NIST Update
Visiting Committee on Advanced Technology

Walter G. Copan
Under Secretary of Commerce for Standards and Technology
and NIST Director

National Institute of Standards and Technology
U.S. Department of Commerce

NIST Gaithersburg
October 28, 2019

Meeting Agenda

October 29, 2019

Session I: NIST Update

Session II: Administration's Priorities for Science and Technology

Session III: NIST Strategic Plan – Positioning NIST for a Changing S&T Environment

Session IV: NIST's Role in a Rapidly Changing Technology World

Session V: NIST and Equity

October 30, 2019

Session VI: NIST and Technology Transfer

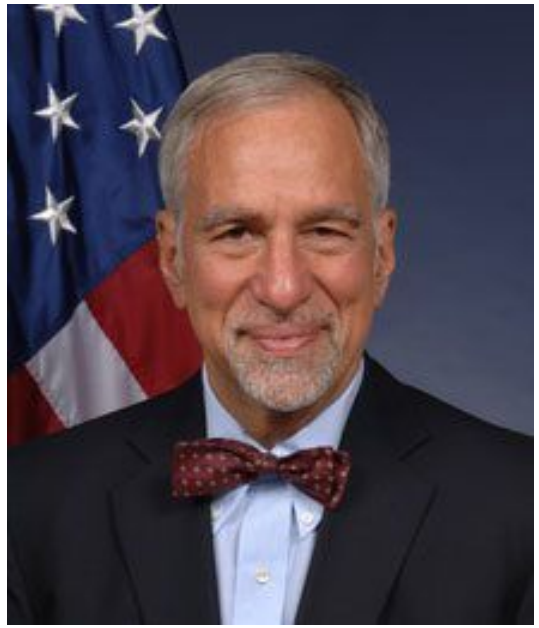
NIST Update

- Agenda Review
- NIST Leadership Changes
- Budget Update
- Recent NIST Highlights
- International Engagements
- Recent Awards

NIST Leadership Changes

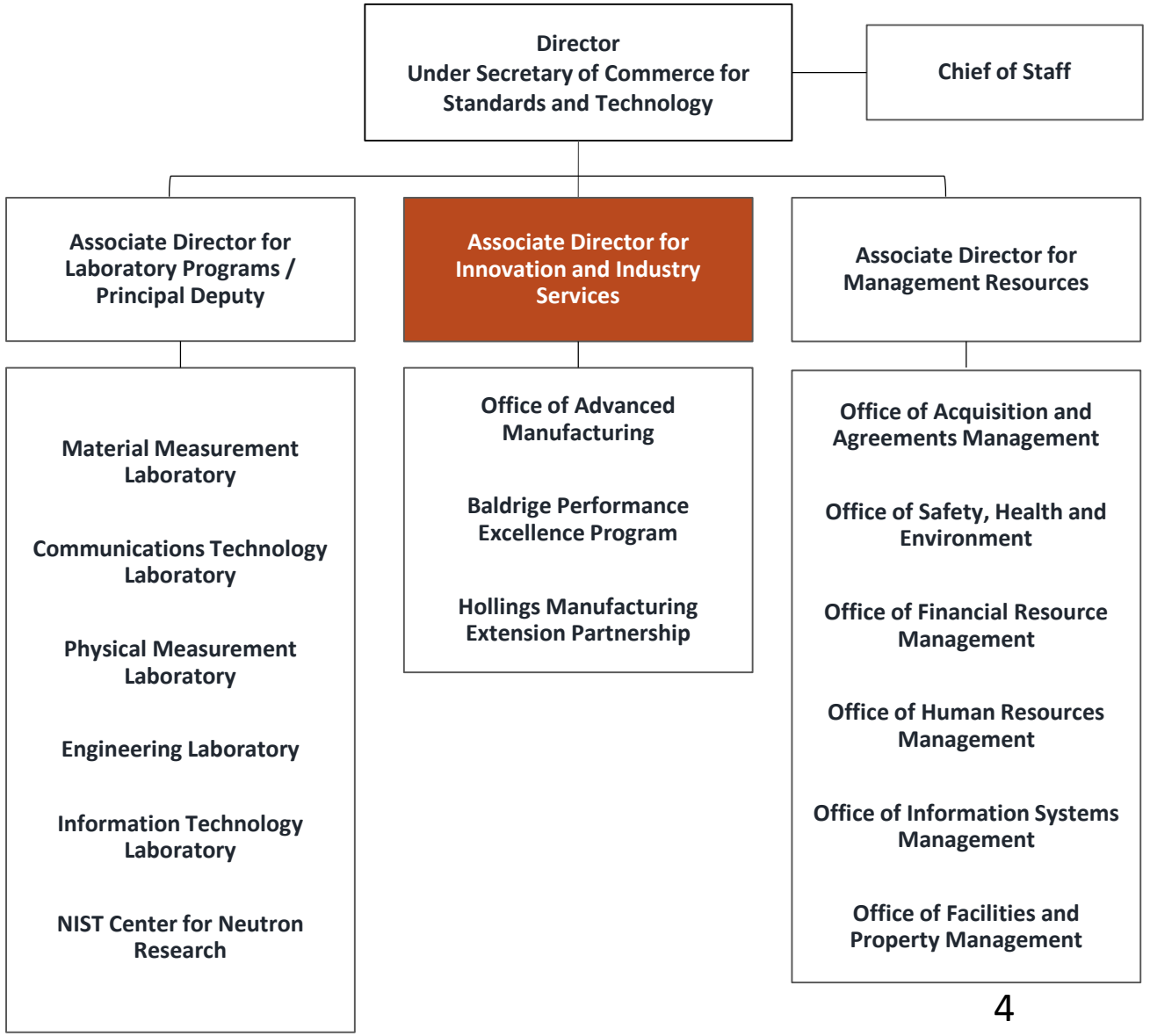
Associate Director of Innovation and Industry Services is Retiring

Retiring



Dr. Phil Singerman

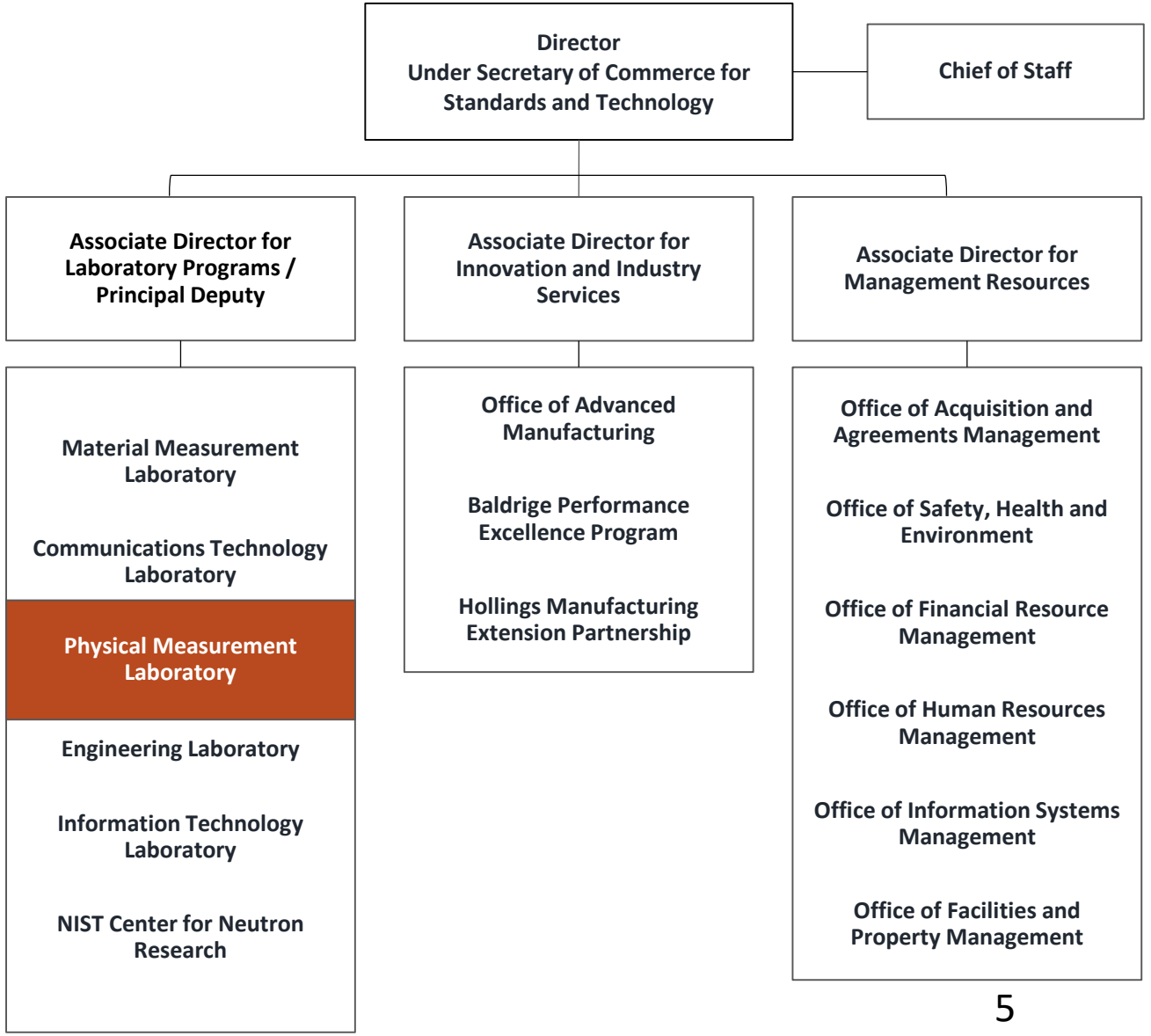
- Started at NIST in 2011
- Previous served 35 years in tech-based economic development



NIST Leadership Changes

Physical Measurements Laboratory Director

Dr. Jim Kushmerick
Director of Physical Measurement Laboratory,



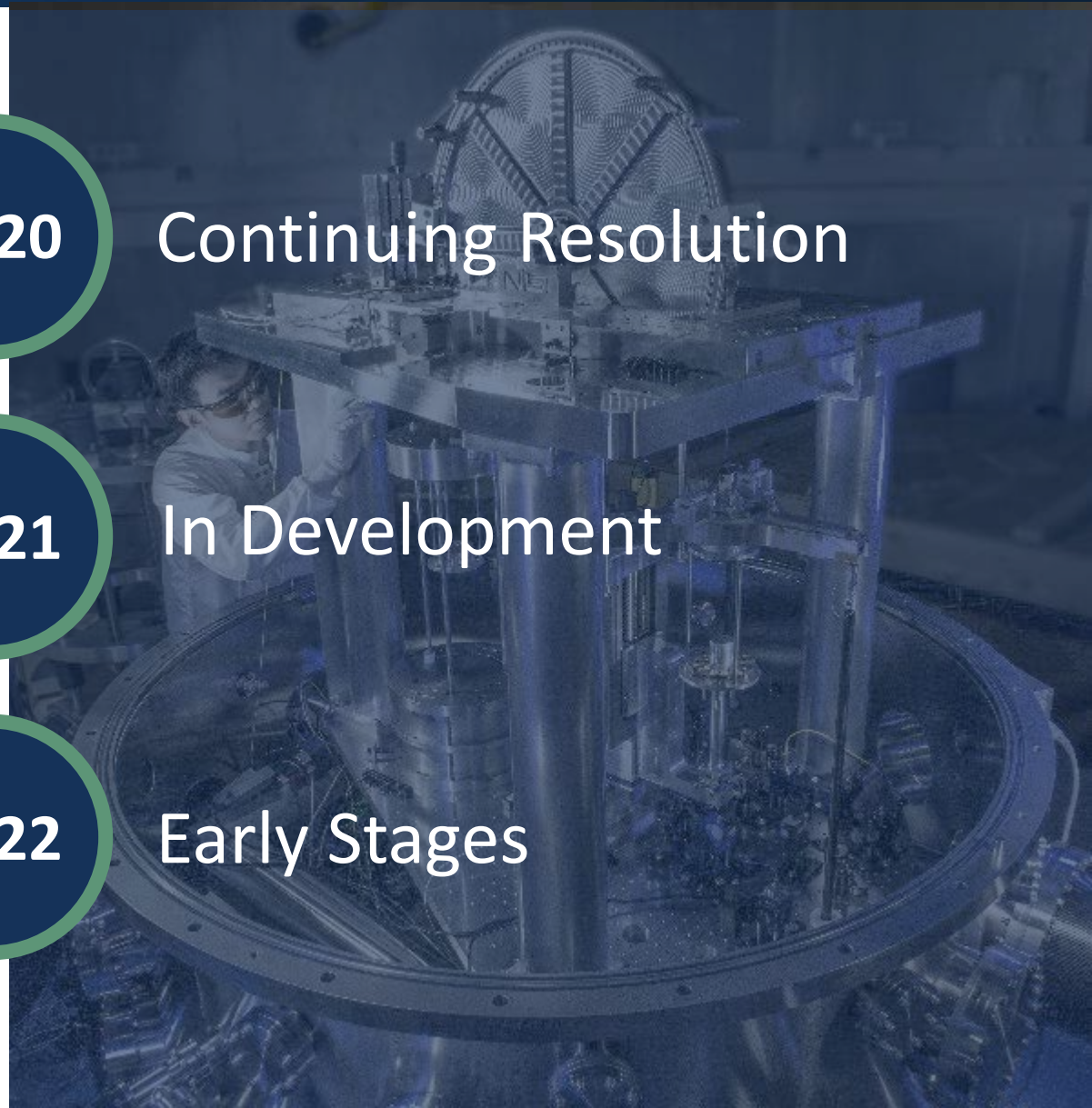
NIST Budget

NIST is operating under, planning for, and developing budgets for three fiscal years

FY20 Continuing Resolution

FY21 In Development

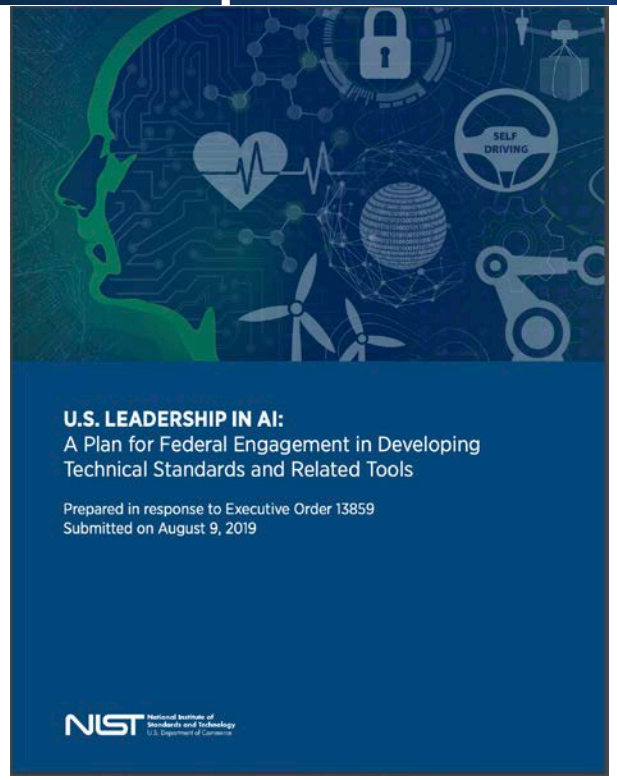
FY22 Early Stages



NIST BUDGET

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Pres. Request	FY 2020 House Mark	FY 2020 Senate Mark
Laboratory Programs (STRS)	$724.5	$724.5	$611.7	$751.0	$754.0
Hollings Mfg Ext Partnership (MEP)	$140.0	$140.0	$0.0	$154.0	$145.5
Manufacturing USA	$15.0	$15.0	$15.2	$15.2	$16.0
Construction & Renovation	$319.0	$106.0	$59.9	$120.0	$123.0
Total	**$1,198.5**	**$985.5**	**$686.8**	**$1,040.2**	**$1,038.5**

AI: Executive Order on Maintaining American Leadership



``Secretary of Commerce, through Director of NIST, shall issue a plan for Federal engagement in the development of technical standards and related tools in support of reliable, robust, and trustworthy systems that use AI technologies.''

Request for information, May 1 – June 10, 2019.

Workshop May 30, 2019.

Draft Plan for public comment, July 2-19, 2019. Final plan released August 10, 2019.

www.nist.gov/topics/artificial-intelligence/ai-standards

AI: Executive Order on Maintaining American Leadership

97
RFI RESPONSES

>400
WORKSHOP ATTENDEES

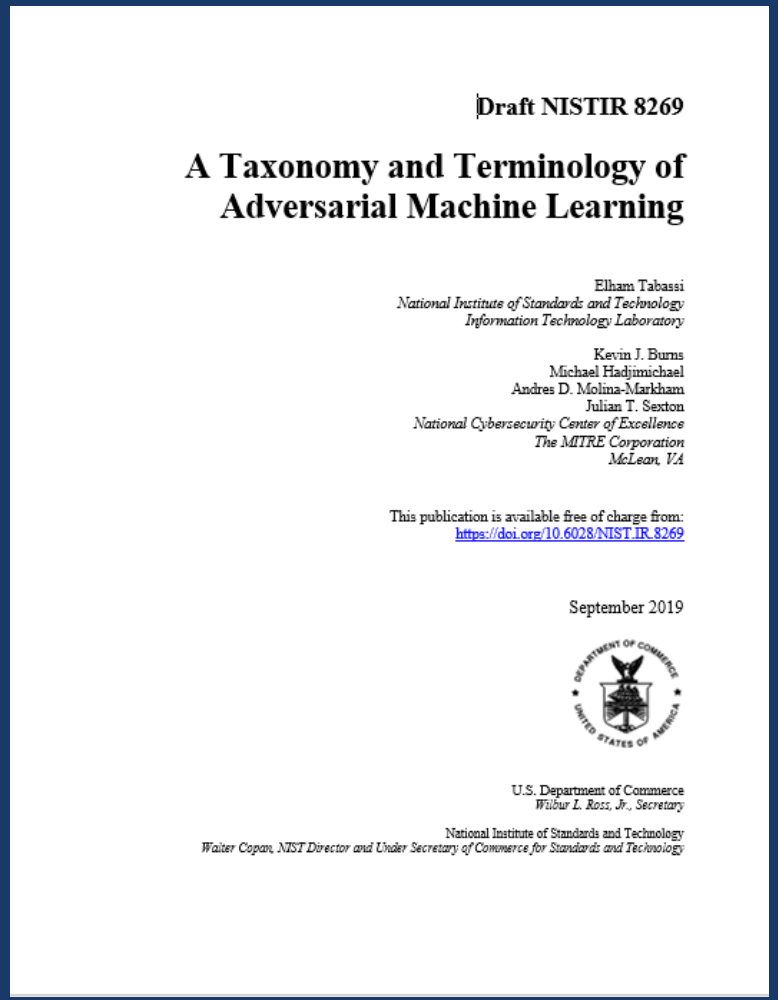
6
BREAKOUT SESSIONS

43
PUBLIC COMMENTS

2
DOCUMENTS

issued on
8/10/19

AI: Terminology and Taxonomy of Attacks and Defenses for Adversarial Machine Learning (AML)



Draft NISTIR 8269

A Taxonomy and Terminology of Adversarial Machine Learning

Elham Tabassi
National Institute of Standards and Technology
Information Technology Laboratory

Kevin J. Burns
Michael Hadjimichael
Andres D. Molina-Markham
Julian T. Sexton
National Cybersecurity Center of Excellence
The MITRE Corporation
McLean, VA

This publication is available free of charge from:
https://doi.org/10.6028/NIST.IR.8269

September 2019

U.S. Department of Commerce
Wilbur L. Ross, Jr., Secretary

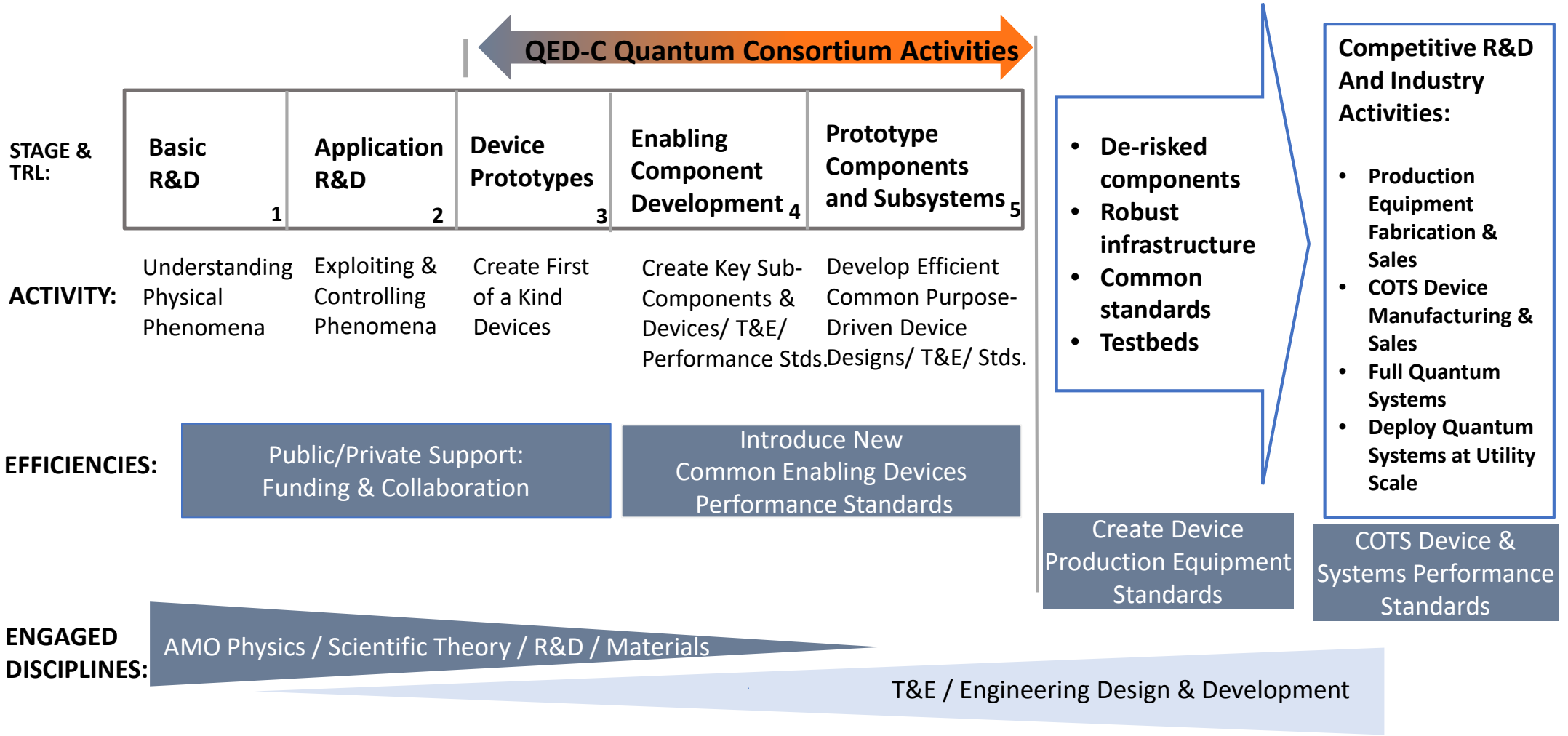
National Institute of Standards and Technology
Walter Copan, NIST Director and Under Secretary of Commerce for Standards and Technology

Securing applications of AI, especially against adversarial manipulations of machine learning (ML)

Develops a taxonomy of concepts and defines terminology in the field of AML

Informs future standards and best practices for assessing and managing the security of ML components by establishing a common language

Quantum Economic Development Consortium



QED-C

Meetings:

1st August 21, 2018 at SRI International in Menlo Park, CA

2nd October 29-30, 2018 at NIST in Boulder, CO

3rd January 22-23, 2019 at CU in Boulder, CO

4th April 30 - May 1, 2019 in Gaithersburg, MD

5th Oct 2-3, 2019 in Boulder, CO

More than 90 Letters of Intent have been received

Governing Board & TACs

- Governing Board elected: 3 large and 4 small/start-up companies, 2 government agencies
- Technical Advisory Committee established 10/29/2018

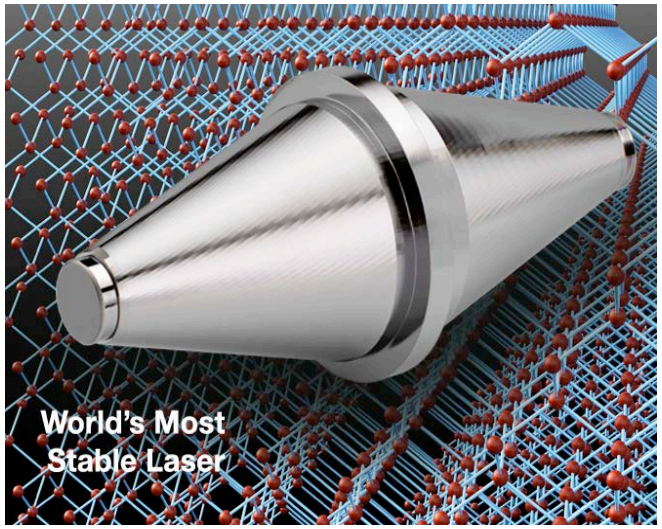
NIST Support

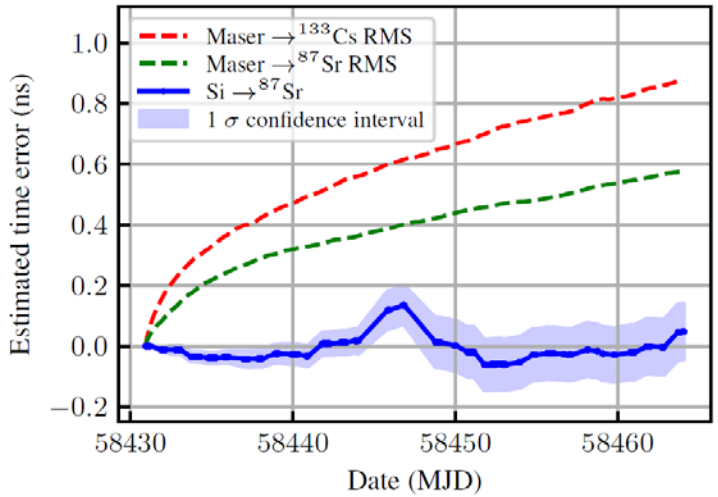
Initiated under a CRADA in June 2018 the QED-C is funded using *Other Transaction Authority*

Legal Structure

Formal legal structure and participation agreements are expected in winter 2020.

Quantum: Optical Time Transfer and Clock Comparison Operations





- Use of ultrastable laser cavities to create world's first all-optical time scale
- Clear path to be practical applications of optical atomic timekeeping 100x to 1,000x better than current time scales
- Clear path to future redefinition of SI second based on optical clocks.

NIST and Advanced Communications

NIST Public Safety Communications Research (PSCR) Innovation Accelerator Program – Recognized Impacts

- PSCR Awardee Spectronn developed a “mobile edge-computing-in-a-box” system
- Multi-networking technology enabled through NIST program allows public safety to have reliable data streams
- Technology implemented for the Brookline, MA police department during the 2019 Boston Marathon (April 15)

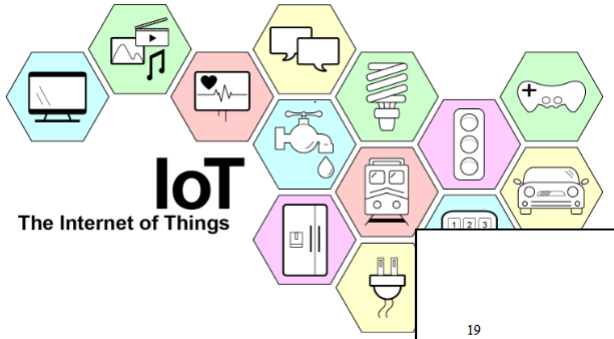
5G Collaborations Essential

175+ participants in NIST **5G mmWave Channel Model Alliance** (Intel, Nokia, Qualcomm, Facebook, etc.)

NIST’s **5G and Beyond** program is providing industry with robust metrology tools and data

Active engagement with other agencies and the private sector on 5G standards

IoT: Draft Core Cybersecurity Feature Baseline for Securable IoT Devices



Draft NISTIR 8259

Core Cybersecurity Feature Baseline for Securable IoT Devices:

A Starting Point for IoT Device Manufacturers

Michael Fagan
Katerina N. Megas
Applied Cybersecurity Division
Information Technology Laboratory

Karen Scarfone
Scarfone Cybersecurity
Clifton, VA

Matthew Smith
G2, Inc.
Annapolis Junction, MD

This publication is available free of charge from:
https://doi.org/10.6028/NIST.IR.8259-draft

July 2019

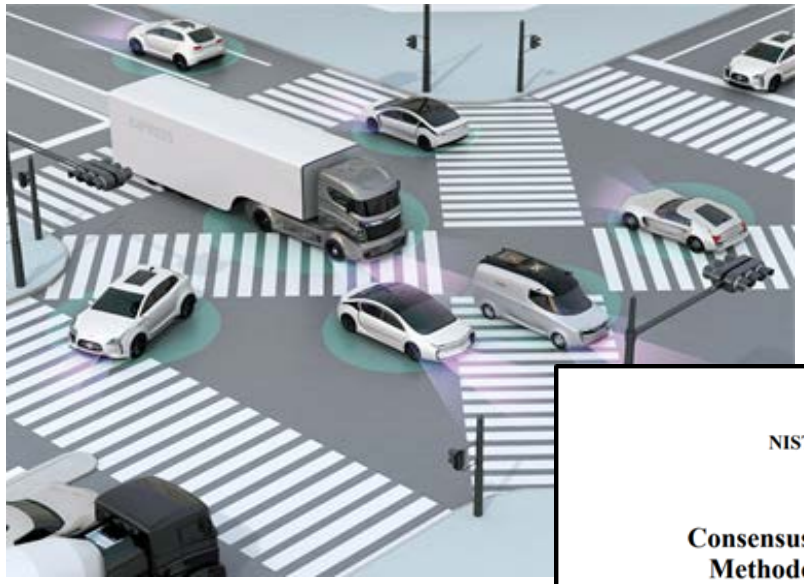
U.S. Department of Commerce
Wilbur L. Ross, Jr., Secretary

National Institute of Standards and Technology
Walter Copan, NIST Director and Under Secretary of Commerce for Standards and Technology

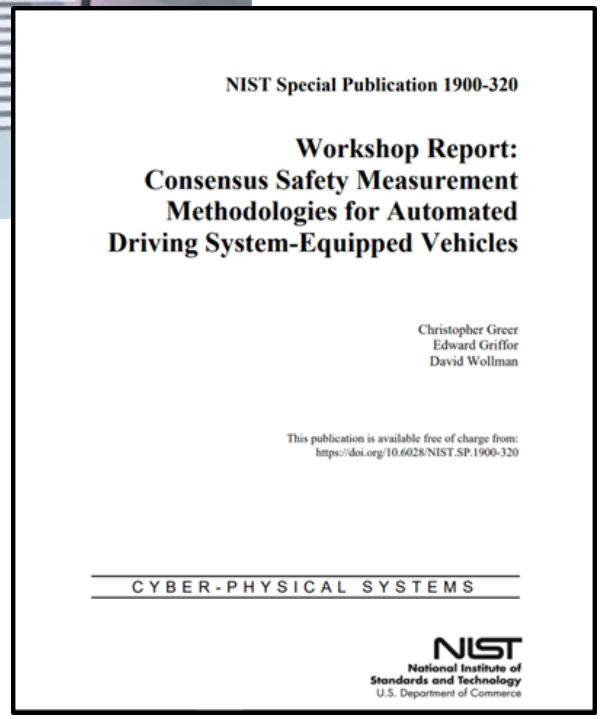
- Provides voluntary guidance for IoT device manufacturers to help to identify and plan for cybersecurity
- Presents a core baseline of cybersecurity features that makes devices minimally securable by the customers who acquire and use them
- Helps customers achieve a basic cybersecurity posture that mitigates general cybersecurity risks

IoT Engineering: Automated Vehicles

Automated Driving System (ADS) Safety Measurement



U.S. Department of Transportation



intel

lyft

RICARDO

VIRGINIA TECH TRANSPORTATION INSTITUTE

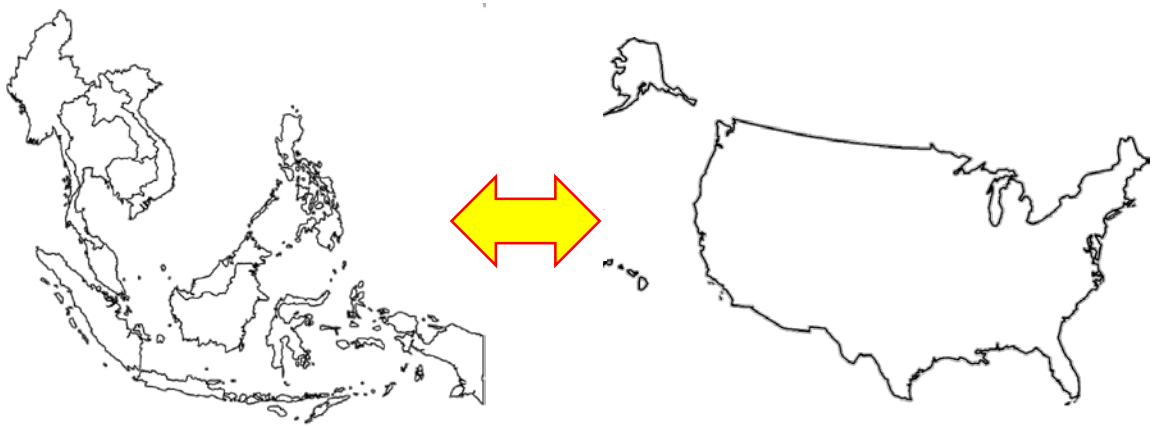
2019 Workshop hosted by NIST in partnership with USDOT

Private sector partners Intel/Intel Mobileye, Lyft, Ricardo Innovation, SAE International, Virginia Tech Transp. Inst.

NIST SP 1900-320; Sept. 2019 Consensus Safety Measurement for ADS-Equipped Vehicles

IoT Engineering: Smart Cities & Communities

Smart and Secure Cities & Communities Challenge (SC3)



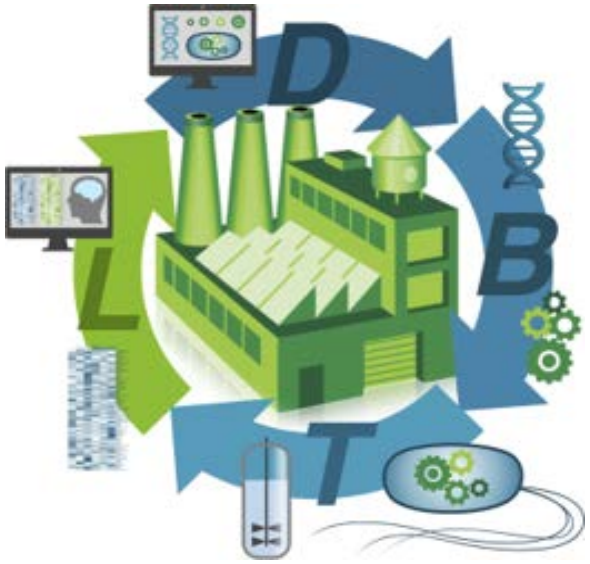
Co-sponsored by NIST, DHS S&T, and NTIA highlighting secure and privacy-enhancing smart city technologies

Dept. State & NIST jointly hosted 60-member ASEAN delegation under VP Pence's U.S. – ASEAN digital and urban infrastructure initiative

- NIST/DHS joint technical analysis with City of San Leandro, CA
- Portland Golden Globe Award for ''Exemplary work in economic development''
- Conference award for NIST demo: Low Power Wide Area Networking for City-Scale Applications

Engineering Biology: Promoting U.S. Bioeconomy

Accelerates innovation and translation via quantitative measurements, reference materials, standards, and data.



Coordinates with other agencies and key stakeholders to promote emerging biotechnologies enabled by engineering biology.

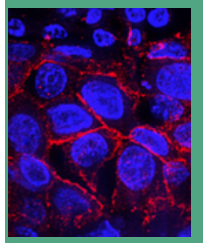
White House Summit on America's Bioeconomy: Oct 7, 2019

Next Generation Cell-based Reference Materials NIST

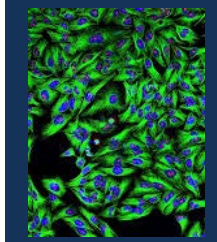
Biometrology to develop cell-based benchmarks and support the advancement of engineering biology and biomanufacturing

NIST Living Measurement Systems Foundry
Other NIST Foundries under construction

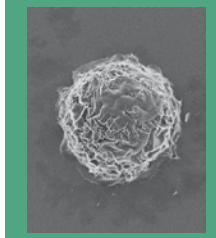
GIAB cells & DNA



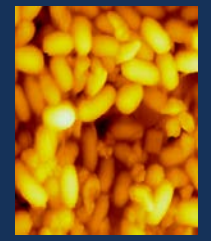
Fully consented cancer & normal cells



CHO cells that express NISTmAb



Jurkat cells with different copy number of inserts



Yeast cells with ERCC insert

Mixed pathogens

☆ Currently available

NIST and Space Commerce

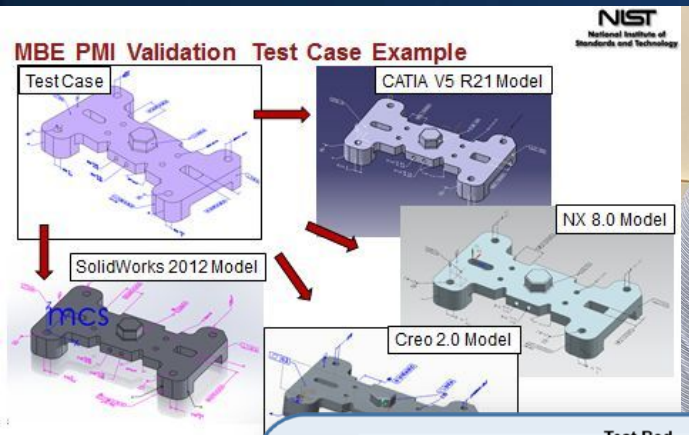
NIST – Key roles in Space S&T, Commerce

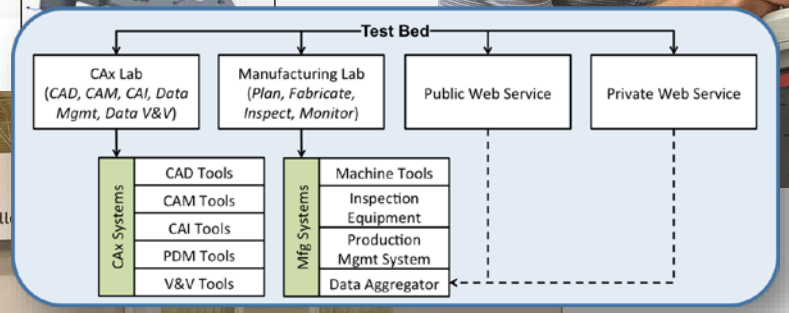
- Standards
- Space Traffic Management
- Models and Algorithms for Space Situational Awareness
- Spectrum for Space Services
- Emerging Technologies for Space

Workshop in Collaboration with:

DOC Office of Space Commerce
NOAA
NTIA
NASA
University of Colorado Boulder / LASP
Department of Defense / Space Command
…

Advanced Manufacturing: Reference Data Accelerates Innovation



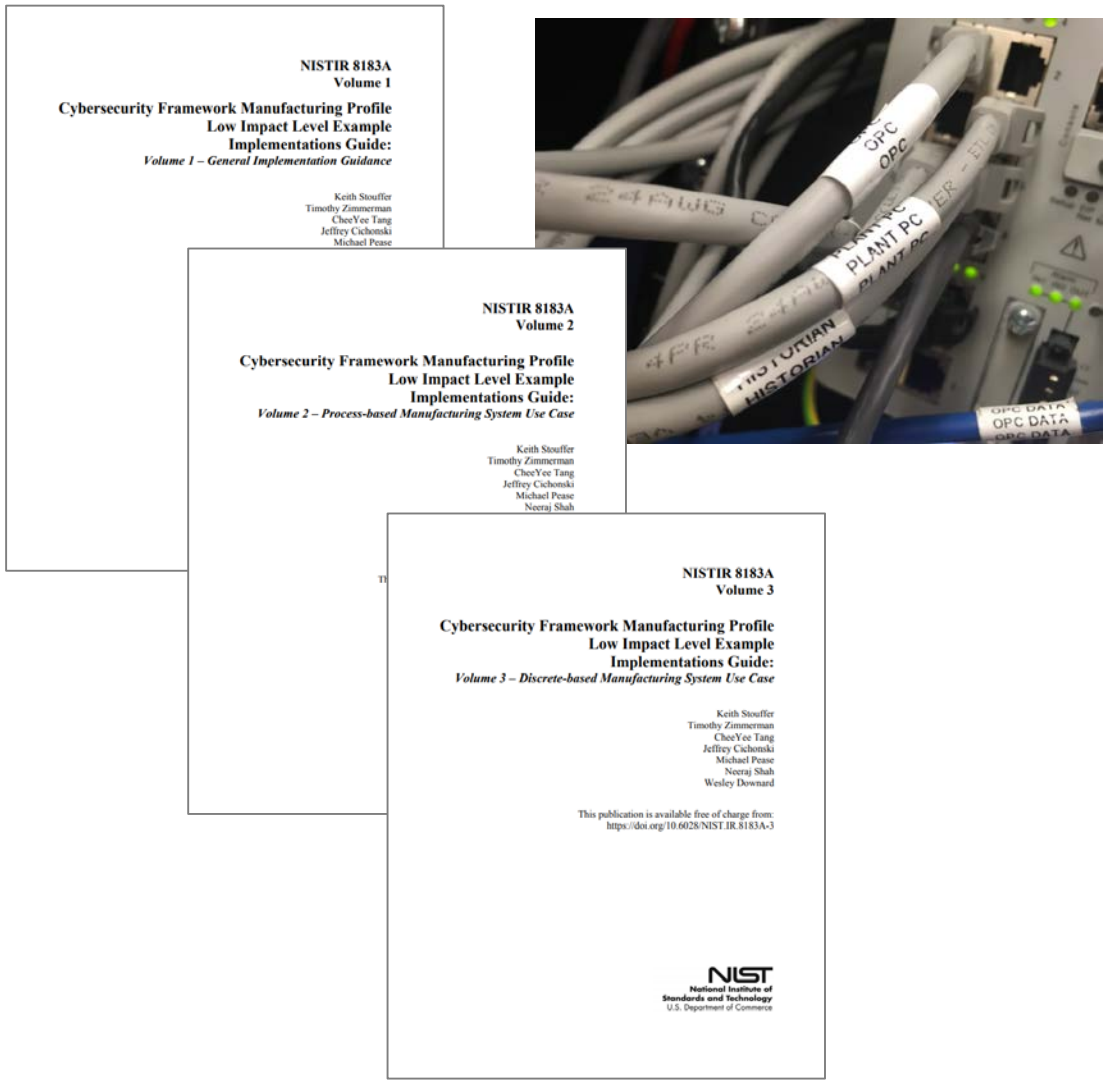


NIST is the most significant source of publicly-available manufacturing data, test cases, and toolkits

NIST developed a cyber-physical infrastructure for advancing standards and technology by networking NIST's manufacturing facility to produce data

The award-winning data is widely used by over 57 organizations and 200+ users each month, while the toolkits have been download 1000s of times

Advanced Manufacturing:
Implementation Guide for the Cybersecurity Framework



730-page, 3-Volume Guide is the first detailed cybersecurity implementation guide for manufacturers

Answers small and medium-sized manufacturers expressed need in implementing a standards-based cybersecurity program

Enables manufacturers to select and deploy cybersecurity tools that fit their needs AND address operations, reliability, and safety requirements.

Advanced Manufacturing: MEP

2019 MEP National Network™ Summit

- Commerce Deputy Secretary Karen Dunn Kelley led dynamic manufacturing roundtable and provided opening luncheon keynote
- Walter Copan delivered keynote and recognition for Tab Wilkins
- Over 600 representatives of the MEP National Network in attendance

Recent NIST MEP Special Funding Awards:

- Over $7,000,000 in funding provided to MEP centers
- Select awards include:
  - New Jersey MEP: $992,050 for food safety training and Food Industry Services
  - Oregon MEP: $1M for Industry 4.0 Tech Acceleration Program (ITAP)
  - Workcred, Inc: $498,845 for Research Examining the ROI of Manufacturing Credentials
  - MMTC (Michigan MEP): $1,074,000 for Cybersecurity for Defense Manufacturing (funding received from Department of Defense)

Manufacturing USA Institutes

Electronics

AIM Photonics
Integrated Photonics
Albany, NY
Rochester, NY

NextFlex
Flexible Hybrid Electronics
San Jose, CA

PowerAmerica
Wide Bandgap Semiconductors
Raleigh, NC

Materials

AFFOA
Advanced Fibers and Textiles
Cambridge MA

IACMI
Advanced Composites
Knoxville, TN
Detroit, MI

LIFT
Lightweight Metals
Detroit, MI

Bio-Manufacturing

BioFabUSA
Regenerative Manufacturing
Manchester, NH

NIIMBL
Bio-pharmaceutical Manufacturing
Newark, DE

Energy Usage / Environmental

RAPID
Modular Chemical Process Intensification
New York, NY

REMADE Institute
Sustainable Manufacturing
Rochester, NY

Clean Energy Smart Manufacturing Innovation Institute
Smart Sensors and Digital Process Control
Los Angeles, CA

Digital Automation

America Makes
Additive Manufacturing
Youngstown, OH
El Paso, TX

ARM
Advanced Robotics
Pittsburgh, PA

MxD
Digital Manufacturing
Chicago, IL

New for 2019/20

DOE sponsored Cybersecurity Institute

New for 2020/21

DOD sponsored Synthetic Biology Institute

Advanced Manufacturing: Manufacturing USA

Mike Molnar testified in House Science Hearing "Revitalizing American Leadership in Advanced Manufacturing" (March 26, 2019)

Advanced Manufacturing identified by the White House as one of four *Industries of the Future* to fuel prosperity

15th Manufacturing USA Competition Active – DOE Cybersecurity Institute for Energy Efficient Manufacturing

March 6th visit of NIH Director Francis Collins and U.S. Senator Chris Coons to University of Delaware included NIIMBL Center Director Kelvin Lee (left)

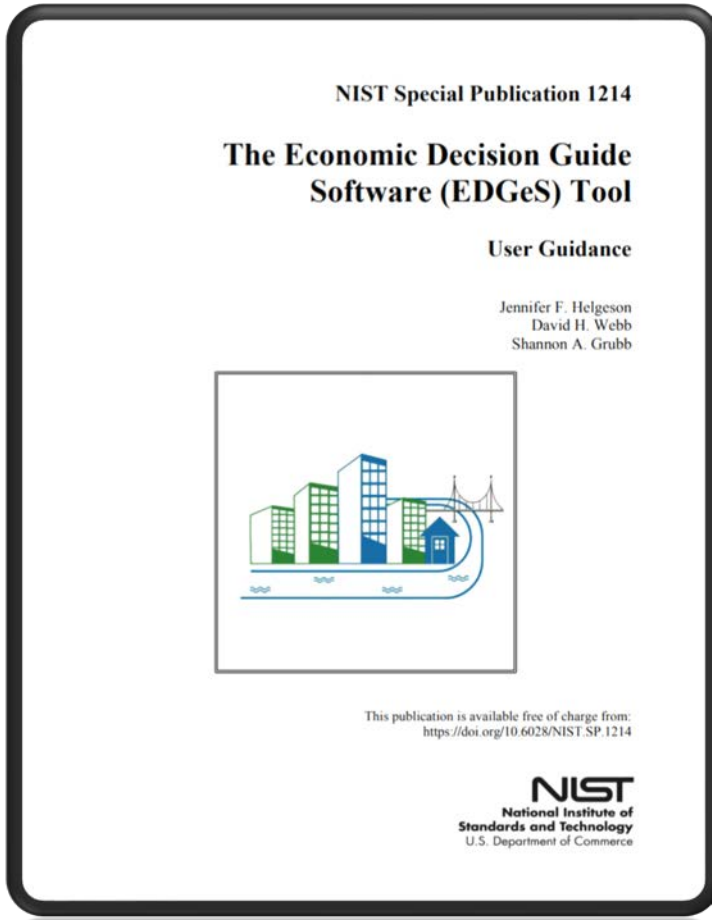
Community Resilience
Economics Decision Guide and Software Tool (EDGe$)

Economics Decision Guide (EDG)

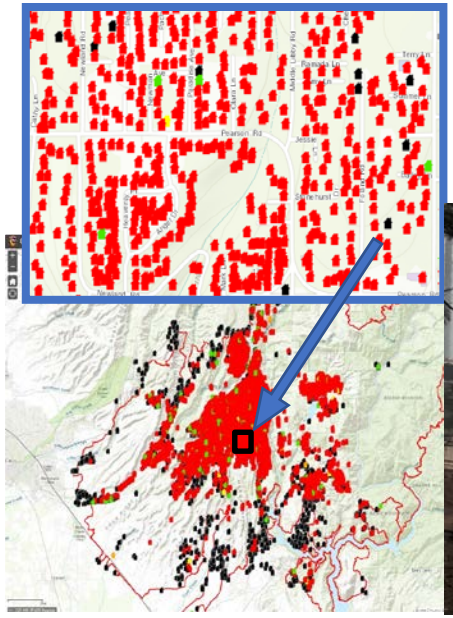
- Standard methodology for evaluating investment decisions to improve a community's resilience capacity
- Now an ASTM E3130-18 Standard Guide: *Developing cost-effective community resilience strategies*.

EDGe$ Tool

- Easy-to-use, helps prioritize resilience planning choices
- Designed for economists and non-economists
- Features include: low-probability, high-consequence events, uncertainty, co-benefits, resilience dividends
- Now publicly available (beta version): https://www.nist.gov/services-resources/software/edge-economic-decision-guide-software-tool



Fire / Wildland Urban Interface:
Camp Fire Case Study



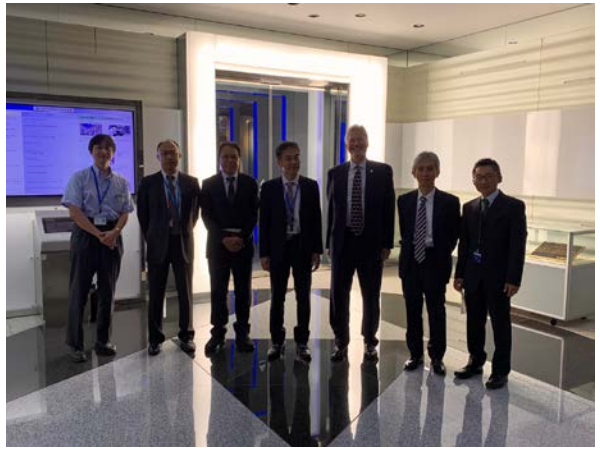
86 Fatalities, 19,531 Damaged or Destroyed Structures

Assess 132 damaged residential structures to identify ignition vulnerabilities to support mitigation

Integrate data sources to build a detailed event timeline to provide recommendations to be more resilient to WUI fires

NIST - International Leadership Roles

STS Forum



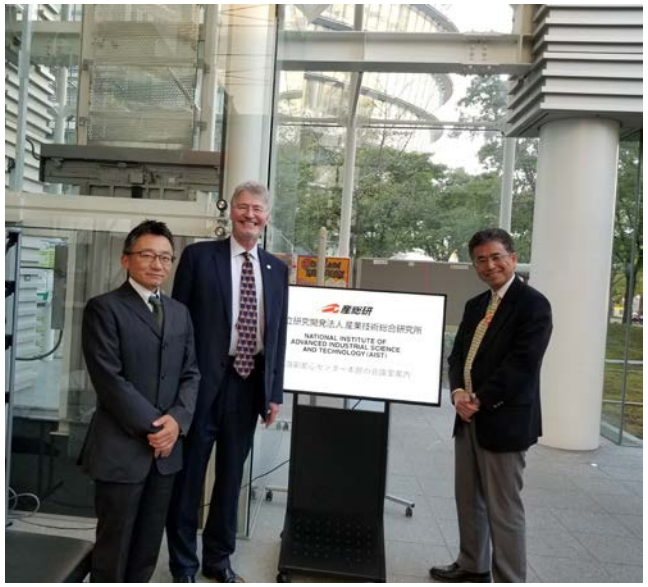
NTT Japan

NMIJ

Leveraging the leadership role of NIST as the premier NMI globally

- **NIST expertise** is in demand around the world
- **Action:** Engage with USG partners to maximize strategic impact

NIST advances collaborations for mutual benefit –
binationally, regionally, globally
Relationships in emerging technologies, facilitate standardization
Benefit US trade and diplomatic relationships



AIST

Benchmarks: Made in China 2025

- **$300 billion investment in manufacturing over 5 years**

- **Advanced Manufacturing goals – 10 year plan described in *Made in China 2025***
  - Increasing the Chinese-domestic content of core materials to 40 % by 2020 and 70 % by 2025.
  - 4 Focus Areas
    - Indigenous innovation and IP
    - Domestic brands
    - Secure, controllable standards
    - Localization of production and data

10 key industries	
Information Technology	Advanced railway equipment
Robotics and high end numerical control machinery (AI, machine learning)	Ocean engineering and high-tech vessel manufacturing
Green energy, energy saving, and green vehicles	New materials
Aerospace equipment	Bio-medicine and medical devices
Electrical power equipment	Agriculture machinery

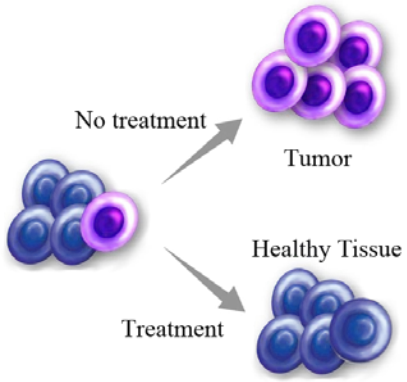
Made in China 2025 National Strategy

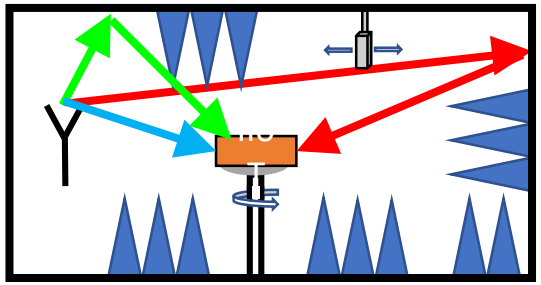
40 Institutes by 2025

Current Manufacturing Innovation Centers in China

1. **Power Battery Manufacturing Innovation Center**, Beijing, June **2016**.
   Pilot plant, Huairou District; Production Plant, Sichuan.
   Batteries for all forms of EV, including full size busses.
2. **The National Institute of Additive Manufacturing**, Xi'an, August **2016**.
   Metals, polymers & composites, ceramics, construction (direct jetting of concrete and polymers). The national institute has 31 regional centers across China.
   Moving in 2023 to the 30 acre "3-D Printing Town," High-Tec District, Xi'an.
3. **The National Information Optoelectronics Innovation Center**, Wuhan, **2017**.
   Next-generation networks, data center optical interconnects, 5G and other information applications, in high-end materials, core chip technology, & advanced package integration.
4. **National Printing and Flexible Display Innovation Center**, Guangdong, Jan. **2018.**
   High resolution, very large, active matrix organic LED displays.
5. **The National Integrated Circuit Innovation Center**, Shanghai, May **2018**
   5 nanometer and below integrated circuits (a significant leap for the world semiconductor industry). Located in Zhangjiang Hi-Tech Park in Pudong New Area, where more than 200 domestic and overseas IC companies are co-located.
6. **National Robot Innovation Center**, Shenyang, June **2018**
   Robotic machines and components.
   There are more than 20 robotics companies surrounding Shenyang, as well as leading universities in robotics. 2nd academic location in Harbin.
7. **Digital Design and Manufacturing**, Wuhan, September **2018**.
8. **Lightweight Materials Technology**, Beijing, **2018**
9. **Smart Sensor Innovation Center**, Jiading District, Shanghai, **2018**.
10. **Rail Transportation Equipment**, Changsha, **2019**
11. **National Intelligent Connected Vehicle Innovation Center,** Huairou District, Beijing, **2019**
12. **National Agriculture Machine Innovation Center,** Luoyang (50 miles west of Zhengzhou), **2019**

IMS Competition Winners





- Neutron Interferometric Microscopy of Small Forces and Hierarchical Structures
- NIST in a Drop: Revolutionizing Measurement of Single-Cell Kinetics
- World's Best IIoT Testbed

Recent Awards

IEEE Standards Association
Standards Medallion

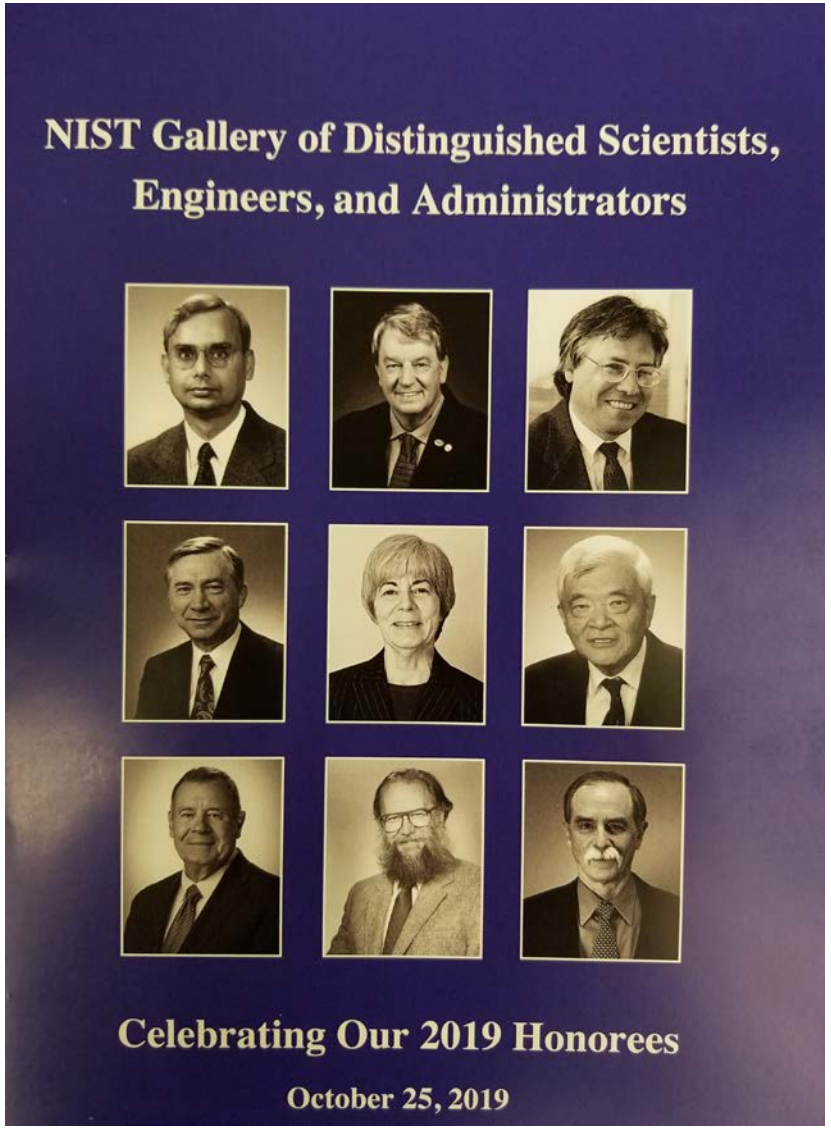
Government Innovation
Rising Star Award

Portland Golden Globe Award

Blavatnik National Laureate in
Physical Sciences & Engineering

10 NIST Researchers Receive the Presidential Early Career Award for Scientists and Engineers (PECASE)

NIST Hall of Fame – Class of 2019



Muhammad Arif (Physical Measurement Laboratory, 1988-2018)
Neutron interferometry and neutron imaging

Dale P. Bentz (Engineering Laboratory, 1980-1987 and 1988-2018)
Groundbreaking advances in the concrete materials industry

Richard F. Kayser Jr. (Office of the Director, 1976-2018)
Scientific leadership and the Health, Safety and Environmental program

William R. Ott (Physical Measurement Laboratory, 1968-2011)
For exceptional leadership of NIST Laboratory programs

Sharon A. Shaffer (Office of the Director, 1971-2006)
Stakeholder communications that enhanced NIST's reputation

Wing Tsang (Material Measurement Laboratory, 1962-2013)
Experimental and theoretical chemical kinetics

Robert L. Watters Jr. (Material Measurement Laboratory, 1976-2016)
For lifetime contributions to measurement services, SRMs, SRD

Charles L. Wilson (Information Technology Laboratory, 1979-2006)
For excellence in measurement science, semiconductors and biometrics

David J. Wineland (Physical Measurement Laboratory, 1975-2017)
For scientific innovation and leadership in developing trapped ions, as also recognized by the 2012 Nobel Prize in Physics

WWV 100th Anniversary

October 1, 2019 - Fort Collins CO

NIST WWV – the longest continuously operating radio broadcast station in the world

U.S. Time and Frequency
Scientific research / Ionosphere monitoring /
Space weather

Meeting Agenda

October 29, 2019

Session I: NIST Update

Session II: Administration's Priorities for Science and Technology

Session III: NIST Strategic Plan – Positioning NIST for a Changing S&T Environment

Session IV: NIST's Role in a Rapidly Changing Technology World

Session V: NIST and Equity

October 30, 2019

Session VI: NIST and Technology Transfer

DISCUSSION