

**VISITING COMMITTEE ON ADVANCED TECHNOLOGY (VCAT)
MINUTES OF THE OCTOBER 18, 2016 MEETING
BOULDER, CO**

ATTENDANCE:

Visiting Committee

Members Attending

Adler, Allen
Brooks, Rodney
Colwell, Rita
Holt, William *
Ishak, Waguhi
Padovani, Roberto *
Sizer, Theodore *
Wilson, David

Designated Federal Officer

Stephanie Shaw

NIST Leadership Board

Boehm, Jason
Celotta, Bob
Dimeo, Rob
Harary, Howard
Kayser, Rich
Kimball, Kevin
Locascio, Laurie
May, Willie
Messerly, Clyde
Olthoff, James
Orr, Dereck
Porch, Susanne
Rochford, Kent
Romine, Charles (Chuck)
Royster, Cecelia
Saunders, Mary
Singerman, Phillip *
Thomas, Carroll

NIST Staff and Associates

Antonishek, Brian *
Banovic, Stephen *
Boisvert, Ronald
Briggman, Kimberly
Burrus, James
DeIRio, Frank
Dowall, Marla
Drapela, Tim

Evans, Heather *
Fasolka, Michael
Fitzgerald, Ryan *
Frey, Mike
Genco, Sheryl
Goldstein, Barbara
Grove, Tom
Henry, Akeem *
Hickernel, Bob
Hochman, Howard
Hoergo, Jennifer *
Jillavenkatesa, Ajit *
Kelley, Mike
Ludlow, Andrew
Marcoullier, Tammi
Martinez, Serena
Miner, Laurel
Niharger, John
Ost, Laura
Parris, Reenie
Porter, Gail
Ringen, Sonja
Robinson, Crissy
Rudman, David
Schlatter, Katie
Szakal, Christopher *
Wang, Jack

Others

Bognitz, Tom -MEP Colorado
Manufacturer's Edge

*Participated Remotely

Call to Order - Dr. Rita Colwell, VCAT Chair

Dr. Colwell called the meeting to order at 8:30 a.m. The Chair reviewed logistics and the meeting agenda.

OVERVIEW AND SAFETY UPDATE

NIST Update and Agenda Review – Dr. Willie E. May, Under Secretary of Commerce for Standards and Technology and NIST Director

Dr. May began his update by expressing sorrow for the loss of two prominent members of NIST's research staff, [Dr. Katharine Gebbie](#) and [Dr. Deborah Jin](#).

Dr. May mentioned that two recent security incidents exposed the security deficiencies at NIST. After an audit of NIST's Police, Security Guard, and Foreign National Visitor programs was conducted by the Federal Protective Service and the DoC Office of the Inspector General, three independent security experts were asked to review NIST's security requirements and practices and provide their individual input and recommendations. The consensus of the recommendations was to strengthen security measures at both campus, to move security functions higher up in the organization, and to improve the overall safety culture.

Physical security improvements have already begun at the Gaithersburg site by installing a turnstile to secure a major junction between public space and laboratory space; NIST is learning from this pilot and continually trying to make it a more effective and efficient gateway. Improvements also include expanded coverage of the sites through CCTV cameras, the installation of cyber locks within individual laboratories, and improvements to both the visitor registration and associate systems. There have been critical IT network security equipment upgrades. The DoC Office of Security and NIST are currently working with the DoC office of the Inspector General to review NIST's Foreign Guest Researcher program. In Boulder, NIST has taken steps to improve the security deficiencies, such as requiring two factor authentication to access buildings, an increased number of security guards and patrols, and after-hours locking of service galley doors. NIST leadership also met with the City Staff and Congressional Delegations to discuss upgrading the security posture of NIST's Boulder campus.

Dr. May provided an overview of the current budget status. Congress has not come to an agreement on the President's Fiscal Year 2017 budget request; on September 28th, a ten-week continuing resolution was passed authorizing NIST to spend at the same rate as the prior year until December 9th.

Dr. May next discussed a few program highlights. He first addressed the National Network for Manufacturing Innovation, which on September 12th Secretary Pritzker renamed to Manufacturing USA. NIST currently has an open-topic competition to award the Department of Commerce's first Manufacturing Institutes; proposals have been submitted and are going through deliberations. NIST hopes to have at least one institute awarded by the end of the current administration. The Department of Defense has committed to awarding Manufacturing USA institutes on robots in manufacturing and on advanced tissue biofabrication. The Department of Energy is also adding an institute on modular chemical process intensification.

Dr. May then gave updates on a number of programs including the Baldrige Performance Excellence Program and the creation of the Baldrige Cybersecurity Excellence Builder assessment tool, the Community Resilience Planning Guide for buildings and infrastructure systems, NIST work in forensic science, the release of a new SRM to support the manufacture of biologic drugs, as well as NIST's role in voting systems and our work with the Election Assistance Commission in the development of voluntary voting system guidelines.

Discussion:

The group discussed the following topic:

- The evolution of NIST over the past few decades, its expanding scope of responsibilities, and how and when to refocus on core efforts.

- Plans to address the security of NIST at the Boulder campus.

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

Safety Update – Dr. Richard Kayser, Chief Safety Officer

Dr. Kayser reviewed the latest safety metrics at NIST and provided an update on two new programs: workplace inspections and radiation safety. NIST's Occupational Safety and Health Administration recordable incidents have stayed the same as in FY15 and the number of Days Away, Restricted, or Transferred cases went down by 3. There is an issue with the recordkeeping of hearing loss that Dr. Kayser promised to update VCAT on at the next meeting.

Dr. Kayser then updated the VCAT on NIST's workplace inspection program, the first phase of which to spell out clear roles and responsibilities was implemented on October 1st. Online and classroom training is now available. Just since the last VCAT meeting in June, over 300 NIST staff members have been trained. The remaining requirements are to be completed and in effect by October 2017.

Finally, Dr. Kayser reviewed NIST's radiation safety programs. He reminded the VCAT of the extensive efforts NIST has made since the plutonium contamination event in June 2008. In September 2016 the Nuclear Regulatory Commission (NRC) did an unannounced inspection. The outcome was high praise to all of the NIST staff and the way NIST proactively identified and corrected issues and kept NRC informed.

Discussion:

The group discussed the following topic:

- Roles and responsibilities of reporting of safety hazards and radiation safety
- What the engineering problems are and how to prevent exposure to those hazards.

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

CRITICAL FACETS OF THE NIST CORE

Evolution of the NIST Research Agenda – Dr. Kent Rochford, Associate Director of Laboratory Programs

Dr. Rochford led a discussion on the importance of NIST's fundamental R&D metrology programs and the recent stress on these programs stemming from the ever increasing number of non-research related mandates. Dr. Rochford began by stating that while other federal agencies have seen either a flat or shrinking budget, NIST has seen a 46% increase since 2009 in its laboratory program budget. At the same time, support for construction of research facilities has decreased dramatically. Dr. Rochford continued by highlighting the budget growth focused on addressing a number of national priorities, most predominantly manufacturing and cybersecurity. Funding for manufacturing has roughly doubled since 2011 and cybersecurity has tripled. During this time, much of NIST's budgetary growth has been aimed at developing partnerships and collaborations and not to investing directly in intramural research. Dr. Rochford also highlighted that NIST has a lot of room to grow in several research areas. From NIST's perspective, areas that have had some growth recently but still have room to achieving critical mass are advanced communications, disaster resilience, and bioscience. Lastly, there are endless areas where NIST could grow or start new programs. NIST is looking to the VCAT to help down select.

Discussion:

The group discussed the following topic:

- What areas should NIST focus on with the current funding levels?

- What are some of the new areas for growth?
- What is the real NIST role?

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

Facility Needs of NIST's Scientific Work – Mr. Clyde Messerly, Chief, Design and Construction Division, NIST Office of Facilities and Property Management

Mr. Messerly began his presentation by stating facility deficiencies is the number one risk at NIST. Most of the buildings on NIST's Boulder campus were built in the 1950's and are in serious need of repair. There are currently two wings, 3 and 6, that are under renovation. NIST's Gaithersburg site has similar issues in that two-thirds of those laboratories were built in the 1960's and are in need of repair. To list out a few of the facility deficiencies and the effects:

- Lack of temperature stability affects optics;
- Humidity fluctuations affects sensitive measurements;
- Vibration problems affects sensitive spatial measurements;
- Equipment from the 1950's means that replacement parts/components are difficult to obtain.

Every 3 years, a Facility Condition Assessment (FCA) is performed, developing a metric called the Facilities Condition Index (FCI). An excellent rating is 95 or better, good is 90-95, fair is 85-90, and poor is anything below 85. The overall condition of the facilities on both of NIST's campuses is in poor condition according to these metrics. Based on studies from 2013 and 2015, Boulder's FCI is 82, and Gaithersburg's FCI is 84 based on studies in 2011, 2013, 2014, and 2015.

Mr. Messerly next described the status of NIST's funding support for facilities improvements. The Federal Facilities Council (FFC) recommends funding of 3-4% of current replacement value, which would be \$80-107M for NIST's four sites. NIST's current funding is just under \$50M, far short of the FFC's recommendations, has led to a \$346.2M backlog of facility condition improvement projects. The largest category in this backlog is for mechanical-electrical system repair and replacement, totaling \$209.8M. Maintaining mechanical, humidity, and electrical stability in the laboratories is necessary to conduct the kind of research NIST requires.

Mr. Messerly next summarized the facility renovation projects underway on both the Boulder and Gaithersburg campuses.

Lastly, Mr. Messerly summarized the impacts of the condition of NIST's facilities on its mission. A 2006 report estimated that these conditions led to a productivity loss of about 20%. Yearly impact to the nation was identified as \$130 million. Extrapolating that impact to today, the total impact to the nation would be \$1 billion. He reiterated that these conditions affect not only the research, but it also affects the people doing the research.

Discussion:

The group discussed the following topic:

- How to present the need to update/renovate/replace/maintain the building facilities in terms the new administration would understand, ie. The Radiation Physics Laboratory is responsible for maintaining the standard for the mammography, x-rays, etc.?

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

Importance of an Open Research Environment – Dr. Willie E. May, Under Secretary of Commerce for Standards and Technology and NIST Director

Dr. May stated NIST's most important program is its world-leading scientific research program, since that underpins the work of NIST's other programs. NIST has 3,400 federal employees, 3,970 guest researchers and other NIST associates of which 1,400 are foreign guest scientists. Since 1974, NIST's federal staff has not grown substantially, while NIST's guest scientists have grown nearly tenfold. Dr. May emphasized that enacting extensive bans on foreign guest researchers would have a negative effect on NIST's ability to continue to be a world-class scientific research laboratory. NIST needs to find a way to manage its environment and take advantage of the best minds world-wide to carry out the NIST mission. Furthermore, Dr. May highlighted that NIST must address its own security issues, since an outside entity would not understand the particular requirements of NIST and its mission.

Discussion:

The group discussed the following topic:

- The question is, is NIST worried about the model of research changing aside from the security part?
- What would happen to NIST without an open research environment?
- Clarity of major decisions made by those who do not truly understand the fundamental research.

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

Discussion on the Letter from the VCAT to Secretary Penny Pritzker regarding the upcoming Administration Transition – Dr. Rita Colwell, VCAT Chair

Dr. Colwell, the VCAT Chair, lead the discussion on the finalization of a letter report to the Secretary of Commerce articulating the current concerns and recommendations of the VCAT regarding NIST's budget and programmatic portfolio. After finalizing the letter report in this session the VCAT unanimously voted to approve the letter.

UPDATE ON MAJOR PROGRAMS:

Hollings Manufacturing Extension Partnership Program – Ms. Carroll Thomas, Director, Hollings Manufacturing Extension Partnership Program

Ms. Thomas provided the VCAT with an update on MEP's recent activities. She began with a brief reminder of MEP's mission and history.

Ms. Thomas provided the VCAT with an update on the MEP Center re-competition. The entire network of MEP centers has been re-competed over the past 18 months to optimize funding available to centers so that it is more in line with the number of small and medium manufacturers that each center serves. This re-competition also increased the program's focus on small and rural manufacturers. Three out of four rounds of the competition have been completed, with the fourth round scheduled to begin in early 2017.

Ms. Thomas also updated the VCAT members on MEP's efforts to embed center employees in each of the existing Manufacturing USA institutes in order to ensure a linkage and connection to smaller manufacturing clients. NIST plans for all existing Manufacturing USA institutes to have an MEP presence by January 1, 2017.

Ms. Thomas pointed out the major challenges ahead that are not in MEP's control, including rapid technological change spurring "Manufacturing 4.0", the legislated cost share, and funding to provide consistent resizing of the centers. What is in MEP's control is the branding messages for the MEP centers, improving performance metrics, and expanding MEP's role in manufacturing ecosystems.

Discussion:

The group discussed the following topic:

- The measure of success with the transition from working with the "Client floor" and the CEO's.

- The benefit of the connecting the Manufacturing USA program with MEP.
- Using training as a building block to strengthen the manufacturing base in the US.
- The metrics used to track the penetration, funding, and not just the number of successes but, also the value and substance of the interaction.

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

Cybersecurity Convening Activities – Dr. Chuck Romine, Director, Information Technology Laboratory

Dr. Romine provided an update on NIST's various partnership and convening activities in support of cybersecurity.

He began with an update on the National Cybersecurity Center of Excellence (NCCoE). The NCCoE, DoC's first Federally Funded Research and Development Center, has more than 60 CRADA partners. Since moving to a new facility, the NCCoE has grown from 4 laboratories to 23 with 15 active projects. The NCCoE published a draft practice guide; produced 2 draft technical guidance documents; 2 NIST interagency reports; and have held more than 10 workshops. In addition, NIST's National Strategy for Trusted Identities in Cybersecurity (NSTIC) program has been integrated with NCCoE.

Dr. Romine next provided an update on NIST's cryptography program, which the VCAT reviewed in 2014. The VCAT recommended that NIST increase the strength of NIST's internal capacity and capability in cryptography. Since 2014, NIST has addressed this recommendation by adding new staff including 2 new PhDs and 3 new foreign guest researchers. The VCAT also recommended that NIST increase engagement with the broader community, including international partners. NIST has accomplished that by leading international efforts in quantum-resistant cryptography at the University of Waterloo, holding conferences in Japan, and interacting with British Standards Institution and Fraunhofer in Germany. In 2018, NIST will host the International Post-Quantum Cryptography Workshop, the premier workshop in this space. The VCAT also asked to have clarification on NIST's policies in cryptography, which has been accomplished with an internal report on NIST's cryptographic development program and procedures. Other recent accomplishments include issuing a Federal Register Notice on post-quantum or quantum-resistant cryptography and the draft SHA-3 Functions Guideline, Special Publication 800-185.

Dr. Romine next provided updates on the Framework for Improving Critical Infrastructure Cybersecurity and the Presidential Commission on Enhancing National Cybersecurity. NIST reached out to stakeholders to understand areas where more work is needed. Two areas of high interest are in cyber threat intelligence and supply chain risk management. ITL is also working with the Baldrige Performance Excellence Program to develop a self-assessment tool to enhance use of the framework. For the Cybersecurity Commission, NIST has held six field hearings and testimonies, and is on track to deliver recommendations to the President by December 1, 2016.

Dr. Romine wrapped up with new opportunities for NIST contributions in cybersecurity, including:

- The growth in the Internet of Things, addressing the privacy implications;
- Data Analytics, improving cybersecurity;
- Machine Learning and Artificial Intelligence, the challenge of determining the security of those kinds of systems and how to build systems to understand these systems;
- and National Strategic Computing Initiative, building new technologies to ensure there is security built in before systems are deployed.

Discussion:

The group discussed the following topic:

- The Internet of Things and related privacy issues.

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

Redefinition of the SI – Dr. Jim Olthoff, Director, Physical Measurement Laboratory

Dr. Olthoff provided the VCAT with an update of the ongoing process of the redefinition of the International System of Units (the SI). The revision of the SI, which primarily affects the kilogram, ampere, kelvin, and mole, is intended to allow all of the units to be realized anywhere in the world through multiple paths.

The kilogram is the last unit to still be realized by a physical object – “Le Grande K”, which resides in France. After the redefinition, the kilogram will be realized through two primary ways: by a watt balance, where NIST identifies electromagnetic force with gravitational force, and by counting the number of atoms in an enriched silicon sphere. Dr. Olthoff highlighted NIST’s accomplishment of developing a new working watt balance in five years, which produced one of the three most accurate values of Planck’s constant in the world, in addition to its designed purpose of realizing the kilogram.

Dr. Olthoff next reminded the VCAT about the redefinition of the ampere and the kelvin, which will be defined in terms of charge of the electron and the Boltzmann constant, respectively. The research performed by NIST in support of this redefinition are also enabling NIST to advance efforts to develop embedded, quantum-based sensors that don’t require calibration.

Dr. Olthoff next described the major milestones of the redefinition. By July 1, 2017, all values for the constants to be redefined have to be submitted to the Committee on Data for Science and Technology (CODATA), which is the organization that determines the values of the physical constants. CODATA is expected to do the redefinition or recalculation of the values at that time. Then, in the fall of 2018 the General Conference on Weights and Measures will approve the redefinition, which will be implemented on World Metrology Day in May of 2019.

NIST will then take a number of steps to promulgate the redefinition through its measurement services and products. This includes a full analysis of the impact on all of the NIST calibration services. NIST is also working on international education and publicity efforts and developing materials for direct communication with its customers to know what to do and where to get help.

Discussion:

The group discussed the following topic:

- A funding opportunity to develop a documentary film, as part of the communication effort;
- The simplest, clearest way to teach the redefinition to the public through textbooks.

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

Communications Technology Laboratory – Mr. Dereck Orr, Communications Technology Laboratory

Mr. Orr gave a brief update on recent work of the Communications Technology Laboratory, describing efforts in Public Safety Communications Research Division (PSCR) and National Advanced Spectrum and Communications Test Network (NASCTN).

Mr. Orr reminded the VCAT that NIST was provided \$300 million over six years to perform research and development in support of a nationwide public safety LTE network. To execute this research, the PSCR will fund a number of programs throughout NIST to meet particular challenges that public safety face and how NIST is going to take advantage of the broadband network. PSCR will also continue to convene stakeholders in

the public safety arena, industry, and academia through a consortium. At one point, NIST had above 75 industry partners, which allowed PSCR to build a complex LTE test network. NIST has funded NASA to utilize the prize challenge contract vehicles while building that infrastructure within NIST. NIST will also use grants and cooperative agreements to get academia and industry involved in the basic research.

A primary challenge for public safety is the inability to track each other or assets when they go inside of buildings. PSCR has convened a working group to create a roadmap for public safety location-based services. NIST has funded three internal projects; two in ITL and one in PML to create a new standard on indoor localization and tracking and if this works it will be replicated outside of NIST. In the Time and Frequency Division, enhanced 3D geolocation is being looked at especially in ultra-wideband technologies.

In March 2015, NIST published a roadmap for developing analytics to leverage the flood of data that will be produced by this new network. NIST also held a summit in August of 2016 to look for opportunities on how this information can assist and not hinder public safety in their operations.

Mr. Orr next provided the VCAT an update on NASCTN. The NASCTN was created to be a neutral, third-party organization to provide trusted data to help inform future spectrum policy with other federal partners, such as Department of Defense, Department of Transportation, National Telecommunications and Information Administration, and NIST. NASCTN initiated three significant spectrum-sharing projects, the waveform measurements of radars operating in the 3.5 GHz band; out-of-band emissions measurements of LTE devices operating in the AWS-3 band; and the impact of LTE signals on GPS receivers.

Discussion:

The group discussed the following topics:

- Fundamental research in measurement capabilities around millimeter waves and mobility in 5G and beyond;
- Fundamental measurement science capabilities in microwave metrology.

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

Closing Thoughts – Dr. Willie E. May, Under Secretary of Commerce for Standards and Technology and NIST Director

Dr. May reminded the VCAT of the priorities he presented to them when he became NIST Director in 2014:

- Fill key senior leadership vacancies;
- Work with the senior leadership to continue to strengthen the NIST safety and security culture;
- Completing the successful implementation of the new technical programs;
- Enhancing current and new capabilities to enhance mission delivery;
- Strengthen the MEP program and continue to connect them to the laboratory programs;
- Addressing the long-term sustainability of the Baldrige Program;
- Support the Secretary with innovation agenda, improving the efficiency and effectiveness of NIST's internal operations – hire the correct people in a timely fashion; and
- Increasing staff engagement in the direction and implementation of NIST programs.

Dr. May specifically asked the VCAT to help in determining strategies for establishing and sustaining a healthy NIST. He also asked the VCAT to help ensure goals and expectations are met in the areas of disaster resilience, cybersecurity, advanced manufacturing and advanced communications. In the future, NIST would like the VCAT to continue to examine the measurement service program and advise on the effectiveness of its international engagement programs.

Dr. May concluded by stating that NIST has become a key player in the administration's innovation team and is the nation's go-to agency for measurements, standards, and technology and NIST would not be where NIST is without the support of the VCAT.

Discussion:

The group discussed the following topic:

- The consideration of a 6-year appointment for the Director of NIST taking the NIST Director out of the political arena; a change in legislation.

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

Administrative Business

Dr. Colwell reminded VCAT that they need to produce a report by the end of February, and that a main focus of the report should be on recommendations for balancing core research and efforts of NIST to ensure that other forms of service to the nation are not overwhelming one or the other. Dr. Colwell also enquired how the VCAT could help with educating the new administration on the important role of NIST. Because of the traditional timing of the VCAT report, the VCAT members discussed whether shorter topic specific papers might be a more-timely approach for informing incoming policy makers.

There were no public comments offered.

Adjournment

Given there will be a change in administration on January 20, 2017, the VCAT expressed their appreciation for the incredible leadership that Dr. May has provided to NIST. The VCAT is impressed with Dr. May's dedication to NIST over the decades and wish him the best in the future. The meeting was adjourned at 5:30 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. Rita Colwell, Chair, NIST Visiting Committee on Advanced Technology