VISITING COMMITTEE ON ADVANCED TECHNOLOGY (VCAT or Committee)
MINUTES OF THE JUNE 8th, 2021
WEBINAR MEETING

ATTENDANCE:

Visiting Committee Members Attending
Adler, Allen
Cerf, Vinton
Fischer, George
Ishak, Waguih
Jackson, Keoki
Kaler, Eric
Khan, Mehmood
Ku, Katharine
Sizer, Theodore (Tod)
Vasko, David (Dave)
Wasserman, Gail

Designated Federal Officer
Shaw, Stephanie

NIST Leadership Board
Bahar, Mojdeh
Boehm, Jason
Brockett, Del
Brown, Essex
Chin, Joannie
Dimeo, Robert (Rob)
Dowell, Marla
Fangmeyer, Robert
Hooker, Stephanie
Ivester, Rob
Jenkins, George E.
St. Pierre, James (Jim)
Kushmerick, James
Lin, Eric
Mackey, Elizabeth (Liz)
Molnar, Mike
Moon, Sesha
Olthoff, James K.
Romine, Charles (Chuck)
Sastry, Chandan
Vaughn, Robert (Skip)
Wixon, Henry

NIST Staff
Acierto, Linda
Andrews, Anne
Antonishek, Brian
Averill, Jason
Balachandra, Anita
Barrett, Claire
Boeckl, Kaitlin (Katie)
Brown, Hannah
Chang, Walter
Chukran, Melinda
David, Lindra
Dohne, Kirk
Dunaway, William
Espinal, Laura
Evans, Heather
Fasolka, Mike
Fato, Hope
Fetsko, Melissa
Folk, Alex
Gayle, Frank
Gendron, Cheryl
Gillerman, Gordon
Glenn, Rachel
Glick, Millie
Goldstein, Barbara
Hanna, Nancy
Hardis, Jonathan
Healy, William (Bill)
Hickernell, Robert (Bob)
Hildebrand, Jacqueline
Hoehler, Matthew
Huergo, Jennifer
Ivy, Nahla
Jahanmir, Said
Jeanette, Benjamin (Ben)
Kelsey, Richard
Keys, Mirta
Materese, Robin
Mattson, Bruce
Meritis, Dimitrios
Orji, Ndubuisi (George)
Porch, Susanne
Reidy, Kari
Rimmer, Catherine (Kate)
Rogers, Kelley
Rosa, Jennifer
Rowland, Carolyn
Rudnitsky, Robert
Saundry, Claire
Sberegaeva, Anna
Schlatter, Katie M.
Schlenoff, Craig
Schroeder, Melissa
Schufreider, Jim
Seiler, Dave
Shyam-Sunder, Sivaraj
Silverthorn, Courtney
Strouse, Gregory
Sullivan, Suzanne
Szuchyt, April
Taylor, Michael
Teske, Michael
Theofanos, Mary
Ufford, Donald
Varadi, Laslo
Varia, Dharshan
Vickery, Ben
Vouras, Peter
Wang, Tom
Wavering, Al
Wilkinson, Richard
Wollman, David
Yao, Jue
Yashar, David
Yuter, Stephen

Others
Bauer, Julia – Science Policy News Branch of the American Institute of Physics
Bilek, Katie – CoFounder & Partner | govmates
Cassady, Amber – Lewis Burke Associates LLC
Fakes, Paul – ASME Government Relations
Johns, Bethany – Association of Public and Land-grant Universities
Lewis, Priscilla – COACh, University of Oregon
McGee, James (Jim) – The National Academies of Science
Offutt, Martin – The National Academies of Science
Reichmanis, Elsa – Professor and Carl Robert Anderson Chair in Chemical Engineering at Lehigh University
Richmond, Geri – University of Oregon

Others Continued

Rohlfing, Celeste – American Association for the Advancement of Science (retired)

Slaughter, E. Sarah – Founder and President of the Built Environment Coalition

Stockard, Jean – Professor Emerita, University of Oregon

Tucker, Jane – COACh, University of Oregon

Webber, Naomi – Lewis Burke Associates LLC

Tuesday, June 8, 2021

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

Dr. Adler called the meeting to order at 10:03 a.m., reviewed the meeting logistics and took roll call. Dr. Adler turned the meeting over to Dr. Olthoff.

SESSION I: NIST UPDATE – PROGRAMMATIC UPDATES, SAFETY, AND INFRASTRUCTURE

NIST Update and Agenda Review – *Dr. James K. Olthoff, Performing Non-exclusive Duties of the Under Secretary of Commerce for Standards and Technology and NIST Director*

Dr. Olthoff began by acknowledging outgoing VCAT members, Jay Alexander and Tod Sizer, for their contributions, time, and experience. He continued with a brief overview of the agenda.

During Session I Dr. Olthoff described current activities at NIST, including the status of the NCNR (NIST Center for Neutron Research), along with plans for post-COVID telework and an outline of how NIST expects to re-open the Boulder and Gaithersburg campuses.

Session II will provide an assessment of NIST's laboratories, including conclusions from a recent evaluation by the National Academies of Science, Engineering, and Medicine (NASEM) of the Material Measurement Laboratory (MML) and the Engineering Laboratory (EL).

Session III will describe the evolving priority landscape and address topics such as the new administration's budget overview, plans for the Manufacturing Extension Partnership (MEP) and Manufacturing USA, and the NIST standards development process for emerging technologies. New Executive Orders aim to enhance the nation's cybersecurity, secure America's supply chains, and ensure that the future manufacturing economy is made in all of America by all of America's workers. Dr. Boehm will provide an overview of funding opportunities and describe how the CHIPS (Creating Helpful Incentives to Produce Semiconductors) Act may present some challenges.

Session IV will describe NIST's efforts in diversity, equity, and inclusion (DEI). There will be a fireside chat with the new NIST Director of DEI, Dr. Sesha Moon; a presentation from COACh, a grass-roots organization in the U.S. that is working to increase the scientific success and leadership capacity of women scientists and engineers, on data-driven studies of promotions in STEM (Science, Technology, Engineering, and Mathematics) fields; and presentations on the results of an analysis on the inclusivity of women at NIST and the network analysis.

Session V will provide an update on the progress of new initiatives at NIST in the strategic planning phase.

Dr. Olthoff briefly summarized the key priority areas of NIST laboratories and programs. Artificial intelligence continues to be a high priority and there are ongoing advisory groups and workshops in progress, with a focus on trustworthiness.

Quantum technology also continues to be a NIST priority. There has been a lot of press on two entangled mechanical drums. Celia Merzbacher, who has an extensive background in many aspects of government and industry, has been appointed executive director of The Quantum Economic Development Consortium.

NIST Impact. An extraordinary engineering biology accomplishment by a NIST scientist reported in the journal *Nature* is that Dr. Elizabeth Strychalski from MML succeeded in creating synthetic cells that reproduce normally.

Manufacturing USA continues to be a focal point for additional work in response to the COVID pandemic and for efforts to advance U.S. manufacturing. The American Rescue Plan granted $150 million of additional funding to Manufacturing USA. Of the total, $90 million is allocated to NIIMBL (National Institute for Innovation in Manufacturing Biopharmaceuticals) to support technology innovation in response to COVID-19 and $60 million is earmarked for the Rapid Assistance for Coronavirus Economic Response Grant Program to support research and development on preventing and responding to future coronavirus pandemics.

Climate change continues to be a priority for the new administration and in accordance with Executive Branch policies, NIST is engaged in developing more efficient power grids. New money has been awarded for this effort which will also involve the NCNR.

Community Resilience. The final priority Dr. Olthoff mentioned is Community Resilience, which is also an important priority for NIST and the Biden administration. Community resilience speaks to the impact of climate change on communities, but not just with respect to physical structures. Resilience is also determined by the response of residents and the community at large to natural disasters.

Dr. Olthoff emphasized that MEP will advance the competitiveness of American manufacturing and will likely play a significant role in securing supply chains. The response of the MEP to the pandemic was excellent as it collaborated closely with small local businesses.

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

Discussion. The group discussed the following topics:

- A timeline for nomination of the new NIST Director and
- Strategic Plan might benefit from a fresh look due to the significant increases in budget.

Safety Update – Keeping NIST Staff Safe During COVID - *Dr. Elizabeth Mackey, Chief Safety Officer and Director of Office of Safety, Health, and Environment*

Phased Re-Opening. Dr. Mackey stated that NIST is realigning the phased return-to-campus criteria with the new Office of Management and Budget (OMB) memorandum on COVID-19 pandemic management. Highlights of NIST's COVID policy include the following:

- Criteria for a phased resumption of normal operations will be aligned with OMB memo 21-15;
- COVID-19 prevention protocols will be maintained for staff, contractors, and visitors;
- Updated protocols to ease requirements for vaccinated staff;
- Case response, disinfection, and notification processes;
- New and revised hazard assessments; and
- Requirements for contractor safety plans.

NIST has also contributed to a draft of the new *Return-to-Office Handbook* published by the Department of Commerce.

Maintaining communication with employees has played an important role during the entire pandemic with people working remotely or via telework. Town hall meetings and the NIST website have provided employees with up-to-date information. There are four published NIST directives pertinent to COVID along with over 18 COVID-related safety documents. A fourth version of the safe return to campus training is currently being developed.

With respect to on-campus case management, Dr. Mackey stated that out of 339 reported cases from the entire campus of people experiencing COVID-like symptoms, 129 cases tested positive, and most were teleworkers. Fewer than 20 people were on campus while infectious. Dr. Mackey's organization is responsible for overseeing the disinfection of potentially contaminated spaces and the notification of close contacts as necessary, and those protocols are working well.

A big success was the Department of Commerce's (DOC) effort with NIST to distribute vaccines on the NIST Gaithersburg campus. DOC worked with Health and Human Services (HHS) to select a location for a COVID vaccine clinic for Federal staff in the National Capital Region. NIST was chosen based on the infrastructure

available including a fully operational health unit, freezers with adequate capacity and temperature control, indoor locations with sufficient space, and adequate parking. A call for all-hands-on-deck from Management Resources enabled the vaccine clinic to proceed after the installation of additional security features. The national HHS staff traveled to the clinic to administer the vaccines and to log information into the vaccine database.

Dr. Mackey said NIST scored favorably in an Employee Viewpoint Survey on COVID communications, with 86 percent of respondents agreeing strongly or agreeing that NIST's senior leaders provided effective communications. On the topic of COVID safety and the phased return of employees to the agency work site, NIST scored very high with 95 percent of survey respondents agreeing that NIST prioritized health and safety. Overall, the message from the survey was that NIST did an excellent job of placing the health and safety of employees first and communicated this policy effectively through its supervisors.

Safety briefings have been taped so that employees returning to campus at different times can still adopt new procedures at their own pace. The Management Observations Process program was redeployed in FY21 and virtual visits are encouraged. New safety programs have started, and future programs are currently in the planning process. In the past year, there were four Occupational Safety and Health Administration recordables. Typically, there are more but not many people were on campus due to the pandemic.

The NIST Enterprise Risk Management Office analyzes safety incident data and assesses the impact of COVID to determine which health and safety issues constitute enterprise-level risk. Systematic processes are currently being developed to support this analysis. For example, the American National Standards Institute risk management standard evaluates a risk matrix to determine the potential severity of an incident, the probability of it occurring, and the impact of risk mitigation activities. There is a new website online to provide information and a communications' and training specialist was hired to assist with these efforts.

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

Discussion. The group discussed the following topics:

- Contact tracing for employees who tested COVID positive and their vaccination status;
- Is NIST encouraging vaccination;
- Is NIST requiring proof of vaccination;
- Daily health and screening forms are completed by everyone who arrives on campus;
- Employees should carry a proof-of-vaccination card; and
- Federal policy with respect to requiring that on-site employees are vaccinated.

NCNR Situation Update – *Dr. Robert Dimeo, Director, NIST Center for Neutron Research (NCNR)*

Dr. Dimeo stated that the unplanned shutdown of the reactor on February 3rd was caused by a failed fuel element. When the reactor started again on February 3rd, fission products were detected that are indicative of a failure in the reactor fuel, and the reactor automatically shut down again. Ten staff members were contaminated and underwent standard decontamination protocols. There were no health or safety impacts to staff, public, or environment, and the event posed no risk to personnel or the community. The reactor will remain shut down until the root cause of the failure is determined, corrective and preventive actions are implemented, and the Nuclear Regulatory Commission (NRC) authorizes a restart.

Progress has been made on decontaminating the confinement building. While observing special working protocols, scientists are now able to get into the building and work on instruments. A big accomplishment was removing 26 fuel elements from the reactor core and moving them to the spent fuel storage pool.

Phase I of the incident analysis by the NCNR Technical Working Group is complete, and there were four noteworthy findings:

1. The safety limit temperature was exceeded for a fuel element,
2. The direct cause of the February 3rd incident was improper latching of a fuel element in the J7 position when the reactor started,
3. Causal factors that contributed to the incident include inadequacies in the refueling procedures, a

lack of proficiency in the refueling process and deficiencies in the training and oversight of the refueling operation. The available tooling was also identified as a causal factor.
4. Corrective actions were proposed to eliminate the causal factors and to ensure no future recurrence.

Additional video inspections are planned for all fuel elements in the spent fuel storage pool to determine their usability. Damaged fuel elements will be removed once special tooling can be acquired to do it safely. Dissolved fission products and particulate matter must also be removed. Thirty specialized air filters are being procured. There are still some areas in the Confinement Building that require decontamination.

Phase II is to convene a subcommittee of the NCNR Safety Evaluation Committee to analyze the NIST response to the NCNR incident and to review the root causes and proposed corrective actions. A NIST-wide Incident Response Team continues to meet weekly to coordinate NIST-level response and incident follow-up. Additional procurements are a critical aspect of remediation along with many other factors such as effective communication with congressional stakeholders.

Remediation and recovery will continue for the foreseeable future as a long-term activity. An external assessment will be conducted by subject-matter experts. A detailed execution plan of corrective and preventative measures is expected to be received by September. The reactor will be restored to operational readiness and approval from the NRC to restart the reactor will be sought. Once a target date is set to restart the reactor, user experiments will be scheduled.

Dr. Dimeo said two sites in the U.S. have neutron scattering programs — Oak Ridge has two facilities and NIST Gaithersburg has one. NIST accounts for about 40 percent of the scientific productivity attributed to neutrons in the United States. The impact of the NCNR shutdown to the user community is significant and NIST continues to try to provide support, but there is now an over-subscription of proposed experiments in the U.S. as well as around the world.

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

Discussion. The group discussed the following topics:
- The reason why fuel element A4 is circled in green on the reactor layout;
- Input from the National Science Foundation about providing support;
- Installation of a liquid hydrogen cold source before the reactor comes back online;
- The potential impact of an outage into 2023;
- Filtering 40,000 liters of water resulted in an accumulation of fission products in the filters;
- Reactor is fully isolated and protected from ransomware; and
- Possible options and the cost to replace the reactor.

Update on NIST Plans for Telework Post Pandemic: Philosophy and Process – *Mr. Essex Brown, Director, Office of Human Resources Management and Dr. Jason Boehm, Director, NIST Program Coordination Office*

Dr. Boehm stated that NIST had a flexible pre-pandemic telework policy in place but at different levels of support across the agency. Ideally, NIST should have designed a process or plan and put in place a pilot program before the pandemic, but after the pandemic started NIST was quickly forced into a maximal telework situation. NIST employees have shown they can be productive and trusted while teleworking. NIST has begun considering ways to embrace telework after the pandemic ends. The Biden administration is planning to release new guidance on telework.

Dr. Boehm stated data was collected and staff was interviewed across NIST about their views on telework. This was a joint process with Mr. Brown's team to develop an updated policy on telework, while making it as equitable in its implementation as possible. From the feedback collected from staff, eight principles for post-telework strategy were formed.
1. NIST will be a forward-leaning telework-friendly organization.
2. NIST will ensure teleworking staff have access to adequate IT resources to work effectively.
3. The telework workspace is at the discretion of the employee.

4. Leadership must be prepared and equipped to manage a mixed on-site and telework workforce.
5. NIST staff may telework with dependents in the home, depending on the situation.
6. Staff schedules should be transparent and accommodate individual as well as organizational needs.
7. A return-to-office time should be set that is fair and reasonable.
8. Moving forward all meetings will enable virtual attendance and NIST is currently working to put the tools in place to do that.

Mr. Brown described the strategy in place for developing new telework and remote work policies. By defining these policies NIST will offer another flexible tool to compete with other agencies for recruiting talented employees. Leveraging the feedback gathered by the Program Coordination Office as well as from other agencies will help inform the direction on the telework policy. The modification and establishment of these policies will increase flexibility, clarify, and correct current policy gaps. Two draft policies were reviewed at the DOC and NIST levels for human resources (HR) and legal requirements. Policies were also vetted by various customers and stakeholder groups at NIST and sent to the NIST Directives Review Board in early May. The implementation of these two new policies is scheduled for early October. This will allow time for vendor-led training for supervisors on leading hybrid teams, frequently asked questions, in-house training sessions, and staff orientations on the new policies.

NIST had to distinguish between telework and remote work. A remote work policy did not previously exist. The new policies go into effect in October to give employees a chance to understand their roles and responsibilities with respect to telework and remote work.

Mr. Brown clarified the focus areas of the new telework policy. New employee eligibility was clarified, and additional guidance was established on what precludes employees from teleworking. Almost all positions at NIST are telework-eligible, though there may be some circumstances that prevent an employee from participating. Given the experience gained over the past 15 months, NIST has a better grasp of what can be accomplished by employees that wish to telework full-time. There was additional guidance provided on the types of IT equipment a supervisor can approve to be used in telework, the workspace requirements, IT safety and security at alternative work sites, and the dependent care rules that specify when an employee can telework with dependents in the home.

With respect to the remote work policy, few employees at NIST had remote duty stations prior to COVID. This new policy will provide organizational units (OU) with approval authority and greater flexibility in establishing remote positions for recruitment and retention. It also offers considerations for management and employees to inform their decisions as well as to improve NIST's ability to recruit from an expanded and more diverse applicant pool. It is believed this policy will be an additional tool that helps NIST retain high-performing staff.

The utilization of telework and remote work programs will be equitable for all staff and consistent across NIST. It will require a proactive stance with regards to training and instructions. Data will be reviewed on a regular basis for trends, both negative and positive.

For more information, see Mr. Brown and Dr. Boehm's presentation.

Discussion. The group discussed the following topics:

- Metrics to judge productivity, employee satisfaction, and teamwork connectivity;
- Variations in job responsibilities that create inequities which could turn into friction;
- Consistency in policy and guidance on remote work sites;
- Safety and security considerations for working away from a NIST facility;
- Necessary mitigation strategies for remote users working on personal laptops; and
- Security issues relevant to NIST visitors and associates working on campus.

SESSION II: ASSESSMENT OF NIST's LABORATORIES BY THE NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE (NASEM)

Report Out from NASEM Assessment of the Material Measurement Laboratory and Engineering Laboratory

Chair of Material Measurement Laboratory (MML) Panel of Assessment—*Dr. Elsa Reichmanis, Professor and Carl Robert Anderson Chair in Chemical Engineering at LeHigh University*

Dr. Reichmanis gave a brief overview of the MML Panel's findings. The committee's expertise covers all aspects of research within MML. MML comprises six technical divisions and two offices. The technical divisions pursue measurement science research and development (R&D) and engage in standards development. The research conducted within MML was deemed as "truly exceptional."

The question was asked whether a succession plan exists to recruit and retain qualified employees that can maintain continuity after leading NIST employees working in emerging areas of critical importance retire or otherwise depart. This issue needs to be examined more closely.

Major equipment purchases affect NIST's budget and the ability to maintain state-of-the-art equipment. Aging infrastructure appears to pose a challenge because it can impact the quality of research. Storage requirements are another area of concern.

Activities such as bringing groups together for workshops and participating in standards organizations in the International Organization for Standardization (ISO) or the National Science and Technology Council (NSTC) have taken place. Furthermore, numerous high-impact journal articles have been recognized for their quality by the broader community. The post-doc network could be strengthened and creating a brand ambassador is recommended.

For more information, see Dr. Reichmanis' presentation.

Chair of Engineering Laboratory Panel of Assessment—*Dr. E. Slaughter, Founder and President of the Built Environmental Coalition*

Dr. Slaughter mentioned that the panel was asked to look at selected programs in the NIST Engineering Laboratory (EL) focused on certain topic areas. For example, the Community Resilience Program (CRP) and the Structural Performance Under Multi-Hazards (SPUMH) Program as well as others. Overall, these EL programs have contributed to major advancements in measurement science, standards, and technology. Recent dangerous events have heightened awareness of the urgent need for EL's work. For example, there were multiple weather and climate disasters throughout the country while the world was also confronting the COVID-19 pandemic. The EL has dual duties of not only conducting research, but also forensic analyses.

One observation is that there is a compelling requirement for the strategic planning of national and program priorities in HR and facilities renewal. NIST's aging infrastructure is a challenge for both the Gaithersburg and the Boulder campuses. Another observation is that there exists an increasing demand for multidisciplinary collaboration and coordination. Due to the impact of natural disasters and other challenging circumstances across the country, people and organizations desire access to the information NIST is developing and upgrading NIST's communication outlets is a requirement.

NIST's research quality is high, and the panel was impressed by the adaptability demonstrated by various teams when responding to evolving needs and conditions. There may be worthwhile ways to consider for enhancing the connection between research staff and practicing professionals or researchers in other institutions. Retiring employees pose a concern if NIST loses core competency in a specific area. Adding additional scientists, professionals, and researchers to the team may help ensure continuity. NIST may face increasing challenges in the future due to inadequate resources. Attracting a diverse group of researchers and staff is going to be of critical importance to NIST going forward.

Dr. Slaughter stated that there are different ongoing activities where the CRP, the SPUMH, and other programs could collaborate to address the multiple crises that have occurred in certain places like Puerto Rico. There is also a possibility to collaborate with public health and social scientists in the CRP and the Fire Research Program to analyze a community's response to crises and safety issues.

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

Discussion. The group discussed the following topics:

- Technical succession planning and talent development requires creating a strategy;
- NIST is critical for the national well-being and its contributions are of urgent importance now; and
- Collaboration between NIST and regulators to respond to a changing environment that can affect natural disasters.

SESSION III: THE EVOLVING PRIORITY LANDSCAPE FOR NIST—NEW OPPORTUNITIES AND RESPONSIBILITIES

Budget Overview - *Dr. Jason Boehm, Director, NIST Program Coordination Office*

Dr. Boehm gave an overview of the President's 2022 Budget Request to Congress, which outlines a large role for NIST in manufacturing networks, workforce development, and securing the nation's supply chain. The American Jobs Act allocates large funding increases for NIST. Investments will continue to be prioritized for emergency technologies, quantum science, artificial intelligence, and synthetic biology. There will also be a new focus on climate change and environmental issues, which are priorities of the Biden administration.

The FY2022 Budget Request amounts to a proposed increase of $462.8 million with $127.6 million for Scientific and Technical Research and Services (STRS), $275.2 million for Industry and Technology Services (ITS), and $60 million for Construction of Research Facilities (CRF). This increase will position NIST to address critical national priorities. There will be a lot of opportunity for growth in STRS, ITS, and CRF.

NIST FY2022 budget increases will ensure U.S. leadership in key areas with additional funding for:

- Climate and energy, +20 million
- Quantum Science, +15 million
- Artificial Intelligence, +15 million
- Bioeconomy, +14 million
- Advanced Communications, +12 million
- Microelectronics, +10 million
- Circular Economy, +5 million
- Equity and Diversity in the Workforce, +5.1 million

A major priority for the Biden administration is to stimulate recovery of the U.S. economy post-COVID through the Build Back Better agenda. The administration's FY2022 request contains an additional $125 million for MEP to strengthen its core network by offering more services and by better connecting manufacturers with the government. Manufacturing USA has allocated $150 million to fund two new Commerce-led institutes via Open-Topic Competition and this will provide further growth and new opportunities.

The $60 million increase to CRF funds will focus solely on the existing maintenance backlog at NIST and will address safety, capacity, maintenance, and major repairs. The President's infrastructure plan and American Jobs Plan has funding and could also be applied to construction needs.

The CHIPS Act was attached to the National Defense Authorization Act (NDAA) and will provide a comprehensive set of programs designed to further strengthen the U.S. semiconductor market, electronics industry, and R&D ecosystem. Under consideration in the Senate is a bill renamed as the `Endless Frontier Act', which will contain a proposal to fund large portions of the CHIPS Act. The proposal includes approximately $52 billion in appropriations. The establishment of an Advanced Packaging Program will be an expansion of existing NIST metrology programs with total authorized funding of $2.5 billion.

To plan for a successful implementation, there are cross-NIST, DOC, and White House teams developing action plans. These plans include staffing strategies and concepts for an organizational structure that includes a program office. Also, incentives and oversight mechanisms must be defined. Furthermore, areas that need further development along with the appropriate reporting structure will be identified at a later date. There is an

entire programmatic track dedicated to the National Semiconductor Technology Center which will involve the Department of Homeland Security, Department of Defense (DOD), Department of Energy, and the National Science Foundation. In addition, a new effort is being created to consider the NIST Metrology Program.

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

Discussion. The group discussed the following topics:

- NIST's efforts for further facility maintenance and renovation;
- Enhancement of the National Oceanic and Atmospheric Administration's budget to improve weather models in the U.S.;
- Identifying useful algorithms for a quantum environment;
- The cost of building a fabrication facility for semiconductor chips;
- Unaddressed priorities in cybersecurity due to no major increase in FY2022 funding;
- Certification of building wellness by NIST; and
- Consumables used for manufacturing biologics.

Future Plans for Manufacturing Extension Partnership (MEP) and Manufacturing USA—*by Dr. Robert Ivester, Acting Director, MEP, and Michael Molnar, Director, Office of Advanced Manufacturing*

Dr. Ivester stated that the expansion of manufacturing programs at NIST is a key priority. Executive Order (EO) 14005 aims to support products made in the USA by leveraging Federal purchasing power and EO 14017 seeks to strengthen America's supply chains. Both EO's will play a critical role in the administration's policy agenda and in the direction of manufacturing efforts as they expand. The NDAA of 2020 authorizes a new Manufacturing USA Institute on semiconductors and calls for a NIST analysis on creating an MEP national supply chain database. The American Rescue Plan appropriated $150 million to NIST for Manufacturing USA Pandemic Response Projects. The American Jobs Plan and the President's Budget Request call for long-term investment increases in manufacturing at NIST, along with $7 billion for MEP and $3 billion for Manufacturing USA.

The President has proposed historic levels of infrastructure investment. U.S. manufacturing is critical to the nation's economic recovery. More manufacturers will receive critical assistance and MEP Centers can provide expanded services. MEP will lead the way towards building a new manufacturing ecosystem.

Dr. Ivester stated that NIST will seek to increase core funding to MEP centers by at least 24 percent because the centers lack necessary resources to support manufacturers as they adopt new technologies and improve their processes. MEP centers must deliver more diverse services than those offered today to satisfy these requirements, regardless of where they are located.

As many as 2.1 million manufacturing jobs will be unfilled through 2030 without strong action from public and private sector partners. Worker shortage could cost the U.S. economy up to $1 trillion by 2030. Systems and resources that can support manufacturers are often not connected, and unemployed and under-employed workers along with people of color and women could help grow the industry. Recruiting this untapped talent pool requires addressing systematic barriers. MEP's role in industry will help manufacturers attract a new workforce to manufacturing, to include upskilling the workforce, with a focus on women and under-represented groups.

The pandemic emphasized U.S. dependence on global supply chains for goods and revealed significant gaps in the domestic manufacturing base. The MEP National Supply Chain Initiative would call on NIST to partner with Federal agencies and private sector top-of-supply chain entities to identify manufacturing gaps as stipulated by EO 14005. MEP has been hard at work across 51 MEP Centers for Cybersecurity, but this effort must expand due to the potential risks facing small manufacturers.

Lastly, Dr. Ivester spoke about the MEP Manufacturing Technology Demonstration Facilities, which are not brick and mortar. The MEP has invested to develop new services throughout all 51 MEP centers. There is now a big opportunity to accelerate new technology adoption in the supply chains for key products and critical technologies as described in EO 14017. This initiative will expose manufacturers to advanced technologies,

train their employees to use this technology and gain hands-on experience, and integrate the trained employees into the work environments of small and medium-size enterprises.

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

Mr. Molnar stated that NIST prepares an annual Manufacturing USA report that conveys the impact of the 16 Manufacturing USA institutes. Overall metrics compiled last year show over 2,000 member companies and universities with over 500 major applied research projects while engaging with over 70,000 people through education and workforce development programs. A major milestone reached is that there is now participation from all 50 States and Puerto Rico in Manufacturing USA projects.

The Coronavirus Aid, Relief, and Economic Security Act provided funds for Manufacturing USA institutes to engage in high-impact projects for the pandemic response. NIST and DOD made awards to nine institutes to work with over 90 partners on 36 major manufacturing innovation projects to combat COVID-19. A special report was prepared on these activities. Congress has appropriated $150 million to NIST for additional pandemic response projects.

Despite the pandemic, the NIST-sponsored NIIMBL (National Institute for Innovation in Manufacturing Biopharmaceuticals) institute was able to launch two programs in vaccine analytics and vector manufacturing that played an important role in developing COVID-19 vaccines. NIIMBL has achieved a collaborative partnership with industry now and companies are calling on NIIMBL to tackle new challenges by focusing more on agile manufacturing for existing types of products, such as monoclonal antibodies.

When Congress reauthorized Manufacturing USA in December 2019, it renewed Federal sponsorship of NIIMBL. NIIMBL is currently in the final year of a 5-year cooperative agreement with NIST. NIST developed a review protocol that includes an independent external evaluation panel comprised of representatives from large and small manufacturers, nonprofits, government agencies, and academic universities. This panel stated that they were impressed with NIIMBL's progress, and the NIST Director supports NIIMBL's renewal.

The administration has highlighted advanced manufacturing as an ideal vehicle for building the industries of the future in geographically diverse locations. China has emulated NIST's program and has 16 large manufacturing innovation institutes and is on track to reach their goal of 40 institutes by 2025. The current National Strategic Plan for Advanced Manufacturing identified 16 national advanced manufacturing technology priorities.

The President's Budget Request includes two new NIST-sponsored institutes for next year along with a proposal for an additional 10. The CHIPS Act funding has enabled a Manufacturing USA institute to target semiconductor packaging. NIST has special authorities for Open-Topic Competitions that enable multiple institute awards from a single competition. A new technology roadmap competition will be helpful for planning new institutes. Mr. Molnar concluded his presentation by stating that NIST has an all-star team supported by the technical resources of the NIST laboratories. National priorities may be used as selection criteria in the two-stage institute competitions. Preferences may be given to ensure equity and to rural or underserved regions.

For more information, see Mr. Molnar's presentation.

Discussion. The group discussed the following topics:

- Possibility of a virtual environment for MEP and Manufacturing USA demonstration centers, and
- Enhanced coordination of MEP and Manufacturing USA to leverage technology.

NIST and Emerging Technology Standards Development—*Gordon Gillerman, Director, Standards Coordination Office*

Mr. Gillerman stated that NIST has a special role in standards and is stepping up coordination and leadership in critical and emergency technology standards, which are creating markets and defining opportunities for innovation. China's engagement in international standards is growing.

It is important to emphasize that the standardization process provides a springboard for technical innovation. Technology standards shape the markets of the future and are essential to innovation leadership. The public domain intellectual property associated with standards in areas such as wireless interoperability has a material effect on future markets.

China's increased participation in international standards development rivals the U.S contributions. Key differences are that the U.S. has a private sector-led standards system while China has a central government-led standards system. China is vying for leadership roles in setting standards by sending more people to international standard meetings.

Mr. Gillerman showed three pie charts of leadership in standards activities from the top nine participating countries. The U.S. participation is significantly larger than the Chinese in international standards development, according to the Institute of Electrical and Electronics Engineers. In the 3rd Generation Partnership Project, China and the U.S. are almost even, as the Chinese have a tremendous interest in the next generation of communications technology since they manufacture much of the equipment. In the International Telecommunication Union, a treaty-based standards organization, the Chinese are dominating, but this may change since the U.S. Government is reorganizing itself to have better engagement.

When comparing the standards process between the U.S. and China, the U.S. has a voluntary, decentralized, and market-driven system, whereas China has a much more centralized government-organized system. China has developed a tiered standards system whereas the U.S. traditionally relies on public-private partnerships built on cooperation, mutual communication, and parity among diverse stakeholders.

NIST is coordinating U.S. Government activities and bringing government agencies together to share information about standardization. The standards community is motivated to coordinate activities and to provide leadership in defining standards for key emerging technology areas. NIST is a significant contributor to cybersecurity standards, and more than 440 NIST employees participate in over 1,750 diverse standards activities. The Standards Coordination Office has been deploying standards training to government agencies. To date, over 6,000 participants have received training. The `International Standards Alert' is a newly launched standards publication. Additional resources from a budget increase of $750 thousand is supporting this process.

Mr. Gillerman stated that the next steps are to increase NIST standards participation and influence in critical and emerging technology, raise competence and increase the capacity of Federal employees to influence standards development. Also important are to enhance interagency coordination, lead efforts with DOC bureaus and the Department of State for providing actionable information on international standards threats and opportunities, and increase messaging about the importance of open, consensus-driven international standards.

Finally, some key takeaways are that NIST is increasing its coordination and leadership role in critical and emerging technology standards for areas like biotechnology and artificial intelligence. Technology standards create opportunities for innovation and define future markets. China's engagement in the international standards area is growing.

For more information, see Mr. Gillerman's presentation.

Discussion. The group discussed the following topics:

- China is copying Ion Chromatography standards and republishing them as Chinese national standards;
- The Standards Participation Database lists NIST people attending standards organization conferences;
- NIST can be a good host for international meetings by making the visa process easier for international Standards Developing Organizations;
- NIST's participation in standards groups such as the Internet Engineering Task Force; and
- Chinese tactics that undermine standards development for internet protocols.

SESSION IV: NIST EFFORTS IN DIVERSITY, EQUITY, AND INCLUSION (DEI)

Opening Remarks and Introductions—*Dr. James Olthoff, Associate Director, performing the nonexclusive duties of the NIST Director*

Dr. Olthoff opened Session IV by noting that the pandemic shed a spotlight on the best aspects of the inclusive culture at NIST and illuminated areas in need of improvement. NIST took the proactive initiative to acquire the necessary expertise for creating an institutional framework that supports a diverse and inclusive culture and hired Dr. Sesha Moon to fill the new formal role of Director of DEI. Dr. Olthoff noted that Dr. Moon will share her philosophies with the group. The Office of the Associate Director of Laboratory Programs (ADLP) initiated three relevant data-driven studies that will be covered in this session. The first study was conducted by COACh, which is a grassroots organization based at the University of Oregon. Their mission is to increase the number of successful women and other under-represented groups in science and engineering. COACh designed and implemented a data-driven study to determine the root causes of inequity in promotions and provided some preliminary recommendations. Also, two NIST staff conducted additional data-driven studies; one study addressed the inclusivity of women at NIST and the second study examined people networks at NIST and how employees work together.

Fireside Chat with NIST's New Director of DEI—*Dr. Sesha Moon, Director of Diversity, Equity, and Inclusion, and Dr. James Olthoff, Associate Director performing the nonexclusive duties of the NIST Director*

Dr. Moon shared an insightful perspective on how to cultivate a more diverse, equitable, and inclusive culture. She also shared some highlights from her background. For example, she has degrees in Black Studies and her Ph.D. thesis focused on the career mobility trends of women of color in the Federal Government.

Dr. Olthoff asked Dr. Moon to describe her philosophy on DEI. Dr. Moon said she's been in this space for over 15 years. She wants 2021 to be a year where people feel safe to show up to work as their best selves. It is important to cultivate a culture of civility that begins in this committee and permeates through all levels of the organization. Dr. Moon suggested that NIST will have to create space for grace. It is important to embrace being uncomfortable to create an ethos of equitable engagement that unlocks the next level of excellence at NIST.

Over the next 100 days, Dr. Moon stated that she wants to review the available qualitative and quantitative data on DEI at NIST. She will schedule meet-and-greets to hear first-hand the experiences of employees at NIST and considers VCAT members to be a vital strategic resource that can share insights on establishing DEI benchmarks and defining best practices. She acknowledged the references to DEI in several presentations from this meeting and believes that there are many opportunities to do transformational work at NIST.

Findings and Recommendations from Data-driven Studies: COACh Study of STEM Promotion—*Dr. Celeste Rohlfing, Chief Operating Officer, American Association for the Advancement of Science (retired), and Dr. Jean Stockard, Professor Emerita, University of Oregon*

Dr. Rohlfing acknowledged the contributions from her entire team as part of the `Equity Action Plan' for NIST. The project's purpose was to implement a data-driven study of promotion disparities for under-represented groups in ZP (Scientific and Engineering Position) and leadership career paths and to provide recommendations and strategies that support equity in career advancement.

The study consisted of listening sessions and the analysis of data from HR and the Federal Employee Viewpoint Survey aggregate data. In addition, a survey was conducted of employees that are level ZP III and higher, as well as ZT (Scientific & Engineering Technician Position) employees. Small focus groups and one-on-one interviews were also conducted. All the data collected was analyzed quantitatively. The final deliverable was an equity action plan that outlined the summary of key findings and recommendations.

Dr. Stockard mentioned that all reports are available online. After hosting listening sessions, Dr. Stockard's group analyzed the HR data. They found that the percentage of women has increased at the higher grades, but it is still lower than expected at grade 5. The multivariant analyses showed a correlation between how long people have been employed and their seniority. However, over time, the percentage of minorities changed very little, so this variable was not used in the analyses. The fact that the percentage of minorities was relatively unchanged is a concern.

There were no significant gender differences observed in supervisory posts, in promotion patterns by site, salaries at hire, or in the conversion of postdocs to regular positions. Other important factors considered include hiring and separation. Minorities and women are more likely to separate.

A survey of people in the ZP category was conducted at grade 3 and higher. The survey had a strong response rate. Women, younger employees, and those in some OUs were more likely to respond. Results were weighted to reflect different response rates. Data on employees' time in grade and time since last promotion paralleled the analysis of HR data.

One analysis track in the study was to examine employees' opinion of the promotion process. There were five questions in the survey related to the promotion process. The main take-away from the survey data is that there were no values greater than 50. The qualitative data was also extensive. The survey itself consisted of open-ended comments which were later reviewed to remove personally identifiable information. Focus groups were conducted with randomly selected respondents. Similar concerns were voiced by many participants, including the need for greater transparency in the promotion criteria and process.

Principal findings of the data analyses are as follows:

- Gender disparities in promotion may not be as significant as initially assumed;
- Serious dissatisfaction with promotion process is widespread;
- Staff want clear criteria and more transparency as well as career planning tools;
- Group leaders want a more consistent application of promotion criteria, data on staff, and additional training; and
- Hiring and retention are important factors but not considered within the study's scope.

Dr. Rohlfing provided a quick overview of the recommendations. The first set of recommendations addressed NIST's leadership and reinforced the need for transparency. One recommendation was to create a steering committee with representatives from different organizational units and laboratories that would review the study's findings. It was also recommended that NIST contact other Federal agencies to learn about effective practices elsewhere. It was strongly recommended that staff and supervisors have regular periodic discussions about career, performance plans, and promotion potential. NIST has already launched a mentoring program. NIST should make a concerted effort to bring external recognition to its staff. NIST staff should be involved in the planning and development of policy changes in this area.

Though the COACh contract was limited to issues around promotion for permanent staff, it became clear that hiring, retention, salaries, and conversion from temporary to permanent positions was just as great a concern among staff and it is recommended that NIST consider an in-depth analysis of these issues.

For more information, see Dr. Rohlfing's and Dr. Stockard's presentation.

Discussion. The group discussed the following topics:

- Does the Federal Government have any broad guidelines that address issues from the survey;
- NIST's pay-for-performance system compared to other GS agencies across the government;
- Requirements for a balanced candidate slate;
- Pilot programs that use LinkedIn Recruiter and Textio to find candidates through analytics;
- Transparency of the promotion criteria from one grade to the next for different career ladders;
- Sponsorship of mentoring programs that target equity; and
- The effect of age on career development.

Findings and Recommendations from Data-Driven Studies: ADLP Rotational Assignments

Assessing Inclusivity of Women at NIST—*Ms. Mary Theofanos, Computer Scientist, Communications Technology Laboratory*

Ms. Theofanos stated that the goal of this effort was to provide data about how gender inequities, if any, manifest themselves in the workplace for women. Quantitative HR data from the past 10 years was used to establish a baseline, and qualitative data was collected from in-depth interviews and a survey of Federal staff.

Women and men experience NIST differently. A high-level model of themes and contributing factors emerged from the data. Three themes were interconnected; NIST culture creates a chilly climate for women, gendered experiences contribute to the chilly climate, and gendered outcomes influence women's experiences in the organization.

The quantitative results revealed that NIST culture has been shaped by excellence in science, patriarchy, meritocracy, and elitism. These traits do not encourage an inclusive organization if only the science matters.

Objectivity and rationality are foundational elements of good science, and most NIST employees believe NIST is more objective than subjective. Some employees believe meritocracy is a myth. Though hard work and dedication may counteract an uneven playing field, the odds of success are not quantifiably defined.

A significant gender-related difference was observed when employees were asked whether most opportunities go to the most deserving employees. Eighteen percent more men agree with this observation.

The percentage of women in the ZP track has increased from 14 to 25 percent but their overall representation is still low. Women reach pay band 4 more slowly than men at each level of education. A smaller fraction of ZP women ultimately reach pay band 5 than ZP men and leadership roles are dominated by men.

Patriarchy is a social system in which men hold primary power and dominate leadership roles. Scientists are valued more than other staff, and men are more likely to be regarded as scientists and leaders than women. Women in leadership positions are viewed in ways consistent with patriarchal norms and judged according to gendered assumptions. Whether standing up for oneself in the face of biases or when asking about a bonus or promotion, women are often labeled in negative ways. The interviews and surveys also revealed well-known microaggressions that undermine women's confidence and ability to succeed.

Men believe the organization is gender neutral. Some workplace facilitators for men serve as barriers for women, including meritocracy, microaggressions, and gendered experiences that include isolation and invisibility, to a focus on body and dress rather than intellect and work. All these behaviors create a hostile environment for women. Women face a dilemma. They wish to view their workplace as gender neutral but know that gender discrimination occurs, thereby creating gender fatigue for women. Men face few barriers related to gender. The study gave women a chance to tell their stories. Almost everyone responded, "I love my job at NIST."

For more information, see Ms. Theofanos' presentation.

Discussion. The group discussed the following topics:

- Substantive suggestions on how to create a welcoming environment for women;
- Steering group created with a focus on equity is providing information and recommendations; and
- Increased budget may address some areas that need improvement by creating new positions.

Inclusivity Network Analysis—*Dr. Laura Espinal, Materials for Energy and Sustainable Development Group, Material Measurement Laboratory*

Dr. Espinal stated it is a factor that inclusivity is important in the workplace because it determines the extent to which employees have access to information and opportunities through their personal connections. An

anonymous network survey was conducted last fall. Data was limited because it was collected during the pandemic and may be skewed by atypical work-from-home modalities.

Two network characteristics measured were composition and similarity. The similarity index compares the network memberships of your connections to your network memberships. Plots were shown that illustrated a distribution with two extremes between the various populations. Data was grouped by three key attributes: gender, organizational unit affiliations, and race.

A key finding pertinent to gender equity is that three-quarters of the workforce is male. In the advice network, the plots and the similarity indices show that the network is over 50 percent female. A recommendation was made to establish a mentor program for women that fosters informal connections between female employees.

A key finding regarding OU affiliations is that most employees will seek advice from someone in their own OU first. Bridging communication gaps between laboratory and non-laboratory OUs will be helpful for both work and advice networks. There were three recommendations; establish a formal Leadership Rotational Program (LRP) for employees to pursue project-based assignments 6 to 12 months in duration across different OUs, create a central hub to support existing Communities of Practice (CoP) and facilitate creating new CoPs, and promote informal connections between silos by providing organizational, financial, and executive support for existing Employee Resource Groups (ERG).

There were no significant differences discovered between the networks of minority and non-minority employees for either work or advice networks. Some possible explanations are that the minority population is relatively small, information was only available for ego networks, and the data was collected in a binary way. Two recommendations were provided; conduct a post-pandemic survey centered on the advice network and focus on racial and ethnic nuances when assessing employee ego networks.

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

Discussion. The group discussed the following topics:

- The definition of an "advice ego network" is that the network is centered around you and you are surrounded by your connections;
- Sponsors, not members of employee resource groups provide better data; and
- Don't exclude sponsorship by someone who is also a member of the ERG.

SESSION V: NIST STRATEGIC PLAN UPDATE

Update on the New Initiatives—*Dr. Jason Boehm, Director, NIST Program Coordination Office*

Dr. Boehm stated as a reminder that the NIST Strategic Plan has been created with four strategic goals:

1. Position NIST to advance U.S. science and innovation;
2. Maximize NIST's stakeholder impact through high-value service delivery;
3. Create the infrastructure for a 21st century research institution; and
4. Build a One NIST culture.

The implementation of the initial phase of the plan was based around a set of discrete actions that touched on issues related to the workforce, infrastructure, and operations. These issues are inter-related and require a coordinated approach.

Dr. Boehm stated that several actions and projects have been initiated and four pertain to the workforce. Two pilot projects underway are focused on how to improve collaboration and agility across NIST programs. A third new action is that NIST has appointed an official coordinator to lead diversity efforts and the expectation is that this appointment will strengthen NIST's ability to attract, retain, and retrain a diverse and inclusive talent base. Another pilot project underway is that NIST has been providing more support for a strong and accountable leadership corps.

Two action items related to infrastructure were taken. One action item was to prioritize an integrated campus

master plan that addressed major facility needs in both Gaithersburg and Boulder. The second action item was to update the strategy for optimizing repair activities using a predictive facilities maintenance tool that will also help guide future investments.

Two action items pertained to operations and procedures that make it easier to work with NIST. One already-completed action item was to define and establish a technology liaison function that facilitates the transfer of NIST-developed technologies through enhanced customer service and process improvements. Currently ongoing is an effort to better communicate important NIST messages by improving stakeholder awareness of NIST, clarifying and sharpening NIST's strategic communications and by initiating an effort to rebrand NIST.

Next, Dr. Boehm described some implementation highlights. One of the important deliverables from the strategic plan was hiring Dr. Sesha Moon as the Director of DEI. Her help and support in addressing diversity issues will be important moving forward. Second, NIST is in the process of working with a team on a branding study and has interviewed stakeholders and NIST staff. Third was the development of a leadership competency model. The goal is to define and develop measurable characteristics that an individual and an organization need for building a culture that has successful teams and coalitions that drive results and serve customers. Finally, there is a funded ADLP project led by the Special Programs Office on Collaborating for Impact Now (CoIN). The CoIN program was introduced earlier this year and its goal is to solve important problems for NIST and the nation through collaboration across organizational boundaries. There were 98 proposals submitted from several OUs. The topics covered include COVID-19, racial equity, climate, economy, health care, technology, and more.

Dr. Boehm shared the path forward by stating that there are continuous efforts to address, monitor, and track challenges like diversity, equity, and inclusivity. It will be important to consider how NIST can absorb significant amounts of new money and undertake new roles. The new NIST leadership will provide input on the path forward and support the strategic planning process that guides institutional decisions. Engagement with the community in a transparent manner is vital.

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

Discussion. The group discussed the following topics:

- Ensuring the safety and security of data when employees are working from home;
- The budget impact of people teleworking is minimal;
- Insurance and liability questions related to employees working from home;
- Direction from OPM pertinent to the new policy on working conditions;
- Sharing desk space is possibility at NIST;
- Compression/telework opportunities for when the Gaithersburg building 222 is emptied for renovations;
- How to deploy funds effectively on a short time scale; and
- Will the new Director of NIST share the same goals and priorities?

Meeting Wrap-up & Administrative Business

A discussion ensued about scheduling the next VCAT meeting and whether it will be virtual or in person.

Dr. Adler asked about increasing the VCAT membership. Dr. Boehm mentioned that several sources have been contacted for ideas, and he asked that existing VCAT members also respond if they have suggestions. A list of potential new candidates is being compiled. Diversity, representation of different regions, and areas of expertise in industry and scientific knowledge will be just a few of the factors under consideration during the selection process for new VCAT members. Dr. Olthoff mentioned that increasing the VCAT membership is a priority.

Dr. Adler thanked the NIST leadership for the thought-provoking presentations and discussions during the virtual meeting. He also thanked Dr. Olthoff for his leadership, contributions, and service to the nation. The VCAT members also expressed their appreciation.

Adjournment

The meeting was adjourned at 4:57 PM.

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