Alberts, Colin – Freedom
Technologies
Cassady, Amber – Lewis -
Burke Associates LLC
DesChamps, Floyd – The
Denser Group
Gil, Caroline Trupp – American
Chemical Society
Heyman, Matthew – Impresa
Management Solutions

*Participated Remotely

Wednesday, February 12, 2020

Call to Order - Dr. Alan Adler, VCAT Acting Chair

Dr. Adler called the meeting to order at 8:30 a.m. and reviewed the meeting logistics. Jay Alexander, Hemma Prafullchandra, Tod Sizer, and some NIST staff attended the VCAT meeting via webinar. Dr. Adler turned the meeting over to Dr. Copan.

SESSION I: NIST UPDATE

VCAT Elections

Dr. Copan mentioned the absence of Dr. Rita Colwell, the past Chair of VCAT, and welcomed Dr. Adler, who will serve as the Acting Chair along with his role of Vice Chair. The first order of business was an election for the new chair and vice chair.

While ballots were being disseminated to VCAT members to vote, Dr. Copan said the Technical Guidelines Development Committee (TGDC) and NIST have been working together with the Election Assistance Commission (EAC) to develop a new series of voluntary guidelines and standards that would later be accepted by the EAC and thereafter ratified for use as a voluntary guideline by the states and territories of the United States. American National Standards Institute (ANSI) coordinated private-sector inputs for the TGDC. The voluntary guidelines, VVSG 2.0, were accepted by the EAC, and new guidelines will be promulgated later this year.

The results of the VCAT elections were Dr. Allan Adler to be Chair and Katharine Ku to be Vice Chair.

Review Material Presented at the non-Quorum Portion of the October 2019 Meeting and Vote to Include in Annual Report – Dr. Jason Boehm, Director NIST Program Coordination Office

Dr. Boehm briefly discussed the portions from the October 2019 VCAT meeting, The NIST Privacy Framework, US Government and Emerging Technology Standardization – Implications for NIST's Roles, Changing Dynamics in International Standards Development, Industry Stakeholder Panel, and NIST Actions on Equity and Career Advancement for Women and Minorities, which were covered during the October 2019 meeting when there was not a quorum. The Committee acknowledged and accepted these sessions as part of the official record.

For more information, see the summary of the [presentations](#). The presentations are also linked to the October 2019 Agenda.

NIST Update and Agenda Review – Dr. Walter Copan, Under Secretary of Commerce for Standards and Technology and NIST Director

Dr. Copan summarized the program agenda items for both days of the VCAT meeting. He mentioned that on March 3, 2021, NIST will be 120 years old and asked for suggestions on how to celebrate this milestone. He then gave a historical perspective of the act that established the National Bureau of Standards (NBS), signed into law by William McKinley. He also mentioned Vannevar Bush played a role in the nation by formulating a postwar strategy for science and technology. Bush also served on the NBS VCAT from 1942-1946, during which period he also led writing *Science—The Endless Frontier*. Dr. Copan then provided an outline of the NIST update in five key areas.

1. NIST Leadership Changes:

Dr. Chandan Sastry is the new Chief Information Officer. He came from the National Institutes of Health (NIH) where he served as Director of Clinical Research Informatics. Dr. Sastry has more than 25 years of experience leading technology and strategic management projects to support research organizations.

Dr. Copan thanked Dr. Phillip Singerman, who will be retiring, for his leadership in U.S. innovation, technology transfer, and manufacturing competitiveness. Dr. Singerman joined NIST January 2011 after an extensive career in technology-based economic development. Interviews for his successor are under way.

2. Budget Update:

NIST is currently operating under the FY2020 enacted budget of \$1.034 billion, while planning for and developing budgets for FY2021 and FY2022, which are in various stages of development. The FY2021 presidential budget request will focus on industries of the future, but there will be a net reduction of approximately 28 percent in NIST's overall programmatic as well as construction and renovation budget. This will result in NIST having to make challenging choices. The Hollings Manufacturing Extension Partnership Program (MEP) has been reduced from full funding of \$145 million in FY2020 to zero. There has been an increase in the Manufacturing USA program for FY2021. The construction and renovation budget has been reduced approximately 50 percent for FY2021, but negotiations are ongoing with the appropriation committees.

3. Recent NIST Highlights: Dr. Copan summarized a number of recent technical highlights including:

Physical security update, steps have been taken to update the physical security, representing the close partnership with the Office of Security at the Department of Commerce (DOC). There is now 100 percent badge scanning at all gates and has been integrated with the Cyber Lock installation program. National Center for Neutron Research (NCNR) is providing ongoing training and engagement to the Office of Security at the DOC. National Terrorism Advisory System response protocols are in place. People in leadership positions and security services know the steps needed to be taken in case of a threat or heightened alert.

The Privacy Framework was released in January 2020, and many organizations have announced their intent to establish or improve a privacy program using a Ready, Set, Go model and strengthen organizational accountability through collaboration and communication. A special session will be held February 19th at the Center for Strategic and International Studies as part of an ongoing series of outreach; which will focus on research, technology, national security, and defense; and the role NIST will play in linking economic security with national security.

In Face Recognition Evaluation there has been a series of reports issued by NIST on the performance of a product in the face recognition vendor test program, which is provided to the public and policymakers. This is a service to developers of artificial intelligence (AI) solutions and integrated hardware systems supporting AI. The evaluation datasets are sequestered at NIST and represent over 30 million photographs of 12.5 million individuals as part of the testing and validation on how well AI solutions are performing. There has been interest in demographics performances, which will provide transparency so that policy can be formulated without bias. This is generating a substantial interest in Congress, as AI is recognized as a top priority for the U.S.

NIST celebrated the opening of three new X-ray beamlines at the National Synchrotron Light Source II at Brookhaven National Laboratory (BNL). The beamline suite can be used to measure the electronic, chemical, and structural properties of almost any material, often at nanoscale. NIST already has industry-focused partnerships to apply the new beamline capabilities. Programs are under way between NIST, BNL, and industrial partners in catalysis and AI-driven autonomous experimentation.

NIST hosted a selected group of visitors at the National Cybersecurity Center of Excellence (NCCoE), and there was a workshop on the research data framework (RDaF). NIST is now leading a standardization effort, a new RDAF approach across government, academia, bringing together research libraries as well as their registries. The NIH is a strong partner and collaborator in this effort.

NIST has developed a new camera system in fire research. A video was shown of a forest fire that spreads from treetop to treetop that was part of a research fire in the New Jersey Pine Barrens. It was a collaborative program with the New Jersey Forest Service and academic and international partners. The video is available in 360 view in VR headsets and was identified as one of the top VR videos by *Forbes*. The Fire Research Laboratories evaluate how buildings perform in a variety of fire situations and learn about the dynamics of fire propagation through “NIST dragon”, the mode of propagation, the role of embers, where they are coming from, and their velocity in relation to wind velocities.

There have been important safety and performance upgrades, such as the replacement of the relay system in the reactor at the NCNR facility. One of NIST's goals with the National Academies and other partners in the neutron science world is to carry out a national study for the future of neutron sciences to ensure that the United States continues to have an opportunity to have the world's leading neutron science capabilities. The new CANDoR station is in the commissioning phase. It's an exciting new multi-angle capability for neutron scattering at NCNR.

NIST awarded a renewal of a \$20 million cooperative agreement to Colorado State University (CSU) to continue the work of the Community Resilience Center of Excellence. The center has 12 universities partners and is led by CSU and East Carolina University. The center will continue developing computer and field study tools and best practices to lessen the impact of natural hazards on communities and to improve community planning and recovery. The center will also engage communities during development to aid the transfer of these tools to end users.

Forensics is an important research which develops standards to support law enforcement, the first responder community, and a wide range of fields. NIST has renewed the Center for Statistics and Applications in Forensic Science, a consortium led by Iowa State University to support NIST's efforts to advance the probabilistic methods to enhance forensic analysis.

As part of building a culture of innovation technology transfer at NIST, a new pilot program of seed funding for technology maturation was developed called the Technology Maturation Accelerator Pilot, with an initial tranche of \$1 million. There was a significant number of applications. The program focuses on currently existing laboratory technology or intellectual property where translational research is needed to prove feasibility and/or build a laboratory-scale working prototype. A merit review board narrowed the proposals down to ten, which provided a six-minute pitch to a team of venture capitalists.

A gap analysis and recommendations on processes, resources, and structure needed at NIST to support a comprehensive technology transfer program can be scaled beyond NIST-on-A-Chip (NOAC) activities. Greater clarity and adjustments, roles and responsibilities, and resource allocations across NIST are needed. One recommendation is to formalize the role of a technology liaison. Culture change is required especially as related to expectations and processes. Best practices need to be leveraged to ensure NIST is world class in technology transfer.

4. Dr. Copan's FY2020 Priorities:

Priority 1: Advance U.S. Technological Leadership in the Industries of the Future. NIST will continue to expand research efforts in five areas and work to strengthen U.S. engagement in standardization efforts: quantum science, AI, advanced communications/5G, advanced manufacturing, and engineering biology.

Priority 2: Create an infrastructure for 21st century research. NIST must make sure that it has the physical and IT infrastructure to carry out its programs and mission, including the industries of the future and beyond. Sixty-five percent of NIST facilities have not been renovated or newly constructed in the last 20 years. Prioritizing awarding of construction and maintenance funding will be designated for Wing 5 in Boulder, Radiation Physics Laboratory in Gaithersburg, utility infrastructure projects, and predictive maintenance tools and software systems.

Priority 3: Strengthen U.S. Economic Competitiveness: This is a real buildout on the Return on Investment Initiative (ROI). NIST will continue to advance and modernize technology transfer from federal laboratories. Major activities are to raise national awareness of technology transfer opportunities and successes with Manufacturing USA and agency partners, launch a DOC/NIST

competition for a new Manufacturing USA institute, rebuild iEdison reporting system, continue to advance legislative updates to increase ROI, update metrics for Federal Technology Transfer Report, and promote regional technology development and small business engagements.

Dr. Copan's goals for 2020 are to look at the future of NIST's organization and bring to full fruition the organizational realignment to better meet key objectives; advance NIST-wide strategic planning, implementation, and monitoring cycles; develop process improvements; and project a unified messaging of bold initiatives with strategic external relationships that the stakeholder community can rally behind.

5. Recent Awards

Dr. Copan congratulated the following NIST employees for their awards:

- Carl Williams, receiving accolades from the industry and academic community;
- Ron Boisvert, Association for Computing Machinery for outstanding accomplishments;
- Dave Wineland, the Innovation Research Interchange's highest medal;
- June Lau, R&D (Research & Development) 100 Award in the electron microscopy;
- A group of NIST employees recognized by the Ron Brown Excellence in Innovation Award;
- Alan Migdal, Presidential Rank Award;
- Donna Dodson for her leadership in cybersecurity;
- Chuck Romaine for his leadership in a series of initiatives;
- Ian Spielman for his leadership in quantum science;
- Jim Olthoff for his leadership in measurement science;
- Elizabeth Strychalski, Outstanding Young Scientist Award, Maryland Academy of Sciences;
- Naomi Lefkowitz, Fed 100 Award Winner for 2020.

Discussion

The group discussed the following topics:

- Less obtrusive approaches of security for NIST with opt-in program;
- Real-time sensing on the production line for food safety;
- Microbial control strategy for biologics manufacturing;
- 5G Edge applications being created for sensor collection; and
- Importance of synergy between NIST, the National Science Foundation (NSF), and Department of Energy (DOE).

For more information, see Dr. Copan's [presentation](#).

[NIST Safety Update - Dr. Elizabeth Mackey, Chief Safety Officer and Director of the Office of Safety, Health and Environment](#)

Dr. Mackey presented an overview on the status of the safety management system, key metrics to date, lagging indicator incidents, workplace inspection and near-miss data, and highlights of a few special projects.

The NIST safety management system is in the process of formally documenting safety requirements through the directives management system. This is being accomplished through suborders with technical requirements. They cover four areas: occupational safety and health, environmental management, fire and life safety, and radiation safety.

On incident data, with 49 cases reported the first quarter, there have been 19 near-misses and 21 injuries. Of the 21 injuries, 5 were Occupational Safety and Health Administration (OSHA) recordables. There was one illness which was an occupational hearing loss. All of these are being analyzed. Dr. Mackey provided a history over the last 14 years, and so far in FY2020, the results are a bit lower than FY2018 and FY2019, though it is still early, and can change.

Dr. Mackey also reviewed the workplace Inspection Program that was rolled out in 2017. Workplace inspections are performed by staff with assistance from OSHE safety professionals. Annual inspections of

offices are performed. Biannual inspections of spaces with higher hazards including labs and shop are planned. The findings from this program are driving targeted actions of NIST's safety program. For example, of the 10 most frequent types of deficiencies identified during the last half of FY2019, out-of-date door signs ranked the highest, and that subsequently became a focus of NIST Safety Day. Signs are being developed for posting blocked electrical panels, which were caused by aging infrastructure. A new guide to refresh training on chemical labeling is also in development.

Additional concerns around arch beam cranes were also addressed. This type of crane was discontinued and not supported by any manufacturer since the early 1990s. The OSHE inspection team was called, and they recommended hiring an expert to perform testing. Results indicated the welds were not dependable. As a result of this finding, NIST evaluated 14 additional arch beam cranes and determined one of those must be replaced as well. NIST leadership came together and quickly procured equipment. Employees are now able to work safely while a long-term solution is being developed. A Crane Safety Program and Out of Service Program working with OFPM to improve the routine inspection of cranes is ongoing. OSHE continues to work with customers to implement crane safety requirements and facilitate inspections.

It is hoped a new website will be launched the end of the fiscal year, which will provide more easily accessible safety requirements. The biggest challenge is the aging infrastructure, which necessitates the importance of doing upgrades and making sure safety is priorities and addressed.

Discussion

The group discussed the following topics:

- Plan to address loss of costly acquired data and experiments in process; and
- Members of NIST leadership team in Boulder when an underground incident occurred.

For more information, see Dr. Mackey's [presentation](#).

SESSION II: NIST BUDGET UPDATE 2020 ENACTED AND 2021 REQUEST

Overview of 2020 Enacted Budget and President's FY2021 Request - Dr. Jason Boehm, Director of NIST Program Coordination Office

Dr. Boehm provided an overview of the recently enacted FY2020 appropriations for NIST, and the President's FY2021 budget request for NIST. The FY2020 bill provided a \$48.5 million increase over FY2019 budget in these four areas for FY2020:

- Laboratory research programs, \$29.5 million increase;
- Hollings MEP program, \$6 million increase;
- Manufacturing USA program, \$1 million increase; and
- Construction and renovation funds, \$12 million increase.

The Scientific and Technical Research and Services (STRS) funding of \$29.5 million was focused on a variety of projects which will help NIST advance some priorities. There were significant increases quantum science funding (\$10 million), and an additional \$8 million for AI.

The construction funding will be going in two areas: Building One Renovation, \$43 million; and Safety, Capacity, Maintenance, and Major Repair, \$75 million. NIST is working closely with Congress to ensure that NIST gets the resources needed to address its infrastructure needs.

Dr. Boehm next summarized the FY2021 Budget Request for NIST, which contains significant programmatic reductions in order to meet the Administrations' budget priority levels. These include a 13.5 percent reduction to R&D; an 84.4 percent reduction to industry and industrial services programs, which eliminates funding altogether for MEP; and a 49 percent reduction to construction and maintenance.

The President's budget request for NIST would double investment in AI R&D at NIST as part of an overall effort to double federal spending on AI.

For full details see the attached talk.

Discussion

The group discussed the following topics:

- President's focus on building 5G infrastructure and capacity;
- \$640 million from DOE to establish four or five quantum hubs;
- Executive Order for Office of Science and Technology Policy (OSTP) to lead development in positioning, navigation, and timing R&D strategy;
- Concern about future directions of micro-electronics, computing, and telecommunications; and
- Development of backup for the Global Positioning System (GPS) vulnerability to interface.

For more information, see Dr. Boehm's [presentation](#).

SESSION III: NIST FACILITIES PRIORITIES AND DISCUSSION

NIST Facilities Master Plan and Update on Ongoing Projects - Mr. Robert "Skip" Vaughn, Director, Office of Facilities and Plant Management

Mr. Vaughn provided the VCAT with a briefing on the NIST Facilities Master plan, and an update on ongoing renovation projects.

The top ten capital projects have been identified, five for the Gaithersburg campus and five for the Boulder campus. A future meeting with Dr. Copan will determine an integrated prioritization of the projects across both projects and a detailed report will be delivered to Congress in June 2020.

The top five projects identified for Gaithersburg are:

1. New Research Building 228;
2. Building 101 Renovation;
3. Building 221 Renovation;
4. Gate F Shipping and Receiving Facilities for Security; and
5. Building 220 Renovation.

The top five projects for Boulder are:

1. B1 renovation, Wing 5;
2. Building 2 Replacement;
3. Building 3 Addition;
4. Renovate Building 24; and
5. Build new Childcare Center.

On project updates, Mr. Vaughn provided a status update of the Building 245 modernization project. The expansion phase of the project is 99 percent complete, though there were some fume hood and radiation issues needing to be addressed before giving final occupancy. The next phase of the renovation that includes the renovation C Wing is about to begin.

Discussion

The group discussed the following topics:

- Avoid building computational resources in-house and leverage more scalable cloud infrastructures;
- Infrastructure plan for supporting high-performance computer capabilities nationally;
- Study on duct bank system on Boulder campus;
- Emergency design-build projects ongoing due to major mold issues; and
- Small project on Gaithersburg campus for an old Nike missile site.

For more information, see Mr. Vaughn's [presentation](#).

SESSION IV: NIST PROGRAMMATIC PRIORITIES

Priorities for the ADLP and the NIST Laboratory Programs - Dr. James Olthoff, Associate Director for Laboratory Programs

Dr. Olthoff outlined NIST focus areas that are needed to grow engagement and programs because of the importance to the U.S. economy and state of security. The purpose of a focus area is to clearly articulate to internal and external stakeholders what is being accomplished in support of the unique mission and role of NIST. The focus areas are intended to be forward-looking, impactful, and an expression of shared goals by leadership and staff. A focus area requires an increased concentration of resources and represents a commitment of NIST leadership to achieve clearly defined goals. During an off-site in 2019, four grand challenges were identified: quantum science, AI, Internet of Things (IoT), and engineering biology.

For more information, see Dr. Olthoff's [presentation](#).

Quantum Update (QED-C, Standards, and Future Plans) - Dr. James Kushmerick, Director, Physical Measurement Laboratory (PML)

Dr. Kushmerick provided an update on NIST's efforts in the area of QIS (quantum information science). The 20-year QIS program is a direct extension of our core research in precision time and electrical metrology and now represents a \$40.5 million effort.

NIST's efforts in QIS are focused around three coordinated efforts:

- Foundational research emphasizing QIS and metrology;
- Applied research to engineer and improve prototypes in quantum engineering; and
- Realization and dissemination of the units of measurement, the Quantum SI (Système Internationale).

Dr. Kushmerick emphasized the importance for the role of joint institutes—JILA, QuICS, and the Joint Quantum Institute as critical elements of NIST's quantum portfolio. The joint institutes help attract world-class scientists, train students and postdocs, and accelerate the transfer technology.

The NQI (National Quantum Initiative) legislation calls out key roles for NIST in the Quantum Institute Science (QIS) realm, with emphasis being placed on R&D and standards.

The NIST QED-C (Quantum Economic Development Consortium) is thriving. There have been six plenary meetings since it was stood up. Recent meetings have had over 100 industry participants. There have been workshops on specific areas of technical need on cryogenics, materials and losses in superconducting qubits, and control electronics. NIST is responsible for helping to support the operational budget for the first 5 years of QED-C. The new funding for quantum in FY2020 will fully support the operations of the QED-C as well as joint R&D efforts among the partners.

NIST is engaged in quantum standards activities in ITU-T (International Telecommunications Union Telecom). It is important to understand and safeguard the standards landscape and will allow U.S. to have a leadership role through engagement.

NIST is focusing its forward-looking quantum efforts around the concept of a quantum network grand challenge. This effort will leverage the NIST world-leading quantum science portfolio to develop a simplified quantum network as a proof of principle, but also to identify and understand potential bottlenecks and technology shortcomings. The immediate goals of the effort are to develop local testbeds, determine interface specifications for plug-and-play components, and characterize components and networks while developing a metrology framework. This fundamental research will provide a foundation for robust standards to retain U.S. leadership in the QIS ecosystem.

NIST will convene a meeting on May 11th with the Quality Infrastructure Committee leaders from AFRL (Air Force Research Laboratory), DOE, NSF, and NASA (National Aeronautics and Space Administration) to coordinate efforts to build the quantum internet.

Looking forward, NIST will continue QED-C leadership and facilitate a unified interaction strategy for quantum networks, leverage existing expertise to develop a quantum network testbed, maintain a strong presence in relevant standards development bodies, and explore the possibility of a joint quantum engineering center.

For more information, see Dr. Kushmerick's [presentation](#).

Artificial Intelligence Update (Overview of Future Plans) - Dr. Charles "Chuck" Romine, Director, Information Technology Laboratory

Dr. Romine provided an update on NIST's efforts in AI. Dr. Romine outlined a vision for NIST to become an authoritative source of measurement tools, capabilities, and data necessary to define, develop, and evaluate a trustworthy AI. With respect to ITL, NIST's entire purpose is cultivating trust in information technology (IT) and metrology, so having trustworthy AI is critical to the organization. The program has two major components: fundamental research activities to measure and enhance the trustworthiness of AI systems and the application of AI to revolutionize metrology.

NIST is well represented in interagency activities focused on AI including on the Select Committee on AI made up of Cabinet-level representatives, which is chaired by OSTP, NSF, Defense Advanced Research Projects Agency (DARPA), with Dr. Copan representing Department of Commerce and NIST's interests.

Dr. Romine updated the VCAT members on NIST successful efforts to develop a standards engagement strategy for AI as called for in the Executive Order on Maintaining American Leadership in Artificial Intelligence. As part of this effort NIST issued an RFI (Request for Information) and held a series of public workshops. On August 10, 2019 NIST the standards engagement plan that highlighted four major recommended actions:

- Coordination: bolster AI standards-related knowledge, le, and coordination among federal agencies;
- Research: promote focused research to accelerate broader exploration and understanding of how trustworthiness can be incorporated within the standards;
- Partnership: support and expand public-private partnerships to develop and use AI standards; and
- Engagement: strategically engage with international parties to advance AI standards for U.S. economic and national security needs.

There has been a lot of discussion in the press about the fairness and ethics of AI, and while they sometimes do incorporate technical requirements for trustworthiness, many aspects of those concepts are not based solely on technical means. NIST refrains from discussing AI ethics regarding the program because the goal is technical requirements for what constitutes trustworthiness in AI systems. NIST needs to identify risks associated with development and adoption of AI to be effective.

NIST is stepping up its efforts looking at security related aspects of AI. NIST released a draft terminology and taxonomy for Adversarial AI in the Draft NIST Interagency Report 8269 and established a testbed at the NCCoE in collaboration with MITRE to evaluate AI vulnerabilities.

NIST is also actively applying AI to its measurement science mission, and to numerous application areas. In partnership with PML, there has been some development in Boulder on spike-based computing, a neuromorphic style of computing, trying to emulate the spiking that neurons do in the human brain. There is a significant amount of ongoing AI-focused activity in MML targeting advanced materials discovery under the code name of JARVIS (joint automated repository for integrated simulations), which will support some of the work on theory of materials such as density functional theory. In the NCNR is a perfect example on how machine learning can be used to inform experiment design. The reference datasets for SANS (small angle neutron scattering) for machine learning is an illustration of how it is already being used at NIST. In its beginning stages is neuromorphic computing utilizing novel hardware, which may be a significant increase in AI capabilities for the future.

For more information, see Dr. Romine's [presentation](#).

Internet of Things (Future Plans) - Dr. Marla Dowell, Director, NIST Communications Technology Laboratory (CTL)

The IoT (Internet of Things) is a newer priority area for NIST, and there has been an ongoing discussion on how much of a role NIST should play in this area. What has been decided is the role NIST plays in IoT, which is assuring the trustworthiness of IoT systems by developing quantitative metrics, standards, and guidelines. The mission-critical areas are public safety and industrial applications. NIST will initially focus on industrial IoT applications where confidence in trustworthy IoT solutions would prove most beneficial.

The IoT is about the engineered physical systems that are integrated with networking, data, and computational systems that are linked via transducers and sensors. Currently, the global IoT market is worth about \$150 billion, but it is expected to grow to over a trillion by 2025. NIST has many programs that can support IoT. Most of these programs reside in CTL, EL (Engineering Laboratory), and ITL.

One of the challenges is charting a cohesive program. NIST's IoT portfolio includes measurement capabilities, standards, and applications. Standards is a critically important role, and NIST will be emphasizing the industrial applications.

Grand challenges for NIST are SI (International System of Units) traceability for communication, e.g., scattering parameters, RF (radio frequency) power and noise, antenna parameters, materials characterization, interference and cross-frequency phases. Some new challenges that need more development are over-the-air testing, dynamic measurements, system-level metrology, component-level testing, and traceable standards for 5G and beyond. Partnerships have been formed with CITA (Council of Interstate Testing Agencies), 3GPP (3rd Generation Partnership Project), and IEEE (Institute of Electrical and Electronics Engineers) to host the 5G Millimeter-Wave Channel Model Alliance to help inform the kind of programs needed that will provide the most impact.

A grand challenge in the IoT area is the industrial IoT testbed. NIST will create a metric based IoT testbed uniting NIST expertise from ITL, EL, CTL, and PML, in wireless communications, manufacturing, and AI. Standards-based security controls have been established for manufacturers in a NIST Cybersecurity Practice Guide. The NCCoE, NIST 5G Alliance, and the NIST Industrial Wireless Technical Working Group, NSF Platforms for Advanced Wireless Research and Manufacturing USA Institutes are all contributing to this effort.

For more information, see Dr. Dowell's [presentation](#).

NIST and the Bioeconomy (Future Plans) - Dr. Eric Lin, Director, NIST Material Measurement Laboratory (MML)

Dr. Lin gave an overview for engineering biology. In October 2019 there was a whole-of-government effort to position the U.S. to maintain its leadership in the "bioeconomy", namely the industries and services that have risen from advances in biotechnology. Biotechnology was added as an industry for the future in the administration's FY2021 budget priority memoranda. Bio NIST is working to expand its programs in this space and align its capabilities with federal partners like the Department of Defense (DOD), which has also identified biotechnology as one of the technologies that will be essential for force modernization.

NIST is closely engaged with the Interagency which largely takes place through the National Science and Technology Council where there are two efforts looking at bioscience, and biodefense. These groups are working to coordinate federal efforts to: identify the foundational research needs for the nation; develop strategies to best utilize and protect biological data; and to develop approaches to identify and address expertise needs within the federal government. The Biodefense Subcommittee is working in similar areas and the common theme is to promote economic activity and protect national assets.

The NIST investment into the bioeconomy is \$30.5 million. The majority of NIST's efforts reside in the Material Measurement Lab within the Biosystems and Biomaterials Division and the Biomolecular Measurement Division. NIST also maintains to partnerships with Universities in this space: the Institute for Bioscience and

Biotechnology (IBBR) in collaboration with the University of Maryland; and the Joint Initiative for Metrology in Biology (JIMB) a nascent collaboration with SLAC National Accelerator Laboratory in California.

In the area of Engineering Biology NIST is focusing on a grand challenge to develop a new measurement infrastructure that will provide quantitative measurements and standards for the engineering of complex living systems and processes. The grand challenge is focused on 2 main efforts. The first approach is to build and deploy unique platform technologies that integrate flexible automation, innovation measurements, manufacturing technologies, machine learning, and AI to study and measure complex biological systems and the second approach is to develop and deploy measurement assurance strategies and living cell-based reference materials.

For more information, see Dr. Lin's [presentation](#).

Discussion

The group discussed the following topics:

- Monetization of fee structure for membership of QED-C;
- Connect different quantum processors and link them to do larger calculations;
- Competition for acquiring talent in AI for NIST;
- Develop capability to validate devices to protect public and manufacturers;
- Concern over interaction of IT and IoT resulting in practice guides from NCCoE;
- Commercial liability insurance for corporations around IoT;
- More framework focus on health care industry for wireless connectivity in addition to industrial; and
- Need for research on the ability to measure the age of a cell.

Priorities for the ADIIS Programs - Dr. Phillip Singerman, Associate Director for Innovation and Industry Services

Dr. Singerman provided an overview of the connection of the extramural programs to the NIST mission, the legislative authorities under which they operate, the high-level summary of the people and budget, the leadership teams, and the highlights of major activities and connections for the Baldrige Performance Excellence Program and the Technology Partnerships Office (TPO). Dr. Singerman stated it is important for the Innovation and Industry Services (IIS) to broaden and deepen its internal connections with NIST colleagues as well as expanding and leverage the external connections.

Dr. Singerman gave a historical background of IIS and an overview of the Manufacturing USA Program, the Manufacturing Extension Partnership Program (MEP), the Baldrige Performance Excellence Program (BPEP), and NIST's roles and responsibilities with Technology Transfer in order to set up the more in-depth discussions of Manufacturing USA and MEP.

For more information, see Dr. Singerman's [presentation](#).

Manufacturing USA – Current Status and Future Plans - Mr. Michael (Mike) Molnar, Director, Office of Advanced Manufacturing

Mr. Molnar provided an overview on Manufacturing USA providing an update on the NIST funded Institute, The National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), and recent changes to the legislation that authorizes the Manufacturing USA Program.

The Manufacturing USA Program consists of 14 institutes (soon to be 16) with all but one funded by either DOE or DOD. Together the Institutes have convened over 1,900 members, consisting of companies and academia, with 476 major collaborative R&D projects. Two-thirds of the members are manufacturers from which two-thirds of those are small manufacturers. The NIST funded institute, NIIMBL was launched in March of 2017 with a 5-year, \$70 million cooperative agreement, which catalyzed \$189 million in public-private partnership. Currently there is a \$50 million active portfolio of projects in technology development, applies research

products, education and workforce. The new \$165 million (funded through state efforts), 200,000-square-foot headquarters is scheduled to open at the end of March. NIIMBL has 140 members from all the big pharmaceutical companies, 41 research institutes, and academia.

The Global Leadership in Advanced Manufacturing Act (GLAM), which passed as part of the National Defense Authorization Act, reauthorized the Manufacturing USA Program and made some significant positive changes to NIST authorities with respect to the broader program. Specifically, the legislation:

- Provides NIST the ability to renew federal funding for any manufacturing institute meeting performance standards;
- Emphasizes the importance of education and workforce development;
- Provides authority for pilot programs and public service grants in support of any institute;
- Encourages the establishment of new advanced manufacturing institutes; and
- Creates a new mechanism to facilitate private or nonprofits joining of Manufacturing USA network.

The FY2020 Appropriations provided NIST with an additional \$1M to support technology road mapping activities. A Notice of Funding Opportunity is being developed for this purpose and launched later this year.

Mr. Molnar also provided an update on Chinese efforts to model the Manufacturing USA program as part of their Made in China 2025 initiative with a \$300 billion investment. As part of this effort China has established 12 institutes.

For more information, see Mr. Molnar's [presentation](#).

Manufacturing Extension Partnership – Priorities for the Coming Year - Ms. Carroll Thomas, Director, Hollings Manufacturing Extension Partnership

Ms. Thomas described MEP as a national network of partners and networks, which has over 1,400 manufacturing experts and nearly 2,100 service providers and partners. There are approximately 375 service locations. With over 3.7 million miles of space in the U.S., the MEP program has a location between 2 and 3 hours of every manufacturer.

Based on data collected by a third-party contractor it was estimated that in FY2019 MEP services contributed to the creation or retention of over 114,000 manufacturing jobs.

MEP is working to ensure that it can support U.S needs regarding advanced manufacturing. As such MEP is working to expand its collaboration with the different Manufacturing USA Institutes. Currently these efforts are focused on the programs targeting manufacturing 4.0. NIST/MEP hopes to award three different projects up to one million each on April 1, 2020, which will help build capabilities to deliver to manufacturers over the next three years.

MEP is also working to enhance its collaboration with the NIST Laboratories through the MEP-Assisted Technology and Technical Resource (MATTR) program that is intended to enable MEP clients to get access to and work with NIST laboratories. The effort is in its early stages. One CRADA was initiated in 2019 and a second one will be initiated in February of 2020.

Another key MEP activity over the past year has been the steps it has taken to expand national cybersecurity awareness among small to medium-sized manufacturers. There have been over 30 awareness events nationwide with over 3,500 attendees. The MEP handbook providing additional guidance on the implementation of the NIST Cybersecurity Framework for small and medium manufacturers has been downloaded more than 100,000 times.

For more information, see Ms. Thomas' [presentation](#).

Discussion

The group discussed the following topics:

- Shortening cycle time for Baldrige Award competition;

- How much funding did MEP get from DoD in 2019 and 2020;
- Automotive industry going more electric in the future resulting in supply base changes and unemployment;
- Power generation associated with electric motors and smart grid program;
- Carroll Thomas stepping in as Acting Associate Director for Innovation Industry Services when Dr. Singerman leaves; and
- Essex Brown is the Acting Director of Human Resources while Susanne Porch is on a special detail.

SESSION V: EFFORTS TO STRENGTHEN THE NIST ENVIRONMENT

Update on NIST Equity Efforts - Dr. Heather Evans, Subcommittee on Safe, Inclusive Research Environments

Dr. Evans provided an update/overview of the progress of the Steering Group on Equity and Career Advancement. She stated the mission of the Steering Group on Equity and Career Advancement is to identify the causes of apparent inequities and promotions at NIST which are observed based on data analysis. Inclusivity is one of the core values.

An external study of promotion disparity is prominent and ongoing. The contract was awarded to COACH, which is a grass-roots organization that is working to increase the number and career success of women scientists and engineers through innovative programs and strategies at University of Oregon. Beginning the end of September, there is an 18-month plan of work that is currently on track. A preliminary prevention plan was provided to senior management at the end of January. A survey of our staff and focus groups will be held in March and April of 2020.

There was an open call for proposals for rotational assignments to study equity, diversity, and inclusions. Nine proposals were received from staff in Boulder, Charleston, and Gaithersburg and two were selected. The first was awarded to Mary Theofanos who will be working on assessing the inclusivity of women at NIST by using behavioral science mixed methods. The second was awarded to Laura Espinal who will be working on an inclusivity network analysis, trying to measure the inclusivity, however the challenge is how to incorporate the study to include associates, postdocs, and federal employees. Both studies are on track.

The Human Resources (HR) team is currently looking at different vendors to try to get ideas about new course themes to be offering staff. A brand-new mentoring program provided by the vendor that HR staff is working with currently has 75 mentees that have been selected randomly as well as people who volunteered to be mentors. The training is targeted for March 2020.

NIST is piloting an Organizational Ombuds pilot to provide support and assistant to members of the NIST community in addressing work-related conflicts. It is going to be structured in line with best practices of the International Association for Ombudsmen. Its intent is to round out resources that are available to members of the NIST community.

A Learning from Experts session will begin to bring real-world stories to NIST employees. The first two speakers are Mr. David Vasko, Director Advanced Technology, Strategic Development, and Michelle Mathai, Director of Culture of Inclusion and Diversity, to tell the story about what Rockwell Automation has done over the last decade or so.

There are ongoing efforts to better understand issues where equity inclusion and diversity are happening that require attention and action. Some of the laboratories are looking at starting salaries offered in the past, as well as data and outliers, thinking about processes. This will be leading into promotion, philosophies, and practices that can lead to more fairness and equity.

For more information, see Dr. Evan's [presentation](#).

Update on Rebranding Efforts – Ms. Gail Porter, Director, Public Affairs Office

Ms. Porter gave an update on the steps NIST is taking to improve its stakeholder communications, and the need to reevaluate and perhaps update our brand.

A major challenge to NIST's stakeholder communications is the decentralized nature of the organization, and general lack of consistency in message which dilutes and obscures NIST's visual identity. Branding requires discipline, and it is important to strive for a One NIST brand.

As a first step in strengthening our communications and outreach, the NIST Public Affairs Office conducted an independent review of NIST outreach, media relations, Web content, social media, internal communications, institutional branding, and the Public Affairs office overall. The seven National Experts that conducted their reviews were consistent in their opinion that NIST should strive to be a branded house and not a house of brands as it currently stands. A well-articulated brand will not be enough so long as a large portion of NIST communications happens outside of Public Affairs. Uncoordinated messaging, including competing outreach among internal NIST organizations, hurts a unified NIST brand. To achieve measurable strategic communications goals, NIST needs discipline and consistency in messaging. What is needed is centrally directed, responsive communications outreach that considers internal needs but, is not competing with them.

A statement of work has been written, and currently Public Affairs is seeking to buy services from a credible company to do a constrained branding study, looking at mostly visual identity, logos, and messaging. The targeted key audiences are NIST staff, customers and collaborators, decision-makers and influencers, new media, and the science-interested public. The 2020 priority areas are advanced manufacturing, quantum science, cybersecurity, AI, bioengineering, advanced communications, and return on investment.

These activities are also aligned with the goals of the NIST Strategic Plan and will be a focus over the coming year.

Discussion

The group discussed the following topics:

- Making sure there is a diverse slate of selection when there is an open position;
- VCAT helping with budget to strengthen NIST equity efforts during competition for positions;
- When seeking inclusion and diversity, include people with disabilities in that framework;
- How to approach employees with disabilities and privacy concerns;
- Creating a culture where employees with disabilities are comfortable with self-identification;
- Members of veteran's groups is good area to hire for diversity;
- NIST overview posted on internal Web needs to be used more by employees when describing NIST;
- Bring in social media experts to help get NIST message out;
- Making recruitments as a targeting audience for messaging;
- When creating policy for branding, make sure it is enforced by all employees and not an opt-in exercise;
- Clearly defined logo and template on NIST website for others to find externally;
- Addressing external abuse of NIST logo on websites.

For more information, see Ms. Porter's [presentation](#).

Thursday, February 13, 2020

Call to Order - Dr. Alan Adler, VCAT Acting Chair

SESSION VI: VCAT WORKING SESSION

Dr. Adler called the meeting to order at 8:30 a.m. and turned the meeting over to Dr. Copan. Dr. Copan then presented Dr. Rodney Brooks with a plaque of gratitude for his contributions to the VCAT, as his term ends May 2020.

VCAT Working Session

Dr. Adler asked VCAT members to make observations, ask follow-up questions, or provide suggestions about the VCAT presentations from Day One.

Mr. Fischer stated the sharpness and communication capability of the mission seems to be continually improved. Though it is great to market NIST globally, the unfunded mandates dilute the great work NIST does. He agrees that NIST needs a clarified branding capability, which requires a strategy with focus on buy-in and policies for all departments to make it effective. As standards and approaches are developed in privacy frameworks, it is critical to understand the economic impact. NIST needs to come up with innovations to use standards that lower the cost of compliance. The building renovations need to be addressed more clearly to attract funding. NIST is going in the right direction with its diversity goal in creating opportunities for all genders, disabled, and veterans. A proactive recruiting tool will attract more diverse partnerships.

Mr. Vasko stated on technology transfer, the technology liaison is going to be a good start to create more connections and help pull things out of the laboratory. Engaging industry in discussions, two-way communication back and forth, to obtain better feedback will also aid in this effort. On diversity and inclusion, NIST has good company culture as a base and believes it will be easy to build upon that.

It was stated that the way to overcome the stigma of government regulation with some industries is to emphasize that NIST is here to help. It may be beneficial to have a technology concierge where companies could come to NIST and bring issues around technology, measurement, and standards, which would help with navigation to companies of all sizes to the right point of contact.

Dr. Brooks said a cycle of feedback is better than only one pitch, as it lets people understand what is important to the outside world in a sharper way. NIST has some excellent datasets, e.g., MNIST, face dataset, but these datasets are getting built in totally ad hoc ways and developing guidelines for dataset building would bring uniformity to the enterprise. Ms. Tabassi replied that she calls this "data characterization," and the AI resource center will help in this effort with guidance tools, software, and documents. Dr. Brooks gave an example of dataset production of Amazon Turk workers, whose motivation is only to get paid and not achieve a task. This kind of measurement is not a good interface, so sociological findings are needed to fit within the framework. Ms. Tabassi said there are cognitive scientists working on the team. Even though the White House gave a mandate on AI, Dr. Brooks cautioned for NIST to be careful to not make every experiment at NIST involve an AI component.

Dr. Copan mention that NIST is taking a metrology-forward view of AI to then provide a trusted analysis of the data and to disclose bias, which will inform the research agenda. AI can be a productivity improvement tool and force multiplier at NIST and part of what the organization is trying to accomplish.

NIST provides a safe, sophisticated, knowledge-rich gateway to innovation, whether it's corn, AI, security, privacy, building services, quantum testing, so the framework concept.

Dr. Cerf said figuring out how to measure, how well you have secured a system based on frameworks and guidelines at NIST is still a tough problem, and in addition to a trusted AI, hard metrics for a trusted security

should also be developed. He also pointed out the need to help U.S. Patent and Trademark Office adopt better standards on approving software, and a thirdly was on position navigation and timing, how vulnerable the existing GPS systems are. Dr. Cerf suggested seeking another credible source besides VCAT to let the Office of Management and Budget know the cost for repairs and maintenance have been inadequately supported. The issue of software reliability also needs to be examined. The way IOT devices are being built to simply grab software and ignoring future upgrades and maintenance was given as an example, which results in bugs proliferating in the software. He also suggested in the area of post-quantum crypto that it would be good to have an alternative to the public key crypto, which is dependent on factorization. Demonstration of capabilities in laboratories only go 10 percent of the way to a product. A concept like Small Business Innovation Research may be one way to help with risk reduction in this effort. He wanted VCAT to be aware that the European Parliament adopted a resolution which calls for strong oversight of AI technology. Dr. Cerf expressed concern about safety, security, and reliability associated with IOT when it comes to human interactions with robots, and a need for detection on analytic discovery of brittleness in algorithms. Ms. Tabassi said the secure AI is addressing this, and NIST is working with both DARPA and the Intelligence Advanced Research Projects Activity IARPA Intelligence Advanced Research Projects Activity.

Dr. Jackson said having something quantitative, recognizing the evolving nature of the threats base, in a known threat university would be helpful on the topic of security and standards. The notion of mission creep is a concern. Due to fundamental political decisions that need to be made that are out of the scope of the NIST mission, it is important to say within scope. The provisioning of cybersecurity capabilities to small and medium enterprises is an area that needs further development for the nation. Microelectronics is an area in need of expanded attention, which is a place where NIST could establish some standards. Dr. Jackson had concern of explainability and AI, generating trusted data for communications and looking at adversarial networks to evaluate the brittleness of algorithms. Ms. Prafullchandra suggested getting a legal perspective on outcomes of AI used in business practices may be useful.

Dr. Folena-Wasserman said more can be done by connecting scientists with the scientific community, whether through social media or other sources, which will help with the NIST brand. More needs to be done to explore applications, and NOAC may be a place to accomplish this.

Ms. Prafullchandra addressed a question to Dr. Copan on clarification on where cybersecurity and privacy fit on the priorities for NIST. She said one can put data science together with AI, but it also applies to IOT, so where does IOT fit in? Dr. Copan said they will make sure the messaging is not washed out around the industries of the future and will continue to be reflected on a continuing basis in NIST presentations and stories. Regarding datasets and reference, what is the role of NIST going forward with so much reliance? Is there a need for open source to make sure the software and algorithms are being vetted? Ms. Prafullchandra mentioned that NIST should get kudos for the work it puts in the public domain and build around that. She also thought getting external feedback from private sector on diversity and the cost to achieve diversity would be helpful, and then a second area would be how to maintain when competing with the private sector for retention. She believes more work needs to be done to bring technologies, such as the Privacy Framework, to small businesses. She also wanted to know if there are specific areas that need emphasis or need to be highlighted in the annual report as urgent to be assigned or allocated to the budget, and Dr. Copan said it is a very important area for emphasis due to the critical nature of cybersecurity threats.

Dr. Sizer stated AI is really a tool more than a topic and should be addressed by NIST.

Dr. Ishak commented on Mr. Molnar's presentation as being amazing. About manufacturing, he thinks NIST needs to do a better job in sharing the vision of being a world's leader in creating critical measurement solutions and promoting equitable standards. He wanted more clarification about definitions of trustworthy AI, 5G, and quantum information science. He commends NIST management for choosing the areas of trustworthiness, resilience, safety, reliability, security, and privacy as important topics. On quantum information science, Dr. Ishak wanted to know if the work NIST is doing in entangling independent qubits is going to be explored further. NIST should lead in setting standards on 5G. VCAT should do more to defend the budget for NIST. Perhaps focus historically and postulate what would have happened if NIST did not over the last few decades.

Dr. Copan emphasized that it is the constancy of purpose to benefit the U.S. that NIST wants to make sure is clearly articulated to Congress and the administration.

Dr. Adler commented that during his time on VCAT, he believes there are two messages to relay. The external message is how much NIST contributes to the nation and they need better funding. The internal message is the NIST must protect the brand. He cautioned, however, about selling things too hard, as it might damage the brand.

Administrative Business

In closing, Jason Boehm provided a summary of takeaways from VCAT members' comments to go in the annual report. He will send a written summary to the members via email after the meeting for concurrence. Some of the highlights Dr. Boehm brought forth were that there were major discussions around NIST and national priorities, specifically focused on quantum science and AI. NIST's changing role in the digital economy and emerging technology standardization as well as efforts to strengthen NIST technology transfer was also discussed at length during the meeting. A big focus is on the future plans for the NCNR.

Dr. Copan thanked the entire VCAT for investing their time and expertise with NIST to improve the mission of this institute for the nation and to ensure that for the next 120 years will remain relevant and important for the future of America. He again thanked Dr. Brooks for his contributions over the last six years.

There were no public comments offered.

Adjournment

The meeting was adjourned at 11:00 AM.

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

Stephanie Shaw, Designated Federal Officer, NIST Visiting Committee on Advanced Technology
Dr. E. Allen Adler, Chair, NIST Visiting Committee on Advanced Technology