VISITING COMMITTEE ON ADVANCED TECHNOLOGY (VCAT or Committee)
MINUTES OF THE JUNE 9th, 2020
WEBINAR MEETING

ATTENDANCE:

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

Designated Federal Officer
Shaw, Stephanie

NIST Leadership Board

Bahar, Mojdeh
Boehm, Jason
Brockett, Del
Brown, Essex
Copan, Walt
Dimeo, Rob
Dowell, Marla
Fangmeyer, Robert
Harary, Howard
Jenkins, George E.
Kimball, Kevin
Kushmerick, James
Lin, Eric
Mackey, Liz
Molnar, Mike
Olthoff, Jim
Romine, Charles (Chuck)
Sastry, Chandan
Thomas, Carroll
Vaughn, Robert (Skip)
Wixon, Henry

NIST Staff
Acierto, Linda
Andrade, Dorianna
Barbosa, Nicholas
Baxter, Laura
Beers, Kate
Bender, Avi
Brunner, Zahraha
Carnahan, Lisa
Clark, Tammy
Claussen, Monica
Devereaux, Doug
Dohne, Kirk
Evans, Heather
Fronczek, Lisa
Gayle, Frank
Gillerman, Gordon
Gloster, Gerald
Goldstein, Barbara
Greene, Kristen
Hain, Toby
Hanna, Nancy
Hardis, Jonathan
Healy, Bill
Hoffman, Elizabeth
Huergo, Jennifer
Hughes, Sarah
Ivester, Rob
Jungbluth, George
Kauffman, Leah
Keys, Mirta
Lagas, David
Lawson, Jeremy
Lyford, Chancy
McBride, Tim
McIntyre, Kevin
Nist, Jennifer
Pacelli, Mary
Porter, Gail
Poster, Dianne
Ratcliff, William
Reidy, Kari
Rimmer, Kate
Rogers, Kelley
Rudnitsky, Robert
Saundry, Claire
Sberegaeva, Anna
Schiller, Susannah
Schufreider, Jim
Seiler, David
Shyam-Sunder, Sivaraj
Silverthorn, Courtney
Singerman, Phillip
St. Pierre, Jim
Stine, Kevin
Sullivan, Suzanne
Tabassi, Elham
Tarlov, Michael
Thatte, Dileep
Vallone, Peter
Vanek, Anita
Vickery, Ben
Voorhees, Ellen
Walker, Marlon
Wilkinson, Richard
Williams, Carl
Wollman, David
Yekyung, Kim
Zimmerman, Neil

Others
Ambrose, Mitch – American Institute of Physics
Doster, Kim – Office of Science and Technology
Cassady, Amber – Lewis-Burke Associates, LLC
Del Conte, Bonnie – CONNSTEP
Droegemeier, Kelvin – Office of Science and Technology
Duman, Leila – American Chemical Society Office of the Secretary and General Counsel
Gross, Jordan – DJI Technology
Howe, Matt – CONNSTEP
Kratsios, Michael – Office of Science and Technology
Lavine, Andrew – Duke University
Lee, Kelvin – NIIMBL
O'Donnell, Michael – Iowa State
Shore, Justin LP – Firstnet Authority, DOC
Suzuki, Takashi – Blackberry

Tuesday, June 9, 2020

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

Dr. Adler called the meeting to order at 10:25 a.m., reviewed the meeting logistics and took roll call. Dr. Adler turned the meeting over to Dr. Copan to introduce the first speakers.

SESSION I: NIST UPDATE

OSTP Overview—*Dr. Kelvin Droegemeier, Office of Science and Technology Policy Director; and Michael Kratsios, Chief Technology Officer of the United States*

Dr. Copan introduced Dr. Droegemeier and Mr. Kratsios, thanking them for their good work. Dr. Droegemeier began by emphasizing the importance of reopening and reinvigorating the research enterprise, reminding the Visiting Committee on Advanced Technology (VCAT) of the extraordinary advances made during the crisis, like fast tracking clinical trials and bringing the community together to pool resources. He mentioned there are personnel and facilities issues facing the government and universities on reopening, as well as unique challenges facing international scientists and researchers. COVID-19 has hit communities disproportionately hard, and that requires attention. He emphasized the need to leverage the lessons learned to ensure the U.S. is not only a resilient research enterprise but a much stronger and more effective research enterprise.

On June 5, the National Science Technology Council (NSTC) held a meeting remotely, attended by NIST. A key outcome of the discussion was the agencies' appreciation of flexibilities granted to them by the Office of Management and Budget (OMB), for example terms of grants and issues of audits and delays, and workplace flexibilities. Facility construction is an important issue because of delays and cost overruns as well as schedule, scope, and cost risks. Attention is being placed on this with the Department of Energy (DOE), the National Science Foundation (NSF), the National Institute of Standards and Technology (NIST), and other places that have facilities. Renovations might be needed to bring people back in to work at the facilities. Consideration must be given to social distancing and hand sanitizing stations when this occurs. It is extremely important to maintain flexibility in teleworking going forward in all these agencies so employees can be effective in their job and ensure their loved ones are cared for. The Administration is in the process of streamlining regulations and removing them if they are not effective The NIST Green Paper has been a valuable tool in helping to capture the benefits of speed and flexibilities of authorities and policies for technology transfer.

The Office of Science and Technology Policy (OSTP) has been convening presidents, chancellors, and other key leaders at universities to discuss policy updates that can help them work in a more productive and accelerated manner, and is also working closely with OMB on the yearly Research and Development (R&D) priorities memo that should come out this summer.

Mr. Kratsios stated the White House has been focused on an "All-America Response" working alongside the private sector, nonprofits, university experts, and international allies to defeat the virus. In March, OSTP worked alongside the National Institutes of Health (NIH), the Allen Institute for AI (Artificial Intelligence), Chan Zuckerberg Initiative, Microsoft, and Georgetown University to release the COVID-19 Open Research Dataset (CORD-19), announcing a call to action to the world's AI community. CORD-19 includes a comprehensive collection of data and coronavirus scholarly articles, and it continues to grow.

The White House worked with Kaggle, a machine learning and data science community. Experts in AI can submit tools and techniques that can help summarize, analyze, and search the dataset. Mr. Kratsios shared that NIST played a role in the release of the dataset and call to action. He also stated that OSTP worked closely with NIST to launch the Text Retrieval Conference (TREC) COVID program, working with industry and academic leaders to apply the engagement and assessment approach of the dataset. This will help search engine developers evaluate and optimize their systems to query the dataset.

Mr. Kratsios said the White House announced that the United States will be joining G7 nations in agreeing to launch the Global Partnership for AI (GPAI). The U.S. and allies will advance AI innovations that are

underpinned by shared values, a respect for privacy, civil liberties, and human rights. The GPAI is a forum for worldwide AI experts to collaborate on trustworthiness, future of work, innovation, commercialization, with an initial focus on COVID, as the pandemic has shown the benefits of AI as a tool in scientific discovery and disease detection. Mr. Kratsios said Dr. Copan and NIST have played a huge part in the American AI initiative, which was launched over a year ago.

The White House joined DOE, NSF, IBM (International Business Machines), and others to launch the COVID-19 High-Performance Computing Consortium a few months ago. The partnership brings the federal government alongside industry and academic leaders to provide researchers access for free to the world's most powerful high-performance computing researches in support of COVID-19 research. It has over 40 members including industry and academic partners; details are available on the consortium website (https://covid19-hpc-consortium.org/). Dr. Droegemeier and Mr. Kratsios welcomed the first international members to the consortium, the United Kingdom's Digital Research Infrastructure and Swiss National Computing Center. Mr. Kratsios closed his remarks emphasizing that American leadership in science and technology has never been more of an imperative, and the need for the government to work in partnership with industry and academic leaders.

Discussion.

The group discussed the following topics:

- Research enterprise priorities of U.S. for rebuilding resilience for industries of the future;
- Preparing ahead of time for the next crisis pertaining to supply chain restoration and resilience;
- Importance of bridging the digital divide by to connect all Americans; and
- Recruiting talent to industries of the future including the skilled technical workforce.

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

Dr. Copan shared the latest NIST leadership changes:

- Ms. Mojdeh Bahar replaced Dr. Phillip Singerman as Associate Director for Innovation and Industry Services.
- Ms. Donna F. Dodson, Chief Cybersecurity Advisor, retired after 33 years of service.
- Dr. Paul Zielinski, Director, Technology Partnerships Office, left NIST after 32 years to serve as the Executive Director of Federal Laboratory Consortium.
- Dr. Ajit Jillavenkatesa, a long-term leader in standards policy, left NIST to work in the private sector.
- Mr. Kevin Stine is Acting Chief Cybersecurity Advisor.
- Mr. Jeff Greene joined NIST earlier this year as National Cybersecurity Center of Excellence Director.
- Ms. Courtney Silverthorn is Acting Director of the Technology Partnerships Office.
- Dr. Rob Ivester returned to NIST from DOE as Deputy Director, Hollings Manufacturing Extension Partnership (MEP).

NIST Organization Realignment 2020. Dr. Copan provided an update on the planned NIST organizational realignment. The plan will establish a new Policy and Strategic Planning organization, which will include the Program Coordination Office. A new position will elevate NIST's focus on human capital issues in the workforce of associates and federal employees. A new position of Deputy Director for Laboratory Programs will be established, and key research support functions will be better aligned. A new position of Senior Advisor for Technology Innovation is intended to promote NIST's national leadership in technology transfer and policy. Dr. Copan stated NIST is looking to better integrate Public Affairs and communications efforts across the organization and ensure the NIST brand is visible in the U.S. and abroad. Also, NIST is in the final stages of interviewing for the head of Acquisition and Agreements Management.

NIST Budget. Dr. Copan stated NIST is operating under, planning for, and developing budgets simultaneously for three fiscal years (FY). The FY2020 is an enacted budget, and FY2021 is under development with Congress and Appropriations, with some delays due to COVID-19 and other national priorities. He also stated

that NIST is still in the early stages of planning for the FY2022 budget. The enacted budget for FY2020 is a little over $1 billion; the President's FY2021 budget proposes $738 million for NIST.

NIST Reauthorization Testimony Themes. Dr. Copan provided testimony before the House Science, Space, and Technology Subcommittee on Research and Technology, which highlighted NIST's plans and accomplishments in critical U.S. technology areas. Areas of focus were future authorities for NIST based on the Green Paper as part of the reauthorization, industries of the future, manufacturing programs, and the bioeconomy. Other topics included the future of advanced communications, 5G, U.S. technology competitiveness, supply chain, and standards leadership with particular interest in spectrum and approaches being developed at the National Advanced Spectrum and Communications Test Network (NASCTN), applications of AI, and machine learning.

NIST Privacy Framework Update. Dr. Copan stated NIST looks forward to continued partnership with the Center for Strategic and International Studies (CSIS) about the future of U.S. innovation, AI, and other topics. Many organizations adopted the Privacy Framework, which was released in early 2020, thanks in part to CSIS hosting a conversation on the Privacy Framework with leaders of industry, government, and academia.

Cybersecurity: NIST Work in Encryption. Dr. Copan stated NIST continues work in encryption with post quantum cryptography moving to the third round of down-selection. Also, work in lightweight encryption is essential for mitigation of privacy risks. Recently NIST released several important documents including Special Publication 800-53 Revision 5 and several drafts including a Cybersecurity Framework Manufacturing Profile (NISTIR 8183 Rev 1) and SP 800-207 on Zero-Trust Architectures.

Positioning, Navigation, and Timing: Responsible Use. An Executive Order was issued earlier this year on the responsible use of Positioning, Navigation, and Timing (PNT) calling on NIST and DOC to work with the private sector to identify and promote responsible methods of using PNT services that appropriately manage risks. The goal is to look at time distribution over optical fiber as a backup to GPS-based systems for time dissemination, as well as an initial pilot program over optical fiber and then integration with next-generation optical clocks.

AI Standards Coordination. Dr. Copan stated that work on AI and related standards continues. There will be a series of workshops looking at developing a shared understanding of what constitutes Trustworthy AI. Three areas of focus are a Bias in AI workshop on August 19, 2020; a second draft of Secure AI for public comment in July; and an intramural call for proposals to fund several use-inspired AI research projects.

Quantum: Interagency Coordination. Efforts are underway with interagency coordination on the National Quantum Initiative. The Consortium for Quantum Information Science was held in May to discuss long-term and shared goals. It is important that NIST works collaboratively in the development of a national 5-year plan for quantum networks and develop a roadmap for identifying key gaps along the pathway to commercialization. Work on developing a controllable, non-equilibrium system is going to be foundational to a new understanding of quantum phenomena, in particular, phased behavior in quantum systems. This could lead to better insight on how to generate entangled quantum states with next-generation quantum clocks.

Standards: 5G Spectrum Sharing Testbed. Dr. Copan stated the progress on 5G spectrum sharing testbed is ongoing at NASCTN in Boulder. This is a national tool that will provide data to make effective decisions in the future for network interoperability, interference, and spectrum sharing. It was announced in May through the Institute of Electrical and Electronics Engineers (IEEE) transactions, the Boulder laboratories, has a new machine learning formula to efficiently help 5G wireless networks share communication frequencies. A national strategy around 5G was issued, with NIST having the lead role in this whole-of-government effort in both the R&D and in the standards workstreams.

Emerging Tech Standards. In the area of emerging technology standards, NIST has been working closely with DOC to raise awareness about unintended impacts of rules on U.S. effectiveness in digital technology standardization. He also stated that NIST has worked closely with the Bureau of Industry and Security (BIS) and DOC to provide clarity on standards engagement.

Advanced Communications Update. Dr. Copan stated the Public Safety Communications Research program is a new challenge, using challenge competitions, working with NASCTN and Mitre Corporation to chart out Long-Term Evolution (LTE) impacts on telemetry. This work has been and will be funded through 2022 by spectrum auction funds.

Securing Cyber Supply Chains, Exoskeleton Performance Measurement, and Infrastructure. Dr. Copan mentioned NIST is outlining a series of programs to address approaches for risk minimization in the supply chain. Another area of focus is standards for robotics and exoskeleton performance measurements, which is an important part of advanced manufacturing systems and human performance augmentation and NIST is making progress with industry and public-sector stakeholders in this area. On disaster resilience, the development of a new tool to provide evaluations on how to prioritize projects for impact, cost effectiveness, and investment value is ongoing, and this tool is more broadly available now.

Infrastructure: Plumbing Research Needs. Dr. Copan said NIST has issued a research needs summary as a result of workshops and industry engagement looking to the future of premise plumbing systems. Initial flow model designs in the U.S. go back nearly a century, and NIST is working with industry stakeholders to prepare for a future research agenda.

NCNR Upgrade Plans. Dr. Copan stated NIST is in the midst of an important upgrade planning at the Center for Neutron Research on a new liquid deuterium cold neutron source, which will provide an opportunity for improving flux for increased signal to noise and experimental throughput and will provide world-class measurement capability with a new superconducting Neutron Spin-Echo spectrometer in collaboration with NSF and NCNR.

NIST's Critical Role in Bioeconomy Growth. Next, he stated NIST continues to work in the bioeconomy and, in particular, its applications to volatility response.

NIST and the Circular Economy. The Material Measurement Laboratory (MML) is developing a program on the circular economy to support U.S. manufacturers and the recycling industry. The NIST program is coordinated with interagency efforts and includes plastics recycling grants that are aligned with Manufacturing USA institutes.

Forensics Center of Excellence Renewal. Dr. Copan said NIST recently renewed our Center of Excellence for Forensics. West Virginia University has joined this consortium led by Iowa State University.

U.S. Voting Standards and Guidelines. Dr. Copan stated NIST led the Technical Guidelines Development Committee for the new voting standards and guidelines, working closely with the Election Assistance Commission, and has also worked with the Department of Homeland Security and the Federal Bureau of Investigations to issue a new report on risk management for electronic ballot delivery.

NIST on a Chip. Dr. Copan stated NIST has developed new agreements for a major new program on electrical standards in close partnership with Department of Defense, beginning with the U.S. Air Force. The Ohm dissemination to Quantum Hall Standards is one breakthrough measurement. Collaborations in this area are ongoing with University of California at Santa Barbara.

Baldrige Performance Excellence Program. A new program on Communities of Excellence has been initiated to support the community development excellence and resilience. Baldrige has also been challenged to develop a new presidential award for excellence in workforce education, training, and reskilling.

ROI Initiative Progress Continues. Dr. Copan said NIST is working closely with OSTP, federal agencies, and stakeholders on progress in legislation, new regulations, tools, and new programs.

ROI Progress: Bayh-Dole. Dr. Copan said NIST has mapped the changes of the Bayh-Dole Act and administrative improvements to the findings of the Green Paper. A Notice of Proposed Rulemaking is in

development with DOC before releasing to the interagency. A final new rule for Bayh-Dole is anticipated to be issued later this year.

ROI Progress: Stevenson-Wydler. Major updates to Stevenson-Wydler Act has come through a legislative package to the interagency, adjudicating the responses with OMB later this summer. The revisions will be delivered to House and Senate for sponsorship at that time.

NIST Strategic Plan: Goals. Dr. Copan stated the four goals for NIST:

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

Dr. Copan complimented the NIST workforce working largely in a telework status and said lots of great publications and patent filings have been forthcoming during this period.

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

Discussion

The group discussed the following topics:

- Undershooting budget for renovation and renewing of facilities;
- Dr. Cerf will gather information related to budgetary shortfall for infrastructure, facilities, modernization, and equipment needed for NIST in the future;
- Low 2020 budget for laboratory programs, facilities, and extramural programs focused on U.S. manufacturing;
- Concern over NIST on a Chip being a priority;
- Pace of when to have algorithms in place that would protect post-quantum cryptography;
- Guidance on advocacy for funding that VCAT could explore as a federal advisory group;
- Green Paper findings on Bayh-Dole modernization progress;
- Modeling ways on how architecture will work for PNT and time distribution by fiber into a larger system;
- Challenge of synchronization to quantum networking; and
- Concern about Huawei introduction of new IP in the ITU possibly migrating internet standards.

SESSION II: NIST EFFORTS IN RESPONSE TO COVID-19

MEP Response and CARES Act Efforts - *Ms. Carroll Thomas, Director of Hollings Manufacturing Extension Partnership*

Ms. Thomas stated the national network response to COVID-19 will result in year 2020 being analyzed as far as what went wrong and what went right and what could be done next.

Nearly all manufacturers in U.S. have less than 500 employees and 75 percent have 20 or less employees. There are 12.3 million people employed in manufacturing jobs. The last 6 months of 2019, there was a slight contraction in manufacturing due to unemployment and the inability of small manufacturing businesses to expand.

Ms. Thomas explained the Manufacturing Extension Program (MEP) National Network had received the $146 million that was budgeted for the 51 centers, the funds were invested in building MEP center's capabilities in cybersecurity and advanced manufacturing technology services, focusing on reaching more manufacturers to help navigate smart manufacturing production processes.

In January-February, U.S. manufacturers were impacted by major global supply chain disruptions. The U.S. manufacturing plummeted 6.3 percent, the largest single-month drop in 74 years. The global pandemic declared as a health crisis erupted into critical need for personal protective equipment (PPE). Large

manufacturers of PPE couldn't keep up with the demand for materials. Gaps in lower-tier levels of production uncovered the need for a better understanding of domestic production sources.

Ms. Thomas stated a coordinated response effort was put in place. Local governors received a reminder that their local MEP Centers were ready and available to assist manufacturers, connect suppliers, pivot production, and make critically needed supplies.

Through the Coronavirus Aid, Relief, and Economic Security (CARES) Act, the Hollings Manufacturing Extension Partnership received $50 million on March 27th. The funds that came to the MEP program did not have to be matched, as it was emergency legislation to get funds out quickly to the centers. The provision in the CARES Act allowed cost share requirements to be waived.

Ms. Thomas stated for the first time ever, the MEP program received disaster funding to support U.S. manufacturers. The goal was to reach out directly to new, present, and past manufacturing clients to assess their needs. Ms. Thomas was the selecting official on the application that gave out 26 awards to the centers for $25,401.600. The goal is to reach all 51 centers within 90 days, with the deadline of June 25th.

Ms. Thomas stated all 51 MEP Centers were working together with all markets such as hospital associations, aerospace, and automotive industries. For example, a supply chain was created for large manufacturers who produce ventilators to work with state economic development organizations to locate suppliers in their states. All 51 MEP Centers provided information to the manufacturing community to match capabilities and needs to support production and access to critically needed supplies.

For more information, see Ms. Thomas' presentation.

View from the MEP Centers – Actions Taken and Looming Challenges – *Ms. Bonnie Del Conte, CONNSTEP Director, Connecticut MEP Center and Mr. Michael O'Donnell, Manufacturing Program Director, Center for Industrial Research and Service (CIRAS) Iowa State MEP Center*

Ms. Del Conte stated the Connecticut MEP has been with the NIST Hollings program since 1994 and has a great relationship with the state Office of Economic and Community Development. Before the CARES Act, they had done some outreach with the Connecticut Business and Industry Association (CBIA) and it has been an affiliate with them for 3 years. They are a membership organization with 4,000 members, 30 percent of them being small to midsized manufacturers. This provided a unified voice for state policy as well as at the federal level.

When the pandemic began, the Connecticut MEP reached out immediately to find out what first responders and health care employees needed, and which manufacturers could help. They developed a website, connecticutcovidresponse.org, to match PPE manufacturers to those in need, particularly health care facilities and first responders.

Since the website started, it has had over 81,000 visits. The center processed approximately 1,800 requests for PPE and have identified 48 manufacturers who have repurposed their operation to produce PPE, such as, face shields, gowns, masks, and hand sanitizers. Working with the governor's office, they soon had over 14,000 requests for surgical masks.

State legislation passed a bill to establish a Manufacturing Chief Officer, who has been a liaison for business and industry. The center also has a strong relationship with Senate representatives in Congress. These connections provide a direct line of communication to both the state and federal level. The MEP has provided this strong network in manufacturing.

Mr. O'Donnell, representing the Iowa MEP, CIRAS, stated Iowa has a history of responding to disasters, and have activated an emergency response program 10 different times. On February 12th, it was activated for

COVID-19 based on reports from clients and global supply chain interruptions. Their disaster response program applies an engage-educate-embed model, that allows to adjust and learn the situation evolves.

The first priority in a disaster response is to understand the situation, needs, and complexities. In this regard, during COVID, they have expanded outreach to manufacturing as well as engaged with the health care industry in a public-private emergency response process. There have been 1,200 outreach calls to businesses across the state. The center published a weekly survey on the state of industry in Iowa on multidisciplinary issues, such as the impacts of reduced ethanol production, and availability of CO_2 (carbon dioxide) for food processing and water treatment in Iowa. They have held 25 roundtables with over 450 attendees as part of the engagement efforts.

Mr. O'Donnell stated as part of the education phase, the Iowa MEP National Network has helped companies find information on COVID-19 and emerging best practices. They launched a website and published 15 original content items to help manufacturers implement change to protect their businesses and people. Podcasts and webinars to educate the industry have also been conducted to educate industry across the state.

The key focus for CIRAS is embedding change within their clients, that makes a long-term impact in Iowa. Over the last 3 months, the center provided services on over 130 different manufacturing requests. It connected supply and demand in a stressed and overcapacity supply change environment. The Center has also participated in several national supplier scouting activities. Mr. O'Donnell gave an example of a local hospital in Iowa needing a patient isolation pod, and the Texas MEP led them to a small manufacturer in Illinois that was able to make a connection with a local manufacturer. This is an example of the MEP National Network in action.

Most notably, the center rapidly retooled manufacturers to meet the needs of their health care providers in Iowa. For example, over 1.2 million face shields have been made in Iowa and some of the businesses are moving into that business permanently. Currently, CIRAS is preparing for an economic recovery by organizing service teams, having internet marketing boot camps, and helping small businesses sell over the web.

For more information, see Ms. Del Conte's and Mr. O'Donnell's presentation.

Discussion

The group discussed the following topics:

- Improving visibility into supply chain moving forward;
- How to continue to strengthen infrastructure under MEP;
- A manufacturing grid of capabilities to help the manufacturer community;
- Pharmaceutical industry inclusion in a national capability database;
- Differences in media coverage of information to states; and
- Getting the message out of the value the MEP program and its National Network is providing.

Manufacturing USA Responses – *Mr. Michael Molnar, Director of the Office of Advanced Manufacturing*

Mr. Molnar stated Congress authorized Manufacturing USA in December of 2014, establishing a program office at NIST for program cooperation, support of the network, public reporting, and management of commerce-sponsored institutes. The bipartisan legislation defined eight purposes. Congress reauthorized the program this past December giving NIST new areas of authorities and responsibilities and added a ninth purpose, which is to contribute to the development of innovation and regional initiatives across the nation.

Manufacturing USA brings together public and private investments to improve competitiveness and productivity of the United States manufacturing through a robust network of manufacturing innovation institutes. There are now 14 Manufacturing USA institutes, and the newest one recently announced is on cybersecurity for manufacturing.

Manufacturing USA launched a COVID-19 website on manufacturingusa.com to help address the pandemic response and to inspire institutions for further engagement.

A recent reauthorization gave Manufacturing USA authority to provide public service grants to Manufacturing USA institutes. Previously, they were prohibited from offering any funding to the institutes not sponsored by Commerce. These grants do not require a cost match, but they do require an open competition with selection based on merit and offer speed and flexibility to quickly move on pandemic response projects. Mr. Molnar stated based on the authority, NIIMBL (National Institute for Innovation in Manufacturing Biopharmaceuticals), a NIST sponsored institute, is not eligible for the public service grants, therefore a different noncompetitive request for application pathway was designed.

The CARES Act included $10 million for Manufacturing USA. The strategy was to augment the appropriation with all available funding from a base budget, using any funding not already obligated. The balance was $12.3 million. Further, Manufacturing USA designed the competition to be rolling in case Congress appropriates additional funding, awards to already submitted proposals can be done immediately. Knowing it would take time for institutes to formulate plans or proposed projects, the goal was to establish the funding pathways very quickly. Manufacturing USA worked closely with NIST Grants Management Division, the Federal Assistance Law Division, and Office of Chief Counsel to formalize two competition pathways. They were launched one business day after the CARES Act was enacted into law. The goal is to move quickly to award the best projects with the highest impact. The National Emergency Assistance Program was designed for speed and flexibility, and it solicits high-impact projects designed to respond to the COVID-19 pandemic. Proposals are received on a rolling basis. Awards to four institutes are currently under way totaling $3.4 million. The first award went to BioFabUSA, and the other three will be announced shortly. BioFabUSA is leading a rapid response roadmap for organizations to follow for pandemic response recovery.

Mr. Molnar stated that NIIMBL's ecosystem has more than 150 members in 24 states, including leading global pharmaceutical manufacturers, small businesses, universities, academic medical centers, and federal scientists and was awarded nearly $9 million for their portfolio of priority projects.

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

Plans for and Actions Taken by NIIMBL - *Dr. Kelvin Lee, Director, National Institute for Innovation in Manufacturing Biopharmaceuticals, (NIIMBL)*

Dr. Lee stated that NIIMBL had a Request for Application opportunity for COVID-19 response funding and received over 200 submissions totaling over $90 million of innovative ideas. The scope included any area where NIIMBL community subject-matter expertise could add value to the COVID-related problems to include biopharmaceutical manufacturing.

A large number of teams from the NIIMBL community submitted ideas relating to antibody-based testing as well as diagnostic testing, contract tracing, technologies for not only tracking people, but people working in manufacturing environments, people interacting with equipment, decontamination technologies relating to PPE, and quite a few others on medical countermeasures such as the discovery of new medicines, development of existing medicines, and the manufacturing of those medicines. Dr. Lee said NIIMBL can share expertise and capability to assist regional hospitals and systems with rapid in-house diagnostic testing, as well as helping locate domestic supply chains to reduce foreign dependence for PPE development and manufacturing.

To date, NIIMBL has launched nearly $65 million worth of technology and workforce projects, executed several technology roadmaps, and will be launching some new industry-wide initiatives programs in 2020. In partnership with the National Society of Black Engineers, NIIMBL created an activity called the NIIMBL Experience Program, which identifies freshman at Historically Black Colleges and Universities in an effort to get them excited about a career in biopharmaceuticals.

Dr. Lee stated NIIMBL held a 3-day workshop in February 2020 with leaders from a broad cross section of companies as well as the Food and Drug Administration (FDA) and NIST, with the goal to further advance and accelerate movement towards process intensification; thinking about continuous manufacturing of medicines and creating a new manufacturing paradigm to benefit everybody in the ecosystem.

By 2029, NIIMBL's vision is to invent, design, build, and commercialize drug substance and product manufacturing capability enabling flexibility in manufacturing; control, robustness, and security in supply of materials; supply chain velocity; more sustainable plastic and energy use; lower capital and operating cost; and integrate the entire manufacturing process from a master cell bank vial to a final dose or patient vial.

In February of 2020, NIIMBL moved into its new headquarters donated by the University of Delaware. Dr. Lee stated NIIMBL currently occupies 30 percent of the 225,000-gross-square-foot laboratory-intensive space.

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

Discussion

The group discussed the following topics:

- Workforce planning and contributions of universities partnering with industry;
- Formulating training in the form of short courses or certification programs;
- Growing the pharmaceutical industry in the U.S.;
- Value and importance of a STEM-trained workforce that can operate new equipment on the horizon;
- How NIST can create education workforce skills that private-sector industry members do not fund;
- Making each institute a regional hub for people to access; and
- Strategic risk of training programs for global employees who end up abroad thereafter.

Overview of NIST Laboratory Efforts in Response to Covid-19 - *Dr. Heather Evans, Senior Analyst, Program Coordination Office; Dr. Peter Vallone, Leader, Applied Genetics Group, Material Measurement Laboratory; Dr. David LaVan, Project Leader, Materials Measurement Science Division; and Dr. Ellen Voorhees, Senior Research Scientist, Retrieval Group*

Dr. Evans described an internal effort dubbed "How can NIST help?" to rapidly identify and support research efforts proposed by NIST staff to address the challenges of COVID-19. She led a cross-laboratory team to develop and carry out a plan.

The "How Can NIST Help?" effort consisted of four parts:

- Idea generation;
- Information Sharing;
- Collaboration; and
- Action

Idea generation. The team solicited ideas from the technical staff, looking for ideas that could have a significant impact and be done safely in the current work environment. After 4 weeks, 75 submissions were collected, from all six laboratories.

Information sharing and Collaboration. The team used range of collaborative software tools to encourage idea generation and sharing. The team hosted several seminars with outside speakers and NIST staff. Overall, this effort helped unify NIST staff around the mission and continue to be engaged despite working remotely.

Action. The main themes for the call to action were as follows:

- Machine Learning, AI, Data and Analytics;
- Manufacturing and industry;
- Volunteering and engagement;

- Wireless innovations;
- Personal protective equipment;
- Biological measurements; and
- Energy and environment.

Dr. Evans provided an overview of a number of ongoing efforts, including a cross-laboratories team working on exposure notification technologies to keep communities safe; a survey by the Applied Economics Office of small and medium sized manufacturers to understand their planning for natural disasters during the pandemic; measurements to characterize ethanol in hand sanitizers; wireless innovation projects, and more. In particular, NIST staff has demonstrated their commitment to the community through volunteering and engagement activities.

For more information, see Dr. Evans' presentation.

Next on COVID-19 detection, Dr. Vallone explained the work of the Applies Genetics Group at NIST to address the challenges of the pandemic. The Applied Genetics Group in NIST's Biomolecular Measurement Division has deep expertise in DNA measurement tools and produces various DNA Standard Reference Materials for forensic science and clinical applications.

Some of the group's areas of focus that began in late February through early March focused around detection focused on molecular testing, or RNA-based (Ribonucleic Acid) detection; the availability of controls and standards; and identifying key stakeholders including working groups, other National Metrology Institutes (NMI), industry, and government agencies. Ramping up the competency of the RNA detection assays was an initial idea. Dr. Vallone said NIST began to work on developing and optimizing assays in-house based on existing assays from the World Health Organization and the U.S. Center for Disease Control.

Dr. Vallone described NIST's efforts to develop a research-grade testing material that can be used as a control to support measurement infrastructure. With an aggressive development timeline, NIST targets a release date by the end of June 2020. Then, NIST will send the materials to commercial makers of controls and assays to other laboratories or different stakeholders, having them return a survey filled out in terms of how useful they found the material. This work was supported by the CARES Act.

To advance the quality of SARS-CoV-2 measurements, NIST is participating in interlaboratory assessments. One, hosted by INSTAND, was a worldwide study involving over 450 laboratories[1]. Also, NIST is also part of a pilot study in the Nucleic Acid Working Group under the CCQM (Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology) to expand RNA measurements, this work is also supported by the CARES Act.

Dr. Vallone stated that diagnostic assay performance was an important research area, in particular researchers learn more about how the virus mutates over time. NIST plans to look at the effect of the mutation on measurement in terms of how it affects qPCR (Real-Time Polymerase Chain Reaction) or digital Polymerase Chain Reaction (PCR) values to show the measurement challenges and robustness of assays used for SARS-CoV-2 detection.

A collaborative working group with JIMB (Joint Initiative for Metrology in Biology) and the UK National Measurement Laboratory (NML) has formed to explore developing a minimum information standard for SARS-CoV-2 controls.

Lastly, Dr. Vallone described a research collaboration between MML and the Information Technology Laboratory to develop mathematical approaches to improve the sensitivity of qPCR detection methods.

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

[1] https://www.instand-ev.de/en/

Next, Dr. LaVan addressed NIST research related to PPE. He said that NIST has been applying its measurement and standards expertise to problems with the emergency reuse and decontamination of PPE to assist with the COVID-19 response.

One key area underway is on UV (ultraviolet) source measurement standards. This is work that has been ongoing in the Physical Measurement Laboratory, which has a longstanding program to look at both wavelength and intensity standards for UV. Dr. LaVan said that multiple standards are in development with the Illuminating Engineering Society (IES), and some are specific to lamp types. An illustration was shown of a UV-C (shortest wavelength) dose indicator that is marketed for hospitals to see whether a sufficient dose was delivered to a surface to ensure decontamination worked.

Dr. LaVan said work happened in early 2000s during the original SARS outbreak, and UV-A (longest wavelength) was found to be ineffective in inactivating viruses, and that UV-C would break down the virus fairly quickly on the order of 5 to 10 minutes, the dose used in research.

Work is being extended to now look at SARS-CoV-2 in collaboration with Department of Homeland Security in a program called PANTHR, which is operated at USAMIRIID facility at Fort Detrick, a BSL-3/BSL-4 facility. Dr. LaVan stated NIST is collaborating to help with wavelength and ultraviolent intensity measurements and is also collaborating with Columbia University, which has a mouse facility that is evaluating safety of 222-nanometer ultraviolent light, which is believed to be more inherently safe.

Dr. LaVan described an industry partnership with the firm UV-Concepts, which reached out to NIST for help in generating testing and data that they would need to show for decontamination of PPE, N95 respirators, gowns, and face shields. A manufacturer of sterilization equipment is UV-Concepts. With NIST collaboration, UV-Concepts is working with ResInnova to test for MRSA and Clostridium difficile.

Dr. LaVan stated that the Engineering Laboratory generated a software tool that estimates the vaporized hydrogen peroxide (VHP) concentration in air of a room being used to disinfect masks, based on longstanding expertise in VHP. The tool accounts for the room size, surface losses, and air change rate using a mass balance approach. Currently, NIST is working with Batelle, the U.S. EPA, and UT Austin on this effort.

Next, he described MML efforts to study the performance of face coverings. In one project, images showed how various designs of homemade face coverings stop the flow of particles and the importance of fit. This qualitative information is being released through the Office of Public Affairs. Another study quantified the filtration efficiency of over 30 different materials commonly used to make face covering. The results indicate that 100% cotton with nap has the top performance. These results have been submitted for publication.

Dr. LaVan closed by emphasizing the importance of standards and interagency coordination. The NIST Standards Coordination Office has arranged access for NIST staff and other agencies to PPE and ventilator-related standards and many NIST staff have participated in a variety of interagency calls and working groups to identify needs and connect NIST staff and resources.

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

Dr. Voorhees explained that NIST is building a test collection for a pandemic search using the TREC (Text Retrieval Conference) framework. She explained that information retrieval is the science behind search engines, and the test collection is a measuring device.

Cyril Cleverdon of Cranfield College was the first one to build a test collection in the 1960s. He wanted to compare index languages which are languages used to make card catalog entries. Relevance judgments were made based on which documents were retrieved. Test collection defines ideal retrieval. From the '60s to '80s, several other test collections were built, but they were very small.

Dr. Voorhees said by the 1990s, no one looked at the research results because they figured the collections were too small and not representative. The Defense Advanced Research Projects Agency (DARPA) had a project called TIPSTER, which built search engines for newswire-type media, open-source collections. Then, DARPA then asked NIST to build a large test collection so that the performers in the TIPSTER program could

be evaluated. Dr. Voorhees said NIST then decided to convene a conference in the fall of 1992, the first TREC conference, and since that time, there has been a TREC conference each year. One of the first places for community evaluations was TREC. The result of a research community evaluation is the state-of-the-art improves. A research methodology was established to answer questions of how to do research in the area. This also facilitates technology transfer and amortizes the cost of the infrastructure needed to do the evaluation.

In response to an OSTP call for action, TREC-COVID is building the infrastructure to improve search systems for future biomedical crises while providing human-curated answer document sets for today's questions. Dr. Voorhees said effective searches will help clinical personnel get the evidence-based answers needed.

She explained why a new collection is needed and that TREC has already built test collections based on scientific articles in biomedicine, but the problem is the search during a pandemic is different. Rapid evolution of topics of interest occurs, and people do not know what they want to search for until they have done some initial research. Then the literature in that area explodes. CORD-19 is adding roughly 300 documents a day to their collection, and a large percentage is not peer-reviewed.

Dr. Voorhees said the CORD-19 document set is a dataset of open-access literature for coronavirus research. Questions have been collected that were inspired by actual search logs at medical libraries, including the National Library of Medicine. The TREC-COVID is run in a series of rounds. In each round, a new release of a document set happens. The first round was kicked off on April 15th, and there have been three rounds. The third is in progress. The size of the datasets more than doubled in between Rounds 2 and 3.

The TREC-COVID website makes the data available from the research endeavor for people to improve their systems. Everything is public. The website contains score reports for every run that was submitted as well as analysis for what's been done so far on the collection being built and how the systems are doing. The plan is for five rounds total, and the final collection will be a cumulative set of 50 topics. Metadata will allow a series of individual rounds to be recovered as needed. Dr. Voorhees said this will provide a rich trove of data to NIST and the public of study collection-building under adverse conditions.

For more information, see Dr. Voorhees' presentation.

Discussion

The group discussed the following topic areas:

- Is it realistic that a constellation of fragments is representative of normal SARS breakdown;
- Testing the curve of speed versus quality of papers being put out;
- Google being involved could be beneficial in evaluating documents coming into the system; and
- Physical mechanism for particle size below the minimum in particle efficiency.

SESSION III: NIST AND COVID-19 SAFETY AND OPERATIONS

NIST Framework for Reopening and What NIST is Doing to Protect Employees and Associates - *Ms. Anita Vanek, Acting Director of Management Resources and Dr. Elizabeth Mackey, Chief Safety Officer and Director of Office of Safety, Health, and Environment*

Ms. Vanek reported on NIST's current situation. There are about 120 and 150 staff on-site between the two campuses. Normally, there's close to 5,000 to 7,000 between staff, contractors, and associates. Mission-essential functions, SRM, distributions, select calibrations, and COVID-19-related research are continuing on-site. The environmental controls at the Advanced Measurement Laboratory is the only location running on the Gaithersburg campus due to reduction in central utility plan operations. In Boulder, it was possible to maintain environmental controls and continue mission-essential functions.

Ms. Vanek said a large number of staff are teleworking, roughly 3,600, on any given day, which translates to 93 percent of the employees teleworking over a 30-day period. There are now virtual meetings, collaboration tools, and virtual onboarding.

There are four guiding principles for reopening:

- Ensure the ongoing safety of NIST staff;
- Create an operational ready state so services can be brought back online;
- Minimize number of staff on-site; and
- Decisions on what activities resume based on mission priorities.

There will be a phased approach to reopening. Right now, NIST is in limited access phase, and then there will be three phases afterwards. Phase One will be 25 percent of staff, Phase Two up to 50 percent, and Three go up to 75 percent of staff. The phases are determined by external factors, conditions in states and communities, guidance and regulations from local, state, and federal governments; and internal factors such as safety protocols in place, necessary supplies, and campus/buildings readiness for occupancy.

To begin Phase One, all external criteria must be met. Ms. Vanek said NIST is in at least a 2-week timeline as far as Gaithersburg for reconditioning. This includes availability of safety and hygiene supplies for the reconditioning staff. Reconditioning for Gaithersburg will be longer because of the environmental controls.

Ms. Vanek explained the reopening team structure. The NIST management team is the deciding body for major policies and ultimately makes the decision on site status. The Executive Safety Committee will be the deciding body on safety policies and procedures. The Reopening Advisory Team consists of laboratory and management resource staff, which will oversee the day-to-day process for reopening policies and procedures. NIST is ensuring a safe work environment and consistent policies for all staff. Major activities include HR-related policies for high-risk staff members, leave and telework; guidance for supervisors on how to talk to staff; safety protocols for working safely on campus; implementation of engineering controls, to include barriers, floor markings, ventilation; site cleaning and disinfections; acquisition of hygiene supplies, disinfectant wipes and hand sanitizers; positive case response, disinfection and contact tracing; and training for staff.

Dr. Mackey begin her portion of the presentation by providing an overview of NIST's continuity of operations and pandemic plan, which is a requirement for each federal agency. When the first U.S. case was reported January 21st, NIST launched an incidence response team a week later. On March 11th, the World Health Organization declared this a pandemic. Then NIST put the pandemic plan in place, which talked about readiness. Currently, NIST is not post-pandemic and is still dealing with mitigation strategies. Dr. Mackey stated NIST and DOC came out with procedures needed to respond on March 23rd, which is when NIST went into mandatory telework.

Dr. Mackey provided an overview of the polices and process NIST used prior to the implementation of mandatory telework to identify and track potential cases in order to mitigate the spread.

For all phases of the reopening, OMB guidance has basic safety precautions to follow: social distancing, hygiene practices including face coverings, cleaning and disinfection, use of PPE when required, ensuring that symptomatic people do not come to work, and contract tracing when an employee tests positive for COVID. Telework guidelines are very specific for Phases One, Two, and Three. Phase One still involves lifting mandatory telework but still using telework as an option. Phase Two, NIST would be permitted to lift the maximum telework but still use telework as part of the solution, maintaining lower levels of staffing. Phase Three, OMB calls "implement optimized operations and new work arrangements," which means that during the pandemic, there is a new normal or different way of doing things.

Dr. Mackey expanded on what campus readiness should look like. That includes bringing the environmental controls back, making sure all mechanical systems are functioning properly, pest control, flushing water lines, and evaluating the ventilation systems. Increasing ventilation and looking at filtration where feasible is being evaluated. Upgrades to routine cleaning and disinfection protocols must be in place. Some areas will have to be repurposed with new guidance for occupation limitations. Safety protocols have been issued as well as a return-to-work training has been drafted and under review by the Safety Advisory Committee, and then it will go to the Executive Safety Committee.

For more information, see Ms. Vanek's and Dr. Mackey's presentation.

Discussion

The group discussed the following topic areas:

- Better communication to employees who want to get back to work;
- Balancing privacy concerns regarding employee absenteeism;
- No loss of life among team members at either major site;
- Several team members have been symptomatic, and a small number have tested positive;
- Disinfection of technical areas, mission-unique workstations, and special needs situations; and
- Need for NIST management to stay connected employees regularly.

SESSION IV: DISCUSSION WITH VCAT

Discussion with VCAT Members – What They Are Seeing as Concerns and Risks in Their Sectors – *Dr. Allen Adler, VCAT Chair*

Dr. Adler began by thanking all the speakers and NIST as a whole and requested the VCAT members to address their concerns and/or comment on what they heard during the meeting.

Several members stated that the meeting was very productive and were impressed with the organization and dialogue.

Ms. Prafullchandra emphasized the need for individuals to come back to a safe environment at work, and that from a global perspective, there may be local implications and cultural differences that are important to satisfy. Dr. Copan agreed that it is important for supervisors to have conversations with employees about issues of risk, and respect issues of individual privacy and needs.

Ms. Ku is pleased that MEP is getting some recognition of doing a good job coordinating the manufacturers. She is concerned the Presidential budget request was pre-COVID and how it will change post-COVID since there will be additional expenses due to reconditioning phase of NIST campuses, as well as other issues that impact the budget. Dr. Copan agreed that MEP has delivered quite successfully and stated that NIST is in the early stages of the FY2022 budget formulation process. He also said NIST has been working closely with Department of Commerce on the next phases of the stimulus as well as how to support America's entrepreneurs and help stimulate the economy through incentivizing public sector engagement.

Dr. Khan was impressed with the manufacturing initiative across the country, but he reminded the committee that it is the most senior population that have the most comorbidities and are the most vulnerable as opposed to younger members of the team, that it is important to protect those members of the workforce for medical reasons due to the consequences of COVID.

Dr. Kaler had three comments. The first, that universities are worried about the second wave of COVID, and the need for NIST to be aware of this concern as well, especially the vulnerable employees. The second was to expect more enhanced and deeper calls for enhanced diversification in the workforce given the current situation around race conversations in the United States, and third, he suggested VCAT members keep in contact with Dr. Adler to ensure the voices of the VCAT members are harnessed in harmony with other supporters of NIST as the congressional budget rolls out. Dr. Copan replied that NIST campuses are closely embedded with academic institutions, and that NIST leadership will be meeting with Johns Hopkins University on Friday to discuss insights and best practices related to COVID-19. He mentioned the presidential directive about Chinese nationals and their participation in the U.S. student population, which is an important conversation to have as the Asian American postdoctoral fellows are important contributors to NIST and the country.

Dr. Jackson appreciated the context given by Dr. Droegemeier and Mr. Kratsios on the sentiments about not letting a crisis go to waste in terms of streamlining and learning. He appreciated the MEP discussion and commended NIST team on progress of Privacy Framework, AI standards, PNT, and 5G spectrum sharing. He

was pleased to see the progress of Bayh-Dole. He cautioned that standards efforts are now slowing down, and that the nation must continue work on technologies such as AI, 5G, and quantum. Dr. Jackson said that discipline is key to enforce social distancing and best practices at the workplace and hopes that leadership will stay on top of that. Dr. Copan said that NIST has been working with DOC, DOD, and the White House to look at elements that would help rebuild the sector and re-shore manufacturing capabilities as well as advanced manufacturing that would benefit the U.S. and its manufacturing sector.

Dr. Ishak mentioned that in Silicon Valley, some entities were moving equipment to employees' homes so they can continue to work at home. He also commended Dr. Copan for his communication skills, and he suggested a regular communication in the form of a half page to employees to keep them abreast of the current state of affairs would be a good thing for NIST. Dr. Ishak said it is important to acknowledge the minority community's thoughts about diversity and discrimination when speaking to them, but it is not appropriate to say, “you feel their pain”, if not a minority.

Dr. Folena-Wasserman expressed her appreciation of the progress NIIMBL has made, to include the University of Delaware, and how well organized they are. She mentioned bioprocessing during the pandemic is important because of vaccine approaches and monoclonal antibodies, biologics are important aspects of medicine, and NIST can help this effort by helping manufacturers develop and manufacture them faster. She also enjoyed the progress MEP has made. Dr. Copan commented that he is glad to have Ms. Bahar on the NIST team, and that the NIST colleagues, the National Network, and the Office of Advanced Manufacturing have been embedded with the work of NIIMBL. The concept of One NIST goes well with NIIMBL as NIST looks to the future of bioeconomy. Dr. Copan mentioned he is looking forward to having VCAT watch the movie *The Last Artifact* to be released nationally by PBS, which highlights how people at NIST are a part of the journey to global partnership and working with nations.

Dr. Cerf stated that the topic on TREC-COVID got his attention, as it is a challenge to get quantitative about information. He also stated that to position NIST to what it has been and needs to be in the future means investment, and he hopes NIST can persuade Congress that this would be a worthwhile investment.

Mr. Garvey stated he thought the MEP response during the COVID crisis proved the network was strong, and he encourages MEP to take the dataset of capabilities and overlay it on the reshoring efforts, as it will enhance the manufacturing prowess in the country and supply chain activities. He also cautioned about the emotional challenges that COVID has brought on as they start to bring people back to the workplace.

Dr. Adler thanked everybody for their contributions to the meeting, to include an outstanding series of presentations, and suggested the reason for the success of NIST is the values it espouses: people first, a high degree of collegiality among the NIST team, scientific integrity, analytical rigor, strong leadership, and paying attention to important strategies.

Administrative Business

Dr. Copan thanked the entire VCAT for investing their time and expertise with NIST to improve the mission of this institute for the nation.

There were no public comments offered.

Adjournment

The meeting was adjourned at 5:00 PM.

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

Stephanie Shaw, Designated Federal Officer, NIST Visiting Committee on Advanced Technology

Dr. E. Allen Adler, Chair, NIST Visiting Committee on Advanced Technology