VISITING COMMITTEE ON ADVANCED TECHNOLOGY (VCAT or Committee)
MINUTES OF THE FEBRUARY 7, 2018 MEETING
GAITHERSBURG, MD

ATTENDANCE:

Visiting Committee Members Attending
Adler, Allen
Brooks, Rodney
Colwell, Rita
Garvey, Michael (Mike)*
Holt, William (Bill)*
Ishak, Waguih
Prafullchandra, Hemma
Sizer, Theodore (Tod)

Designated Federal Officer
Shaw, Stephanie

NIST Leadership Board
Boehm, Jason
Brockett, Del
Copan, Walter
Dimeo, Rob
Dowell, Marla
Fangmeyer, Bob
Harary, Howard
Jenkins, George
Kayser, Rich
Kimball, Kevin
Lin, Eric
Molnar, Mike
Olthoff, Jim
Rochford, Kent
Romine, Chuck
Royster, Cecilia
Schiller, Susannah
Singerman, Phillip
Thomas, Carroll
Vaughn, Robert (Skip)
Wixon, Henry

NIST Staff
Acierto, Linda
Avila, Regina
Bedner, Mary
Butters, Rolf
Carnahan, Lisa
Cranmer, David
Currens, Chris
Dodson, Donna
Evans, Heather
Gayle, Frank
Green, Ashley
Guo, Yuebin
Hardy, Robert
Hooker, Stephanie
Ivy, Nahla
Jahanmir, Said
Kauffman, Leah
Makar, Susan
McBride, Tim
Miner, Laurel
Morrow, Jayne
Na, Charles
Nadal, Maria
Ouimette, Mylene
Patterson, Isaac
Porter, Gail
Przybocki, Mark
Reidy, Kari
Reiff, Joy
Robinson, Crissy*
Satterfield, Mary
Schufreider, Jim
Seiler, David
Shyam-Sunder, Sivaraj
Silverthorn, Courtney
St. Pierre, Jim
Stieren, David
Teske, Michael
Thorne, Roger
Williams, Carl
Wilkinson, Richard
Witherell, Paul
Zangmeister, Rebecca
Zielinski, Paul

Others
Ambrose, Mitchell – American Institute of Physics
Auvil, Stephen – Tedco
Blaustein, Rochelle – Department of Energy
Cohen, Gail - Science, Technology, & Economic Policy, National Academies of Sciences, Engineering & Medicine
Duncan, James – Verizon
Eggers, Matthew – US Chamber of Commerce
Milliken, Lindsey - Lewis-Burke Associates LLC
Schreiber, Bret – Maryland Department of Commerce
Shivakumar, Sujai – Science, Technology, & Economic Policy, National Academies of Sciences, Engineering & Medicine
Varma, Gayatri - MedImmune

*Participated Remotely

Wednesday, February 7, 2018

Call to Order - *Dr. Rita Colwell, VCAT Chair*

Dr. Colwell called the meeting to order at 10:00 a.m. and reviewed meeting logistics. Dr. Colwell mentioned this was Bill Holt's last meeting and thanked him for his contributions to NIST. Dr. Colwell turned the meeting over to Dr. Copan.

SESSION I: NIST UPDATE

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

Dr. Copan also expressed his appreciation to Bill Holt for his contributions to NIST over the past six years. He then provided an update on NIST's safety and security culture, personnel changes, program highlights, and a discussion of NIST's strategic priorities. Beginning with security, Dr. Copan stated that a review of NIST's security program was initiated after several penetrations to its perimeter and buildings by undercover personnel. Through training, all-hands meetings, and support and encouragement from the leadership team, progress has and continues to be made to instill a positive culture of security and safety at both NIST campuses.

Dr. Copan then provided a brief update on personnel changes. These included himself officially becoming the NIST Director and Under Secretary of Commerce for Standards and Technology and Dr. Eric Lin as the Director of the Material Measurement Laboratory. Dr. Copan then mentioned that the federal budget process is ongoing and an announcement of the FY 2019 President's budget request is scheduled for February 12, 2018.

Dr. Copan then provided some program highlights in key priority areas for NIST. In the area of quantum science, tremendous advances have been made by the Joint Quantum Institute with the University of Maryland in creating a 53-atom quantum simulator, which are specialized quantum computers that can model complex quantum systems. Next, he described an article by Forbes and the New York Times about the NIST artificial neuron, which is part of the artificial brain program based on the Josephson Junction Technologies. In internet of things (IoT), he Global Cities Challenge - a collaboration between NIST and the Home Security Science and Technology Directorate - enables local governments, nonprofit organizations, academia, technologists, and corporations from around the world to form teams to work on IoT applications in cities.

In disaster resilience, the Hollings Manufacturing Extension Partnership Program (MEP) awarded $5 million through local MEP centers to assist small and medium sized manufacturers in Texas, Louisiana, Georgia, Florida, and Puerto Rico to recover from the recent hurricanes. In addition, NIST's Engineering Laboratory sent preliminary reconnaissance teams to these disaster sites to determine whether in-depth investigations are warranted. NIST anticipates performing an extensive study on the impact of Hurricane Maria on Puerto Rico's built infrastructure.

Next, aging infrastructure on NIST's campuses in Boulder and Gaithersburg continues to be a problem with buildings that were built in the 1950's and 1960's. For example, building 245 in Gaithersburg, which houses NIST's radiation physics program that provides traceability and calibration services for every x-ray, biomedical, and nuclear medicine procedure, was recently closed for business for almost two weeks due emergency repair of a steam pipe resulting in a loss of $2 million in lost productivity of research, $10 - $15 thousand lost in daily management meetings, and $140 thousand for repairs.

Dr. Copan described his priorities for NIST that include cybersecurity, advanced manufacturing innovation and quality, NIST's Return on Investment (ROI) Initiative that deals with technology transfer, and One NIST, an initiative that focuses on agility, interdependence, and pride across the NIST organization. Dr. Copan also reminded the Committee of the technical priorities identified as part of the NIST strategic planning process: quantum science, bio-economy, artificial intelligence, and internet of things.

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

SESSION II: RETURN ON INVESTMENT (ROI) FROM FEDERAL RESEARCH

Introduction – *Dr. Phillip Singerman, Associate Director for Innovation and Industry Services*

Dr. Singerman began by informing the VCAT that Dr. Copan is formally launching a comprehensive assessment of federal technology transfer efforts, with the objective of ensuring a greater return on investment for the Federal Government's annual budget for research and development. He then reviewed the structure of the session and introduced the speakers.

Dr. Singerman reminded the Committee that it previously discussed technology transfer in October 2012. NIST focused its responsibilities to promote the commercialization of technology from its scientific enterprise, a function shared by universities and other federal research organizations. NIST established a technology transfer policy committee to guide its efforts in this area and reflect the full range of work NIST performs to benefit society and the economy. Dr. Singerman then shared a more inclusive definition of technology transfer for NIST, which includes developing a plan to increase transfer to partners, expanding the view of technology transfer and track outcomes, and the improvement of the economic impact assessment.

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

Overview of Federal Law and Policy in Tech Transfer and Related NIST Authorities – *Dr. Paul Zielinski, Director, Technology Partnerships Office, NIST*

Dr. Zielinski gave a high-level overview of technology transfer in the United States to the VCAT. NIST's goal is to assist private industry in making innovations, distribution, selling, and having new innovations available to the public. Dr. Zielinski reminded the Committee that $140 billion is spent annually on federal research and development. The research is performed across many different agencies but the technology must transfer to the private sector who will make and distribute these innovations.

Dr. Zielinski then provided a brief history of federal technology transfer. In 1947, President Truman issued an Executive Order that recognized the federal laboratories, built during the Second World War, as an economic driver and potential for innovation across the economy. In the 1980's, two pieces of legislation were passed that are genesis of technology transfer: the Bayh-Dole Act which addresses intellectual property and patenting ownership; and the Stevenson-Wydler Act, which set up structures to help to get the innovations into the marketplace. In 1982, the Small Business Innovation Research Program (SBIR) was established to give money to small businesses to commercialize technologies. In 1986, the Federal Technology Transfer Act amended the Stevenson-Wydler Act, creating cooperative research and development agreements, which formalized public-private partnerships. There is consistent growth across administrations to move information from the federal laboratories to the private sector for economic gain and global competitiveness.

He described various mechanisms NIST uses to partner with the private sector. NIST can enter formal cooperative research and development agreements to develop products and/or advance the research toward commercialization. NIST can also partner with the private sector through the NIST Organic Act, which allows and encourages NIST to work with U.S. industry as well as user facilities.

NIST, through specific delegations from the Secretary of Commerce, has a unique leadership role in promoting and reporting on the strength of federal efforts on policy coordination as well as the promulgation of technology transfer regulation. NIST also has a statutory role as the host agency for the Federal Laboratory Consortium for Technology Transfer. Finally, NIST submits annual reports to the President, Congress, and the Office of Management and Budget on technology transfer by Department of Commerce and across all agencies.

Dr. Zielinski finished by highlighting how patenting is different in the government verses in the private sector. The government's goal is to advance it mission, so it must determine how to communicate intellectual property in a way that advances its mission. For example, in some cases, NIST enters a Cooperative Research and Development Agreement resulting in a product with a private company.

Discussion:

The group discussed the following topics the incentive for individual investigators at NIST to patent.

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

Panel Discussion of Benefits and Limitations of Current Technology Transfer Policy – *Stephen Auvil, Senior Vice President at TEDCO; Gayatri Varma, Director, Collaborations Partnering & Strategy Washington D.C. Metro Area Biotechnology MedImmune; Rochelle Blaustein, Deputy Director. Office of Technology Transitions, US Department of Energy*

Mr. Auvil began by describing TEDCO: a state economic development organization with a purpose to foster the commercialization of research and technology to create and sustain of businesses across Maryland, and a mission to discover, invest in, and help build great Maryland-based technology companies.

Mr. Auvil continued by informing the VCAT that from 2000 to 2014, $17 million was invested in programs that support technology transfer from federal laboratories, mostly located in Maryland. Several showcase events were held that brought federal laboratories and industry together. This was a great way to engage the public and government sectors. One example program, the Fort Detrick Technology Transfer Initiative, invested $50 thousand in awards to 26 life science companies. On average, those companies created four jobs, had revenues in their final year close to $1 million, a high average salary, and advanced technology development by three technology readiness levels.

TEDCO has three programs with the federal government. Two are focused on supporting technology scouting and entrepreneurship with federal laboratories (NIST and the Naval Air Warfare Center). The third is a partnership with the U.S. Department of Commerce to help entrepreneurs navigate the Food and Drug Association medical device commercialization process. Mr. Auvil described two challenges for federal laboratory technology transfer: states are hesitant to support what they view as a federal responsibility, and it is difficult to get an exclusive license from the federal government.

Mr. Auvil summarized factors that lead to exceptional university technology transfer. These include entrepreneurial culture, quality and the nature of research, incentives to support technology transfer, and the

ability to manage conflicts of interest rather than avoid them. Mr. Auvil emphasized that these factors also contribute to technology transfer from federal laboratories, and described several programs to improve them.

Next, Dr. Varma from MedImmune described how MedImmune is building an ecosystem to foster technology commercialization. MedImmune hosts two bio-networking events for postdocs, scientists from industry and academia, and federal laboratories. They also host several events for Chief Executive Officers from local companies, bringing them together to discuss new strategies. Every spring they hold the BioHealth Capital Region Forum bringing influential leaders together.

Dr. Varma agreed with Mr. Auvil that conflict of interest needs to be managed and not avoided. If a federal employee wants to start a company, they must leave the organization to do so because of conflict of interest. Universities provide professors leave to startup a new company on their own time, which is preferable.

In closing, Dr. Varma stated for federal laboratories or universities, when engaging in licensing negotiations with a company, it is important to understand anything scientists develop is only one piece of the puzzle. The negotiations must be flexible to accommodate the range of efforts and technologies required to produce the final product and get it to market. Finally, Dr. Varma emphasized that she believes that federal laboratories will have more success spinning out technologies if they can take equity from startups instead of requiring license fees.

Ms. Blaustein from the Department of Energy shared her perspectives. She began by describing an initiative to improve entrepreneurial culture and capabilities among researchers. Federal agencies are working with National Science Foundation through the I-Corps program: an intensive 2-month program for researchers to come together with industry mentors to do customer discovery and understand the science needs of industry. The program helps to move technology to the marketplace, provides business education to the researcher to help them work better with industry, and improves federal laboratory recruitment and retention.

Ms. Blaustein highlighted two areas where she sees opportunities for improvement in federal technology transfer. The first is simplifying access to expertise – frequently the inventor - necessary to successfully commercialize a technology. Currently, these arrangements require two arrangements (a patent license and a Cooperative Research and Development Agreement), which are sometimes handled by two offices. This doubles the necessary transaction cost. Second, copyright should be available for software developed by federal employees. Since Stevenson-Wydler was passed before the value of software was widely understood, the lack of copyright for software makes exclusivity – and therefore commercialization incentive – difficult to achieve.

Lastly, Ms. Blaustein mentioned that some federal government entities use third-party intermediaries bypass some of these restrictions. The Department of Energy has leveraged their contractors as third-party intermediaries to work more closely with industry, providing some of the things the federal government is not permitted to do by shifting the risk to that third party. A foundation is one type of third-party intermediary.

Discussion:

The group discussed the following topics:

- The importance of increasing fundamental research funding, and approaches to raising the visibility of the outcomes from basic research.
- How and whether to focus on and calculate return on investment.
- Pros and cons of open-source software versus maintaining copyright.
- Costs and benefits of requiring scientists to leave federal service to start companies.

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

Plan and Vision for NIST Efforts in Federal Technology Transfer Policy – *Dr. Walter Copan, Under Secretary of Commerce for Standards and Technology and NIST Director*

Dr. Copan introduced his vision for improving federal technology transfer. NIST will begin a comprehensive initiative to assess federal technology transfer efforts, policies, and practices to ensure greater return on investment from the federal government's nearly $140 billion annual investment in research and development (R&D). This initiative will also examine unintended consequences of legislation that have created barriers to engagement between the federal laboratories, academia, and industry, and suggest changes to enable greater access and value to the nation's research enterprise. He calls this “Unleashing American Innovation.”

This initiative has significant support from the current administration and in Congress on a bipartisan basis. Dr. Copan has also introduced the initiative to the Council on Competitiveness, which was highly supportive of the effort.

Barriers exist between state-level organizations or private foundations and the federal laboratories because they cannot overcome the legal barriers, state-level charter, and federal mandate. NIST can reduce regulatory burdens of technology transfer to attract private sector investment in later-stage R&D and improve to the bridge between industry, academia, and the federal laboratory system.

Dr. Copan briefly described his next steps. NIST will engage with the Licensing Executives Society, the Association of University Technology Managers, the Industrial Research Institute, and the American Association for the Advancement of Science and others to work on creating a framework initiative. A Federal Register notice will come out in the spring with a request for information to solicit feedback from the public.

In closing, Dr. Copan mentioned there is a link on the NIST website, that provides a high-level outline of this initiative and access to reports including reports from the National Academies from studies conducted on technology transfer and higher-level issues that affect NIST and the nation.

Discussion:
The group discussed the following topics:

- Finding the right balance between advancing science and technology and commercialization.
- Time spent on foreign patent verses domestic patent decisions.

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

SESSION III: NIST ROLES IN CYBERSECURITY

Update on NIST Cybersecurity Programs, Current Mandates, and Calls for Expanded NIST Roles in Cybersecurity – *Ms. Donna Dodson, Chief Cybersecurity Advisor, Information Technology Laboratory, NIST & Director of the National Cybersecurity Center of Excellence (NCCoE)*

Ms. Dodson began her update by reminding the Committee that NIST cultivates trust in technology through cybersecurity through a program that revolves around research, development, and transition to practice with industry.

Ms. Dodson highlighted recent work of the NIST cryptography program. NIST is leading a world-wide competition in quantum resistance cryptographic standards. NIST has received and is reviewing with industry

and academia worldwide about 70 algorithms and supporting technical packages. To adequately review these standards, NIST has increased its capabilities through additional funding and hiring of eight new cryptographers. NIST has also been updating its cryptography testing and accreditation program to keep pace with the growing number of requests. NIST has also been growing cryptography capabilities as they relate to blockchain applications and lightweight cryptographic algorithms.

Next, Ms. Dodson briefed the VCAT on recent work in risk management. NIST is building better mechanisms to understand and manage cybersecurity risks. NIST has been working to incorporate privacy and security controls throughout its risk management program. NIST continues to build its system lifecycle to support strong risk management. Supply chain is another area of importance, to understand not only what, but also where the parts and pieces came from that are being employed into digital capabilities.

Ms. Dodson also highlighted NIST's work to strengthen cybersecurity of systems that bridge physical and digital infrastructure – the so-called IoT. NIST's laboratories are working on definitions, guidelines, and best practices, as well as coordination of standards across sectors of the digital economy. In addition, the NCCoE is working on IoT use cases. For example, the NCCoE staff worked with over 80 percent of the manufacturers in the U.S. on security, architectures, and capabilities for IoT in health care environments with wireless infusion pumps.

Ms. Dodson described several mandates that give NIST cybersecurity responsibilities. Executive Order 13800, "Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure" gives NIST responsibilities in risk management, the Cybersecurity Framework, and the National Initiative for Cybersecurity Education. In addition, the Office of Management and Budget recently updated their cybersecurity guidelines for federal agencies through A-130, which incorporates NIST standards and best practices.

Finally, Ms. Dodson summarized Congressional interest in expanding the NIST role in cybersecurity. This includes the Main Street Act, to have NIST expand its role with small and medium-sized businesses and transportation; the NIST Cybersecurity Framework, Assessment, and Auditing act, which would give NIST an auditing role; among others.

Discussion:

The group discussed the following topics:

- Why cryptography for quantum computing and quantum communications is so difficult?
- Where the experts in cryptography are from, and how to recruit them to NIST?
- Differences between the National Security Agency's program to attract PhD cryptography students and NIST's program.
- How to ensure NIST has appropriate resources to address new mandates.

For more information, see Ms. Dodson's presentation.

NIST's Role in Cybersecurity – a view from the private sector – *Mr. Matthew Eggers, Executive Director, Cybersecurity Policy National Security and Emergency Preparedness Department US Chamber of Commerce*

Mr. Eggers briefed the VCAT on the U.S. Chamber of Commerce's (or Chamber) view of NIST's role in cybersecurity. He summarized the Chamber's relationship with NIST in three key areas:

- The Cybersecurity Framework
- Education and Advocacy
- IoT Security

The Chamber of Commerce believes the Framework has been a remarkable success and powerful tool that represents the best example of public-private partnerships in action.

On education and advocacy, the Chamber of Commerce partners with state- and local-chambers of commerce to promote the Framework. NIST participates in these educational events held across the country to promote the use of the framework with local university academics, state officials, and Chief Information Officers. Secret service and Federal Bureau of Investigation officials also participate to discuss potential partnerships with business. Mr. Eggers also stated that they also have a Global Information Security Working Group that promotes alignment with the Framework internationally.

With regard to IoT, the Chamber recognizes the need for industry to lead the effort to strengthen cybersecurity of these systems. NIST will likely have a similar role as with the Framework and enterprise risk management.

In closing, Mr. Eggers shared the Chamber's perspective on legislation proposing an auditing role for NIST. First, these responsibilities would divert NIST's expertise, time, and attention beyond its core mission, to the detriment of other work. Second, an auditing role could jeopardize NIST's working relationship with industry. The Chamber has informed the staff of the House Science Committee with their concerns.

Discussion:
The group discussed the possibility of industry working with NIST to set priorities regarding IoT.

For more information, see Mr. Egger's handout.

Path Forward to Support Adaption and Adoption of Cyber Security Framework (CSF) – *Mr. Matthew Barrett, Program Manager for the NIST Cybersecurity Framework, Information Technology Laboratory*

Mr. Barrett began his presentation by reviewing the properties of the Framework (or CSF). The Framework established a common and accessible language that is understandable. The simple language is about empowering the non-cybersecurity experts to understand how they affect and are being affected by cybersecurity. The CSF is flexible to different sectors and organizations and is meant to be customized to account for organizational objectives, varying requirements, budgets, and technical environments, which have their own vulnerabilities and threat profiles.

Mr. Barrett emphasized the prevalent use of the Framework: as of 2015, 30 percent of U.S. businesses are using the Framework and it is believed that will increase to 50 percent by 2020. Federal agencies are required to use the Framework. It is also being used internationally. With increased use, however, there are increased demands on NIST's time and resources.

Mr. Barrett then described NIST's strategic focus areas for expanded use of the Cybersecurity Framework for 2017-2018: small businesses, international organizations and governments, regulatory environments, and federal agencies. For example, for small businesses, NIST has been partnering with the National Cyber Security Alliance around the Cyber Secure My Business campaign to increase awareness and understanding. NIST has also developed Starter Profiles that create profiles for commonly occurring circumstances or business objectives.

NIST's international approach includes bilateral dialogues with over 32 countries worldwide with translation of the Framework into Japanese, Italian, and Hebrew, among others. NIST is also working with international standards development organizations to map standards documents to the Framework to support its use.

With regard to regulations, the Cybersecurity Enhancement Act of 2014 states: *"Prevent duplication of regulatory processes and prevent conflict with, or superseding of regulatory requirements, mandatory standards, and related processes."* NIST continues to work with regulators and regulated parties to support use of the Framework.

Lastly, Mr. Barrett summarized NIST's efforts to promote use of the Framework by federal agencies. NIST has been consulted as memorandums are authored and have noted use of functions in the FISMA metrics. Some examples of NIST's engagement are:

- The FY 2015-16 Guidance on Federal Information Security and Privacy Management Requirements Cybersecurity Strategy and Implementation Plan, OMB Memorandum M-16-03 & 04
- The update of Managing Information as a Strategic Resource, OMB Circular A-130
- Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure, EO 13800; and
- The Cybersecurity Framework: Implementation Guidance for Federal Agencies, drat NIST Interagency Report 8170

Discussion:

The group discussed the following topics:

- The Hollings Manufacturing Extension Partnership Program's efforts to support the use of the Framework by small- and medium-sized manufacturers.
- How the VCAT can support Framework use.
- Cybersecurity challenges around measurements and supply chain.
- Having the VCAT help to ensure that NIST maintains an appropriate role in cybersecurity.

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

SESSION IV: NEXT STEPS AND ADJOURN

Administrative Business

Dr. Colwell announced the results of the elections. Dr. Rita Colwell was elected VCAT Chair and Dr. Allen Adler was elected Vice Chair. Both positions will begin their two-year term on April 1, 2018, and end March 31, 2020. In January 2020, the members will hold an interim election to select a member to complete the remainder of Dr. Colwell's term as Chair. The members will complete and finalize the 2017 Annual Report through email.

There were no public comments offered.

In closing, NIST shared a video, "The Romance of Precision Measurement" showing the role of NIST and the importance of what NIST does through the eyes of past Directors. the VCAT members thanked Dr. Rochford for his leadership of VCAT and as the Acting NIST Director.

Adjournment

The meeting was adjourned at 3:50 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