VISITING COMMITTEE ON ADVANCED TECHNOLOGY (VCAT)
MINUTES OF THE October 6, 2015 MEETING
GAITHERSBURG, MD

ATTENDANCE:

Visiting Committee Members Attending
Chand, Sujeet*
Garvey, Michael*
Holt, William*
Kerr, Karen*
Padovani, Roberto*
Prafullchandra, Hemma*
Sizer, Theodore*
Solomon, Darlene*

VCAT Exec. Dir.
Lellock, Karen

NIST Leadership Board
Boehm, Jason
Brockett, Del
Cavanagh, Rich
Celotta, Bob
Dimeo, Rob
Fangmeyer, Robert
Harary, Howard
Jenkins, George
Kayser, Rich
Kimball, Kevin
Locascio, Laurie
May, Willie
Molnar, Michael
Olthoff, Jim
Porch, Susanne
Rochford, Kent
Royster, Cecelia
Salber, Stephen
Saunders, Mary
Singerman, Phillip
St. Pierre, Jim
Thomas, Carroll
Wixon, Henry

NIST Staff
Acierto, Linda
Andrews, Anne
Bonevich, John
Beers, Kate
DeLongchamp, Dean
Evans, Heather
Fasolka, Mike
Guyer, Jon
Hardis, Johnathan
Hight-Walker, Angela
Jillavenkatesa, Ajit
Kauffman, Leah
Kushmerick, James
Lin, Eric
Madsen, Mark
Miner, Laurel
Nair, Rajesh
Nist, Jennifer
O'Rourke, Stephen
Roberts, Kamie
Robinson, Crissy
Salit, Marc*
Schufreider, Jim
Shaw, Stephanie
Stolorow, Mark
Thorne, Roger
Yashar, David

Others
Endy, Andrew – Stanford University*
Voorhees, Peter – Northwestern University*

*Participated Remotely

Tuesday, October 6, 2015

Call to Order – *Dr. Roberto Padovani, VCAT Chair*

Dr. Padovani called the virtual meeting to order at 9:30 a.m. and he welcomed Todd Sizer as the newest member to join the VCAT.

OVERVIEW AND SAFETY

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

Presentation Summary: Dr. May thanked the VCAT for their flexibility in participating in the virtual meeting and summarized the conditions in Charleston, SC as a result of historic flooding conditions. Dr. May officially welcomed Todd Sizer to the VCAT, indicating that advanced communications is a focus for NIST and his expertise is welcomed.

Dr. May shared that there has been a slight uptick in the number of safety cases and Dr. Kayser would be providing additional information on activities NIST has been undertaking to make sure this does not become a trend. He also mentioned the incident occurring on the NIST campus resulting in an explosion in one of the buildings. As a result of this, Dr. May is asking a group of external experts to review NIST's security policies and procedures and offer suggestions for improvements. The VCAT will be briefed on the recommendations during the February 2016 meeting.

Dr. May reminded the VCAT of his primary goals including ensuring NIST has a strong leadership team. All positions have been filled with the exception of the Associate Director for Laboratory Programs and after a nationwide search the review team provided a list of qualified candidates to be interviewed and a selection will be made in the near future.

Dr. May outlined the results of the new Colleague's Choice in Innovations in Measurement Science Program that provides an open competition to encourage and reward staff creativity by putting them in charge of identifying, selecting, and solving significant challenges in measurement science. This program is part of a more general effort to broaden staff engagement. The winning proposal was focused on transforming NIST calibration services across the spectrum with new technologies and E-access. This represents NIST's first crowd-sourced effort and improvements are being considered for the next year.

A summary of employee survey results were provided and demonstrate that NIST slightly exceeds DOC and the federal government overall in the area of employee engagement. However, this is an area NIST is emphasizing and will provide additional information on specific activities the organization is undertaking to improve employee engagement at the next VCAT meeting.

Dr. May highlighted that NIST is operating under a continuing resolution that runs until December 11th. He shared the House and Senate marks for FY2016 and indicated work is underway on the FY 2017 budget and details will shared at the next meeting.

A number of recent staff awards and recognitions were shared including the staff receiving Gold and Silver medals from DOC. He also highlighted several NIST staff receiving various awards for technical contributions and accomplishments.

Dr. May shared information on NIST's growing participation in prize challenges, including a NIST challenge focused on the development of an app using one of the NIST datasets. Through this challenge, NIST received 26 apps with participation from more than 130 individuals. A winner will be announced in the November timeframe.

A reminder of the overall NIST organizational footprint, staff resources, primary mission, expanding partnerships and collaborations as well as NIST role in redefining the international system of units was provided. Dr. May also provided information and updates on a number of more recent efforts and initiatives focused on public safety communications, precision medicine and forensic science.

Dr. May concluded his presentation with a summary of the types of external review of the NIST organization, including the VCAT, the National Research Council (NRC) Board on Assessment and the International Peer Review of NIST Measurement Services. He suggested a process of having the VCAT review the findings and recommendations of the groups during the October 2016 meeting and then every 4 years thereafter.

Discussion: The group discussed the following topics:

- NIST employee survey results and the need to segment the data for better understanding of the employee feedback
- NIST efforts around an insider risk program
- NIST's patent and IP activities

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

Safety Update – *Richard Kayser, Chief Safety Officer*

Presentation Summary: Dr. Kayser shared the recent safety statistics showing eighteen OSHA recordables, three more than last year along with eleven DART cases, also three more than last year. He provided a summary of the types of incidents with the majority falling into the slips, trips and fall category. Dr. Kayser continued his conversation about elements of the actions stemming from the safety climate survey, specifically the areas of unsafe conditions and practices and improving safety training. He shared specific actions in the areas of focused communication and dissemination of information and guidance to help staff understand the importance and their individual roles identifying and reporting unsafe conditions. In the area of safety training, NIST has focused on improving the quality and the delivery options of safety training materials. NIST has worked to improve staff engagement in safety at every level and has been working throughout the organization on the design, implementation and delivery of NIST's safety program.

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

NIST PARTNERSHIPS

Follow-up on Bio and IT Research Portfolios

Presentation Summary: Dr. Locascio and Mr. St. Pierre provided follow-up to questions stemming from the June 2015 VCAT session focused on NIST's activities in these research areas. Dr. Locascio provided information on the targeted research efforts within bioscience today and identified the following areas for increased focused for the future: precision medicine, microbial measurements, quantitative tools for

characterization of complex biologics, and engineering biology. She highlighted the specific NIST partnerships supporting NIST's biosciences program. She also shared information on efforts to recruit new staff in these areas including the NRC post-doc program and relationships with partner organizations.

Mr. St. Pierre outlined how the research investments in IT are expected to shift over time into the areas of advanced networking and communications, big data, cyber-physical system, cybersecurity/cryptography, measurement science collaborations and quantum. He shared information on partnerships supporting a number of these priority areas including the National Cybersecurity Center of Excellence. In the area of staffing, Mr. St. Pierre highlighted the benefit the increased focus NIST has in the area of cybersecurity, including the engagement around the Cybersecurity Framework that has resulted in positive messaging and interest from individuals considering NIST as a workplace.

For more information, see the following presentations: Dr. Locascio and Mr. St. Pierre.

Evolution of NIST Partnerships – *Jason Boehm, Director, Program Coordination Office*

Presentation Summary: Dr. Boehm highlighted the evolution of NIST's partnerships, noting a significant increase in formal partnerships over the past 10 years. NIST's partnerships range from formal joint institutes to engagements with specific communities on standards issues in areas such as cybersecurity, forensics, and advanced materials. The expansion in partnerships has increased NIST's access to expertise and allowed entry into technical areas where there is significant growth potential and offers NIST a pipeline for a future skilled workforce. The partnerships provides flexibility to work with academia and industry in different ways and allows NIST to address emerging areas and mission mandates.

Dr. Boehm outlined some of the challenges involved in the expanded partnerships, including the time to formalize the arrangements, need for special authorities in some cases, and IP issues. There is also a concern about the loss of connection to the NIST culture at some of the offsite facilities. Dr. Boehm concluded his presentation discussing the need for balance between internal programs here at NIST, the research laboratories, and NIST's offsite engagements and whether or not these relationships will have a long-term impact on what is critical to the NIST mission. The VCAT was asked to consider this through the remainder of the meeting with a focus on several specific questions:

- From your perspective, are these partnerships an effective means for engaging and collaborating with industry and/or academia to address NIST's strategic priorities?
- With flat R&D budgets on the horizon what is the appropriate balance of direct investment in NIST core research programs versus investment in partnerships to most effectively complement NIST research capabilities?
- Given NIST's research portfolio and current suite of partnership models, are there other flexibilities and tools we should consider to address priority research areas and retain technical expertise to support the NIST mission?

Discussion:

- How NIST decides when to create a new partnership
- NIST's investments in each of the partnerships

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

Partnership Model: Joint Initiative for Metrology in Biology (JIMB) – *Marc Salit, Leader, Genome-Scale Measurements Group, MML, Drew Endy, Associate Professor of Bioengineering, Stanford University*

Dr. Salit highlighted an emerging partnership with Stanford focused on developing the metrology tools needed to measure biological materials. Dr Endy highlighted the opportunities and challenges of when metrology comes into biology as a material and how if you can realize coordination of measurement and reuse of materials, industry can begin to make decisions on whether to centralize manufacturing or support distributive manufacturing. This is an example of how the tools of metrology will have a significant economic impact. The presenters shared information on recent workshops and engagements demonstrating interest in building an ecosystem of companies or commercial activities that allows for reuse of materials that allows for tool makers to become specialized and companies to do design and engineering of biological manufacturing platforms.

Information about the staff working on the partnership, from students to faculty to NIST staff were shared and the benefits of having the partnership in close proximity to both the university and industry were highlighted. With the partnership coming up on a 1-year anniversary, the presenters shared challenges for the future, including dedicated space and administrative burden with navigating both university and federal systems.

For more information, see the presentation.

Discussion:

- IP sharing and policies
- Future needs for the partnership, including dedicated space, increased investment
- Administrative and research challenges of having staff in both Gaithersburg and Stanford

Partnership Model: Centers of Excellence – *Jason Boehm, Director, Program Coordination Office*

Presentation Summary: Dr. Boehm shared information on NIST's Center of Excellences (COEs), a new program focused on expanding NIST's impact and mission delivery by enabling NIST to partner with foremost experts in critical technical areas. Through the COEs, NIST is able to expand collaborations with leading research institutions in emerging technology areas to help NIST meet mission needs in new or expanding areas of strategic focus; enhance technical innovation through early alignment of measurement science with emerging fields of research; provide new opportunities for training of students and postdocs in measurement science; and provide greater opportunities for NIST to engage with entrepreneurs and industry.

NIST has designed the program to be flexible. NIST received funding for the program in 2013 and currently has about $15M invested across three centers. These include: the Center for Hierarchical Materials and Design (CHiMaD), the Center for Risk-Based Community Resilience Planning, and the Center for Statistics and Applications in Forensic Evidence.

The COEs are funded for an initial period of up to 5 years with the option to renew based on review and decisions by NIST and then they can be extended for an additional 5 years. After a 10 year period, if NIST wants to continue a Center focused on one of these areas, NIST would recompete the center so it may not go to the same party. Initial plans called for a portfolio of about 5 centers in operation at any one time. If new funding for COEs is received, NIST would consider areas critical to the NIST mission such as

complex systems, measurement and control, biological systems and an advanced photonic and optical measurements.

Dr. Boehm highlighted current work on developing a framework for evaluating the COEs. Elements of the framework include internal reviews, best practice sharing and a review panel of external experts. Dr. Boehm indicated the framework would be shared with the VCAT for their review and comment.

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

Partnership Model: Center for Hierarchical Materials Design (ChiMad) – *Eric Lin, Chief, Materials Science and Engineering Division, MML and Peter Voorhees, Co-Director, CHiMad*

Presentation Summary:

Dr. Lin and Dr. Voorhees discussed the NIST COE focused on advanced materials, the Center for Hierarchical Materials Design, CHIMAD. It is a group of universities, the University of Chicago and Northwestern University, Fayetteville State University along with the Argonne National Laboratory, QuesTek Innovations, and ASM International. The COE is funded at $5M per year over a 5-year period. This funding is matched by the universities at the level of 20%.

The overall shared vision for this Center is aligned with the materials genome initiative (MGI) and the center is really focused on trying to realize the full impact of the MGI and accelerate materials discovery and development and reduce the time for when a new material is deployed into manufacturing. This shared vision will demonstrate the power and potential of bringing together data science, computational approaches and state of the art experiments to more effectively design these materials. The leadership of the Center is a close working partnership between all the organizations in CHIMAD and at NIST. The focus of CHiMad is to:

- Leverage significant strengths and a long history of materials design and collaborative research
- Identify thrust areas (use-cases) that focus on particular materials of industrial and scientific importance involve industrial collaborators, and transfer the design methodology to industry and other stakeholders
- Develop community standard codes for both hard and soft materials design materials databases that are motivated by topics of the use groups experimental methods for rapid assessment of materials properties
- Convene workshops and outreach activities on issues that are central to the implementation of the Materials Genome Initiative

Dr. Voorhees provided examples of the specific use cases, including precipitation-strengthened alloys, in-situ silicon-composite materials, and organic polymer solar cells among others. Information on staff resources, engagements and overall governance of the partnership was also provided.

Discussion:

- Industry connection into the Center
- Measures of success

For more information, see presentation materials.

Partnership Model: NIST Labs working with the National Network of Manufacturing Institutes – *Richard Cavanagh, Acting Associate Director for Laboratory Programs (ADLP)*

Presentation Summary: Dr. Cavanagh discussed NIST's laboratory connections with the National Network of Manufacturing Institutes (NNMI) highlighting specific interactions and engagements with the individual institutes. These engagements are based on traditional ways that the labs work with industry and other federal agency partners to understand their measurement needs. He provided specific information on several of the interactions with the various NNMIs. With America Makes, NIST invested $5M in a measurement science grant. NIST has a seat on the technical advisory board and staff serve on a number of the advisory groups and subgroups. NIST researchers collaborate with America Makes on in-situ process monitoring, non-destructive evaluation, and layer-wise quality certification. NIST also convened a workshop on measurement science for additive manufacturing documenting industry needs and priorities to use as a starting point for the National Additive Manufacturing Roadmap and the first America Makes set of projects. America Makes also engaged NIST for development of a standards strategy to carry forward the technical results from America Makes funded projects into ASTM F42 and ISO/TC 261 standards to ensure dissemination and transition to industry.

NIST has similar engagements with the other NNMIs, serving on review and oversight panels, providing technical expertise and working in partnership to develop tools and measurements in the specific areas of focus. Dr. Cavanagh indicated that these interactions and engagements are in direct alignment with NIST's existing priorities.

Discussion:

- Reporting structure for individuals participating in NNMI activities.
- Level of interactions in the individual NIST laboratory Operating Units.
- Focus of the engagements on specific technology readiness levels of industry.

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

Partnership Models: JILA and Joint Quantum Institute (JQI) – *James Olthoff, Director, Physical Measurement Laboratory (PML)*

Presentation Summary: The original purpose of JILA dates back to the 1950s, when the idea of laboratory astrophysics was gaining scientific relevance because of the space program. An institute bolstering NIST activities in this area, leveraged with expertise at universities was formed with the University of Colorado in 1962. Today there are 25 JILA fellows total in the institute, 11 of them are from NIST and 14 are from CU. All of the NIST JILA fellows hold adjunct faculty appointments at the university. In total there are about 250 people including students, guest researchers, and staff working at JILA. JILA has expanded significantly since then in terms of the technological areas that it addresses. Lasers and measurement tools, chemical kinetics, new frequency standards, the world's best atomic clock is there. Measurement science on the nanoscience, quantitative generic gases, and other things like ultrafast science and biophysics are on the research agenda. One of the biggest impacts is the highly-trained innovators, the environment and the extraordinary fellows that JILA produces, and even more extraordinary batch of trained scientist. Over 400 individuals have worked at JILA in some capacity or another and then taken positions of some form or another within NIST, so the amount of scientific expertise that has found its way from JILA into NIST has been extraordinary.

Dr. Olthoff also discussed NIST's role in the Joint Quantum Institute (JQI), a collaboration with the University of Maryland located on the University's campus. It was established in 2006 and currently there are 31 JQI fellows between NIST and Maryland and about a total of 180 individuals working at JQI and it is still growing. JQI's focus is on serving as a world-class research institute conducting fundamental investigations of coherent quantum phenomena with a secondary objective to maintain and advance the nation's leading role in high technology through this collaboration. There are many opportunities in this technology space as we are just beginning to see the first commercialization of these technologies. Dr. Olthoff shared several technical accomplishments and highlighted the publication and citation rate of the publications associated with research at JQI.

He briefly mentioned the Joint Center for Quantum Information and Computer Science established last year. A partnership between NIST's Physical Measurement Laboratory and Information Technology Laboratory, and the University of Maryland. It is largely an extension of JQI and the formation of this institution has allowed the University to hire world class staff that they would not have been able to attract otherwise. The mere combination of Maryland and NIST has made it a very attractive place to work and made it one of the leading centers, probably one of the two leading centers in the world, on this topic.

Dr. Olthoff highlighted lessons learned from across all three partnerships with a focus on the importance of close proximity to NIST as a key to success. Challenges include intellectual property and cultural/operational differences that must be sorted out. NIST has found these partnerships to be hugely successful and envisions the will last well into the future.

Discussion:

- The impact of JILA on the broader technical area

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

Administrative Business

Roberto Padovani mentioned upcoming elections for the VCAT Chair and Vice Chair position will be held at the February 2016 meeting. He shared the current terms of VCAT members and asked for nominations to serve in these positions. A formal request for nominations will be sent out by the VCAT Executive Secretary in the coming weeks. Darlene Solomon was officially thanked for her service to the VCAT and to NIST.

There were no public comments offered.

The VCAT offered final comments and observations and discussed potential topics for future meetings.

Adjournment

The meeting was adjourned at 3:53 p.m.

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

Karen Lellock, Executive Director, NIST Visiting Committee on Advanced Technology

Dr. Roberto Padovani, Chair, NIST Visiting Committee on Advanced Technology