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

NIST Overview

NRC Review of the NIST Communications Technology Laboratory

June 27th, 2019

NIST Past

Article 1, Section 8, of the Constitution of the United States (1789), “The Congress shall have power...To fix the standard of weights and measures”

U.S. Congress on March 3, 1901 chartered the creation of the National Bureau of Standards (NBS)

Standards provide a basis of trust for the U.S. consumer and International trade

NIST Mission

To promote U.S. innovation and industrial competitiveness by advancing **measurement science**, **standards**, and **technology** in ways that enhance economic security and improve our quality of life.

World-Leading Scientific and Engineering Research

Advanced Manufacturing National Programs

Technology Transfer and U.S. Innovation

NIST AT A GLANCE

Industry's National Laboratory

3,400+
FEDERAL EMPLOYEES

5
NOBEL PRIZES

2 CAMPUSES
GAITHERSBURG, MD [HQ]
BOULDER, CO

3,500+
ASSOCIATES

10
COLLABORATIVE INSTITUTES

400+
BUSINESSES USING NIST FACILITIES

ManufacturingUSA
NATIONAL OFFICE COORDINATING 14 MANUFACTURING INSTITUTES

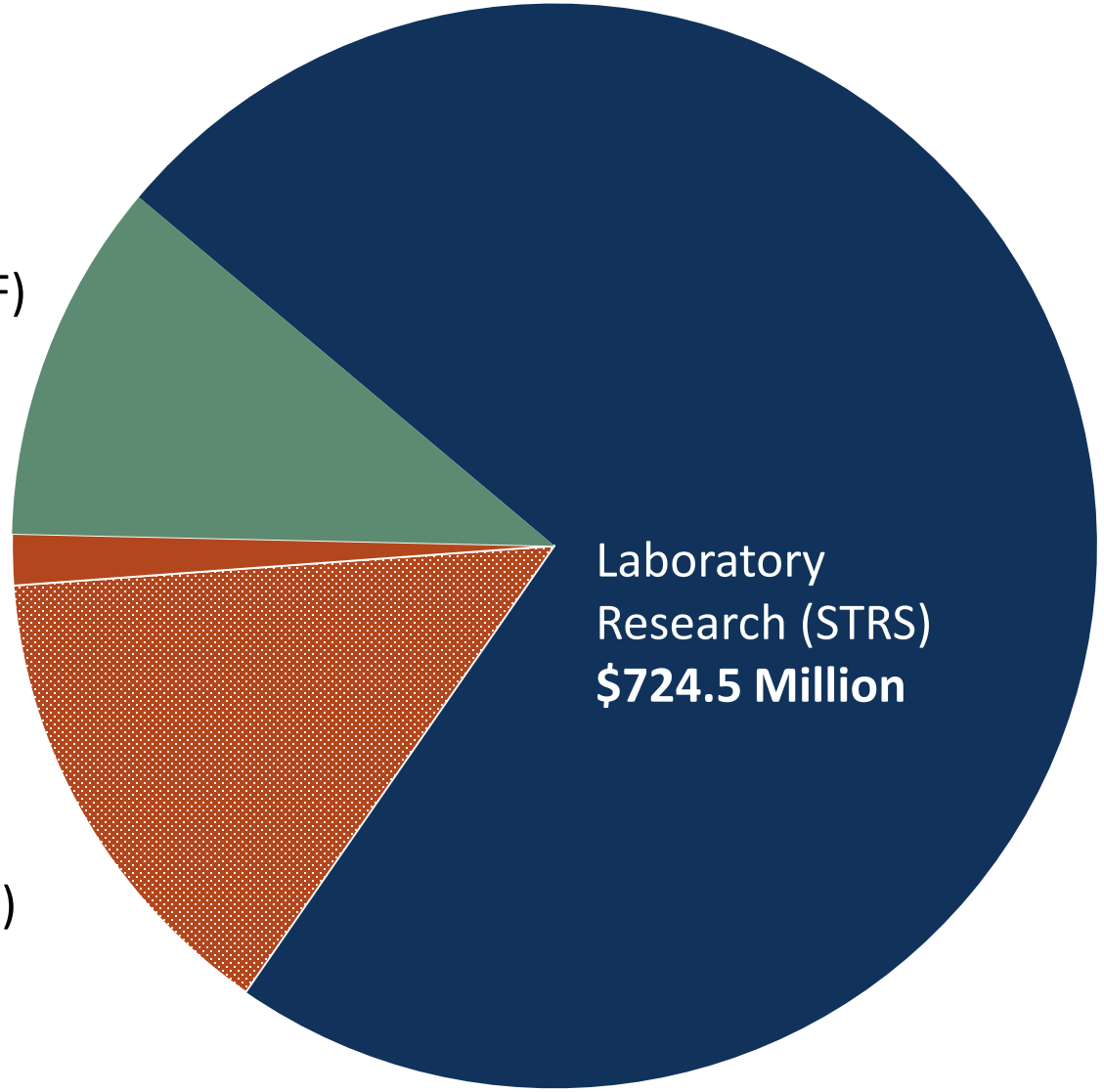
51
MANUFACTURING EXTENSION PARTNERSHIP CENTERS

U.S. BALDRIGE PERFORMANCE EXCELLENCE PROGRAM

NIST's Biggest Strength: Our Reputation

- Technical excellence
- Integrity
- Uncompromising
- Rigorous
- Unbiased
- Industry focused
- Non-regulatory

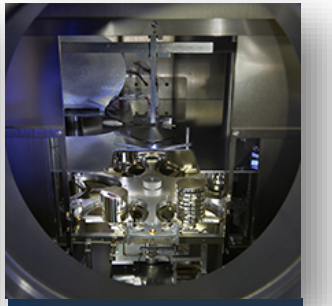
NIST Budget: $985.5 M



FY 2019 Appropriated Budget

NIST Laboratory Programs

Material Measurement Laboratory



Physical Measurement Laboratory

Communication Technology Laboratory

Engineering Laboratory

Information Technology Laboratory

NIST Center for Neutron Research

Metrology Laboratories

Driving Innovation through measurement science

Technology Laboratories

Accelerating the adoption and deployment of advanced technology solutions

User Facility

Providing world class, unique, user facilities

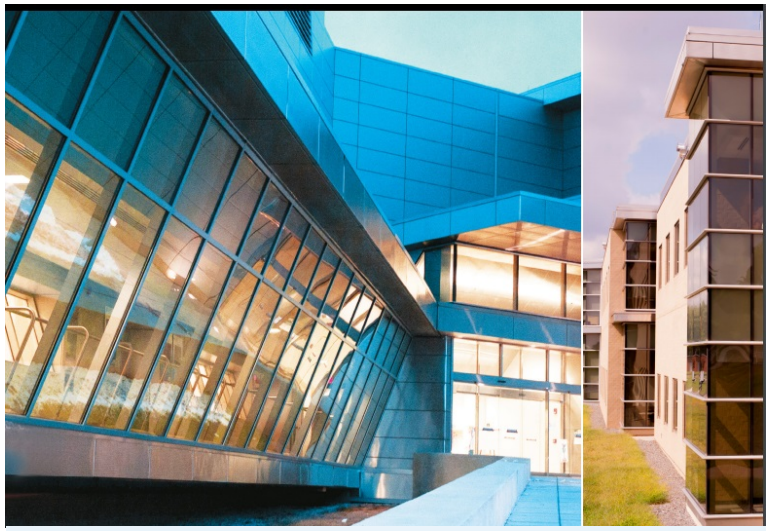
NIST User Facilities

National scientific user facilities provide researchers with the most advanced tools of modern science

- More than 5,700 researchers per year from academia, industry and government use the unique facilities of NIST
- Users perform leading edge scientific research and advance new product development
- Different modes of access include reduced cost/free or proprietary

NIST Center for Neutron Research

50 Years of Impact



CNST Center for Nanoscale Science & Technology

NIST Center for Nanoscale Science & Technology

National Nanotechnology User Facility

NIST Joint Institute and Center Locations

NIST Campuses

Gaithersburg, MD

Boulder, CO

Joint Institutes and Centers

National Cybersecurity Center of Excellence

Institute for Bioscience & Biotechnology Research

Joint Institute for Quantum Computer Science

Joint Quantum Institute

JILA

Hollings Marine Laboratory

Brookhaven National Laboratory

Joint Initiative for Metrology in Biology

Atomic Clock Signal Stations

NIST Kauai HI WWVH

NIST Ft. Collins CO WWV

NIST Centers of Excellence

Forensic Science

Disaster Resilience

Advanced Materials

NIST Extramural Programs

Public-private partnerships strengthening America's manufacturing core and organizational performance

Hollings Manufacturing Extension Partnership

Manufacturing USA

Baldridge Performance Excellence Program

Measurement Science, Standards & Technology NIST

1,200 Standard Reference Material (SRM) products

100 Standard Reference Data (SRD) products

600 measurement services

32,000 SRM units sold per year

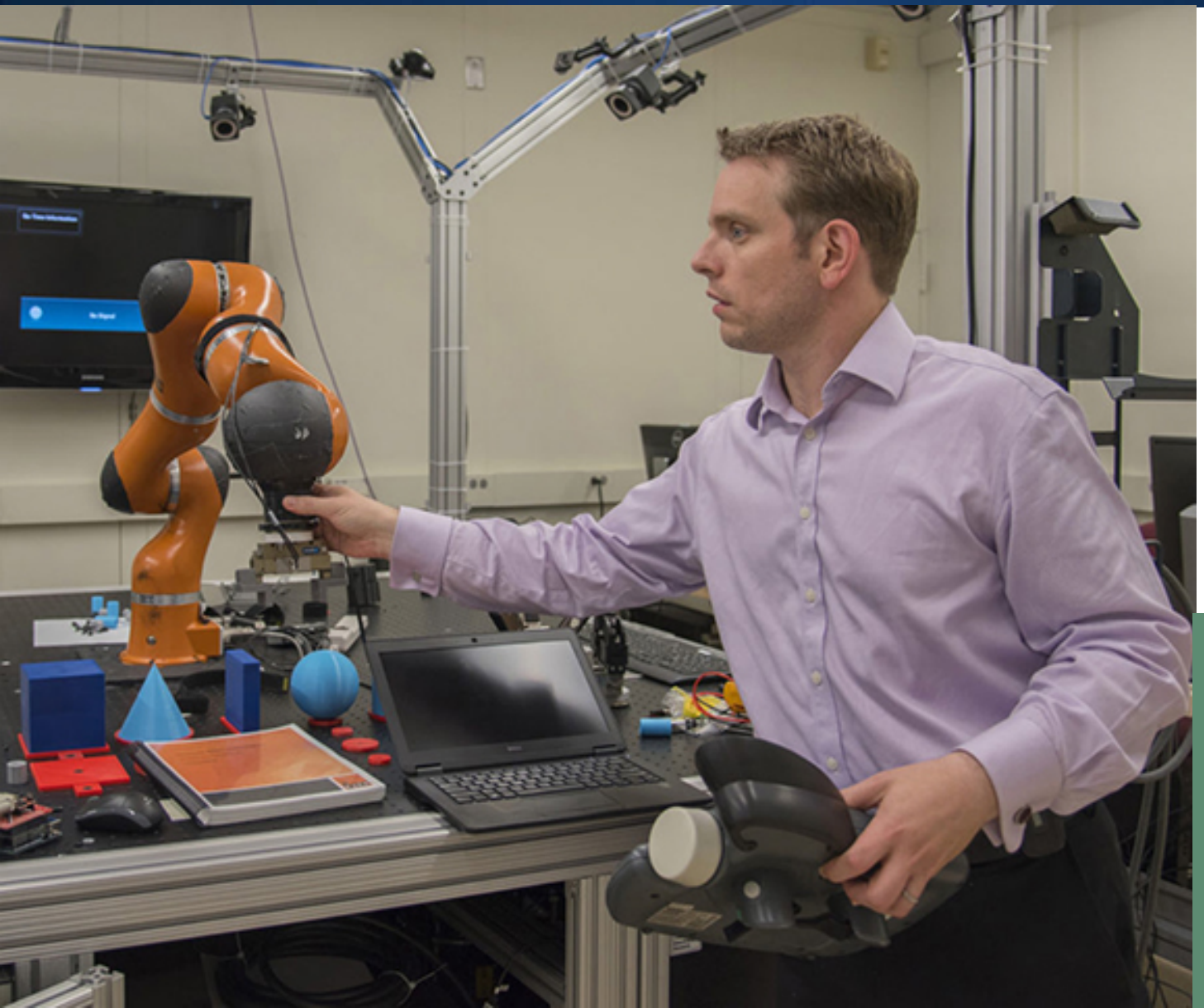
13,000 calibrations and tests per year

800 accreditations of testing and calibration laboratories per year

Calibrated Equipment is Essential

Boeing force measurements are traceable to the SI

Documentary Standards



Important Role

- **400+** NIST technical staff in **100+** standard committees
- Leadership in **international standards** bodies

NIST's technical expertise results in improved standards and U.S. competitiveness

NIST Addresses National R&D Priorities

Security

Cybersecurity and Privacy · NCCoE · Forensics · Body Armor & Materials · Public Safety Communications · AI · Autonomous Systems · Microelectronics

AI, Quantum &Computing

Cybersecurity and Privacy · Quantum Science · Quantum Computing · JILA · JQI · QuICS · nCORE · AI Standards & Test Methods · Machine Learning

Connectivity & Autonomy

Advanced Communications · Networks & Scientific Data Systems · 5G · Wireless Coexistence · UAS Challenge

Manufacturing

Advanced Manufacturing & Material Measurements · Machine Learning · Materials Genome Initiative · Robotics · Additive Manufacturing

Space

Advanced Manufacturing · Materials Development and Measurements · Aerospace Manufacturing · Sensors for Space Measurements

Energy Dominance

Smart Grid · Net-Zero Energy House · Energy Efficiency · Fuels · Sustainability

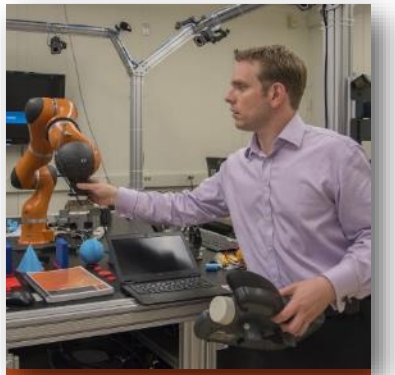
Medical Innovation

Health and Bioscience ·IBBR Diagnostic Standards ·JIMB · Biomanufacturing Process and Development Standards · Health IT · Medical Imaging

Agriculture

Water · GPS Technology · Measurements for Aquafarming · MRI of living plant roots

Programmatic Priorities



Advanced Manufacturing

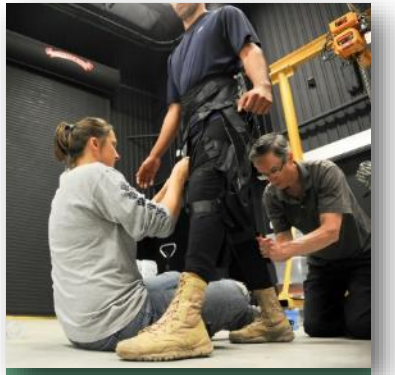
Cybersecurity

Disaster Resilience

© Matt DeLorme

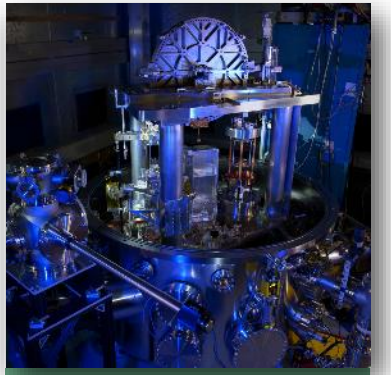
Engineering Biology

Internet of Things



Documentary Standards

Technology Transfer



Measurement Dissemination

Quantum Science

Artificial Intelligence

Advanced Manufacturing

Advanced Materials

Smart Manufacturing

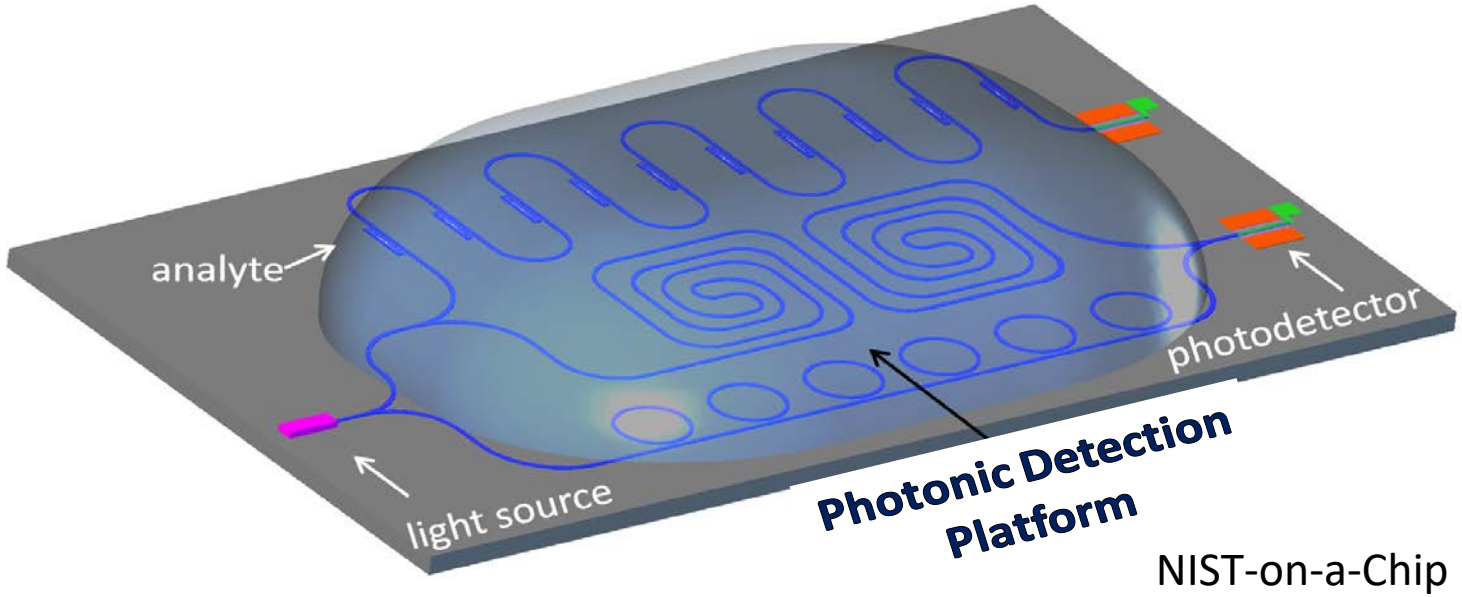
Advanced Sensing

Nanomanufacturing

Biomanufacturing

MEP

Manufacturing USA



NIST-on-a-Chip Platform vision

Cybersecurity & Privacy

NIST's cybersecurity programs enable greater development and application of practical, innovative security technologies and methodologies that enhance the country's ability to address current and future computer and information security challenges

Cybersecurity Framework

Post-quantum Cryptography

Enterprise risk management tool for organizations

NCCoE
NATIONAL CYBERSECURITY CENTER OF EXCELLENCE

The Department of Commerce's only Federally Funded R&D Center

NIST and Disaster Resilience

9/11/2001
WTC Towers Collapse

5/22/2011
Joplin Tornado

6/23/2012
Waldo Canyon Wildfire

August 2017
New construction performs well in TX

Now
Hurricane Maria

Infrastructure Resilience

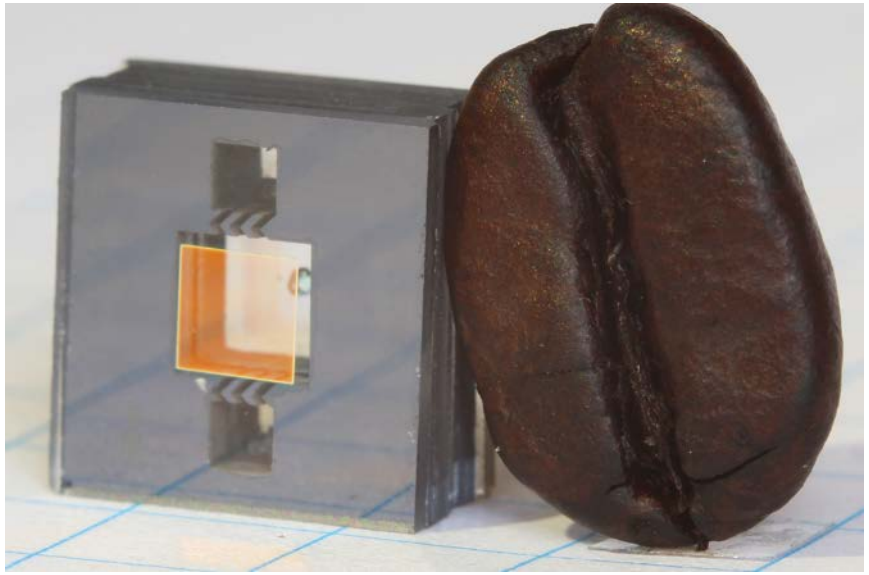
40+ NIST-led investigations of disaster and failure events since 1969

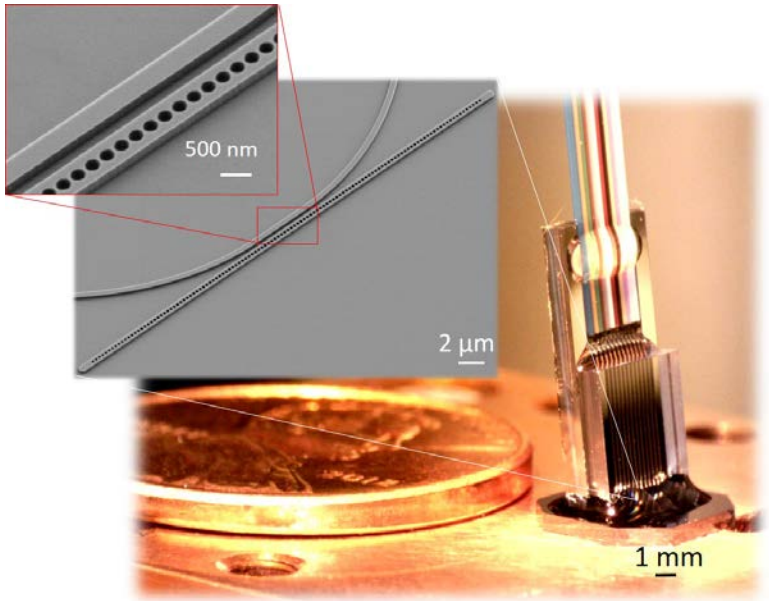
Resulting in **>40** significant changes to building codes and design guidelines

Measurement Dissemination

- Historic vote at the 26th General Conference of Weights and Measures on November 16, 2018 in Versailles, France
- The most significant change to the International System of Units (SI) in more than 130 years
- Unanimous positive vote representing all Treaty of the Metre member nations
- For the first time, all key measurement units will be defined by natural constants rather than physical artifacts

NIST on a Chip – The Next Generation of Measurement





Next-Generation Atomic Clock

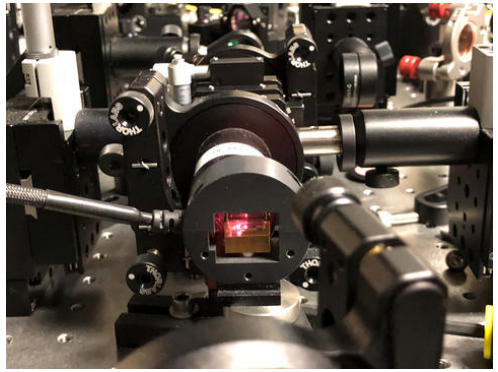
- Smaller than a coffee bean
- Vapor cell on a chip contains rubidium atoms
- Patent submitted
- Designed for manufacturability

Chip-Scale Photonic Thermometer

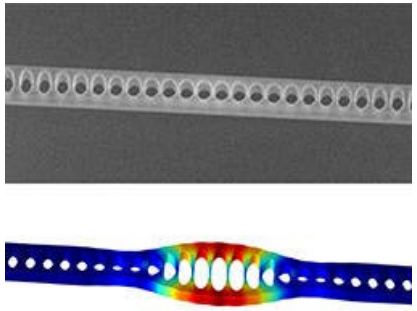
- Uses optical properties of materials to measure changes in temperature
- In joint development with an industry partner

Strategic Focus Area: Quantum Science

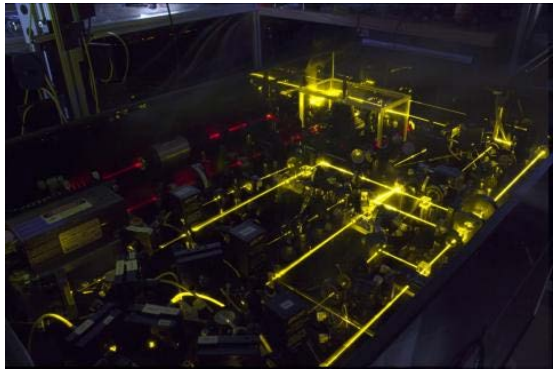
NIST laboratories and joint institutes are leading and preparing for the second quantum revolution through basic research, applied research and engineering, and measurement mission delivery.



Quantum-based Random Number Generator

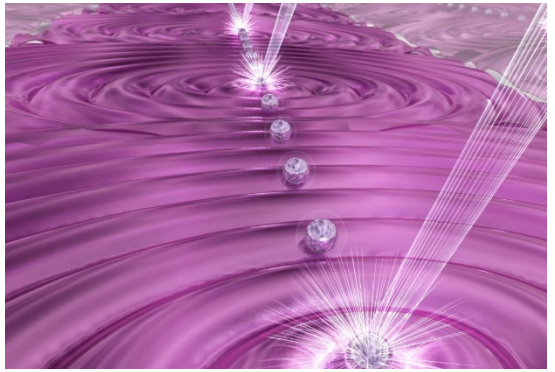


Quantum Photonics



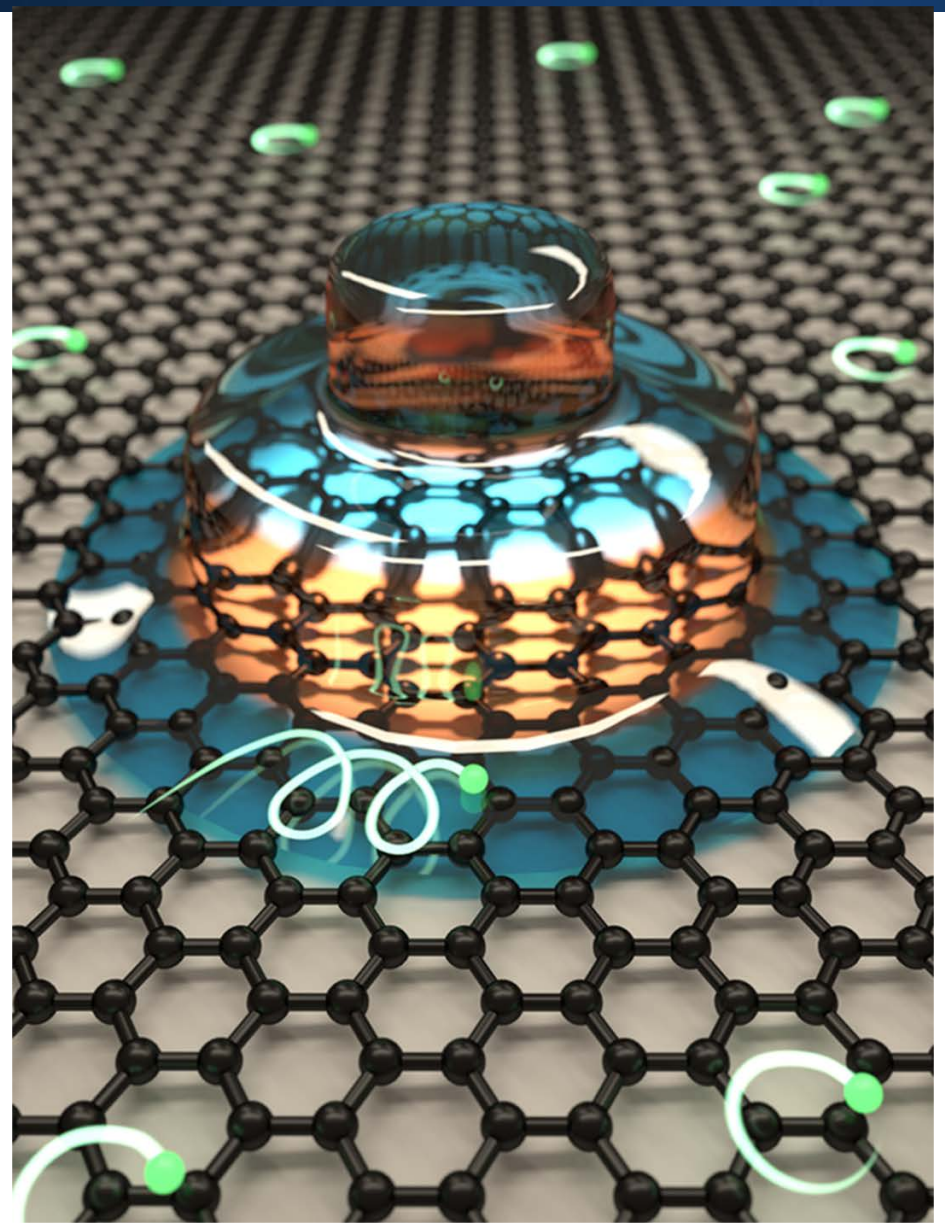
Stable Atomic Clocks

Post-Quantum Cryptography



Quantum Simulators

Quantum Economic Development Consortium (QED-C)



- Aims to expand U.S. leadership in global quantum research and development and the emerging quantum industry
- Foster wide-ranging interaction between academia, industry, national laboratories and government agencies
- Co-led with SRI International, the consortium currently has 50+ industry partners

Strategic Focus Area: Artificial Intelligence

NIST is helping to realize the full promise of artificial intelligence (AI) as an enabler of American innovation across industry and economic sectors, through measurement science, standards development, research and data

- Participate in the development of international standards that ensure innovation, public trust and confidence in systems that use AI technologies
- Research to understand the fundamental aspects that make an AI trustworthy, secure
- Applying AI to measurement problems in areas such as robotics, advanced materials, and genomics
- Per President Trump's ***Executive Order on Maintaining American Leadership in AI***: over the next six months, NIST is leading the development of a plan for Federal engagement in technical standards development

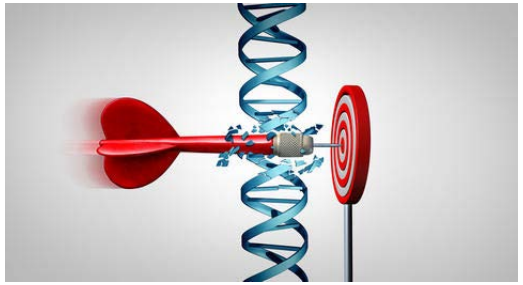
Strategic Focus Area: Engineering Biology

NIST tools bridge the gap between proof-of-concept and market realization by building the foundations of trust in bioscience

Recent Highlights:

NIST Genome Editing Consortium

- 22+ active member organizations
- Partnership to address measurements needed to increase confidence and lower risk of using genome editing technologies



NIST-Stanford Joint Initiative for Metrology in Biology (JIMB)

- New home at *SLAC National Accelerator Laboratory* combines NIST measurement mission with SLAC's unique facilities
- JIMB develops fundamental measurements and reference materials to give the biotech community confidence in their results

SLAC NATIONAL ACCELERATOR LABORATORY

Stanford University

Strategic Focus Area: Internet of Things

NIST is building the foundations of trust in the Internet of Things through programs addressing cybersecurity, reliable connectivity, and interoperability

Smart and Secure Cities and Communities Challenge

- Global City Teams Challenge Expo July 10-12, Washington DC

Cybersecurity for IOT Program

- NIST IR 8200: Interagency Report on Status of International Cybersecurity Standardization for the IOT

Research to improve IOT in real-world environments such as the factory floor

- New NIST method could boost 5G wireless network and reduce costs

PRESIDENT'S MANAGEMENT AGENDA

Return on Investment

NIST

- ROI is a national conversation about the enduring importance of technology transfer and innovation
- Draft Green Paper developed with stakeholders and interagency working groups
- Published as **NIST Special Publication 1234**

15 bold intended actions to remove existing impediments to innovation at the public-private sector interface, and to streamline and accelerate technology transfer

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STAY IN TOUCH

CONTACT US

NIST.gov

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FY2020 Request Compared to FY2019 Enacted

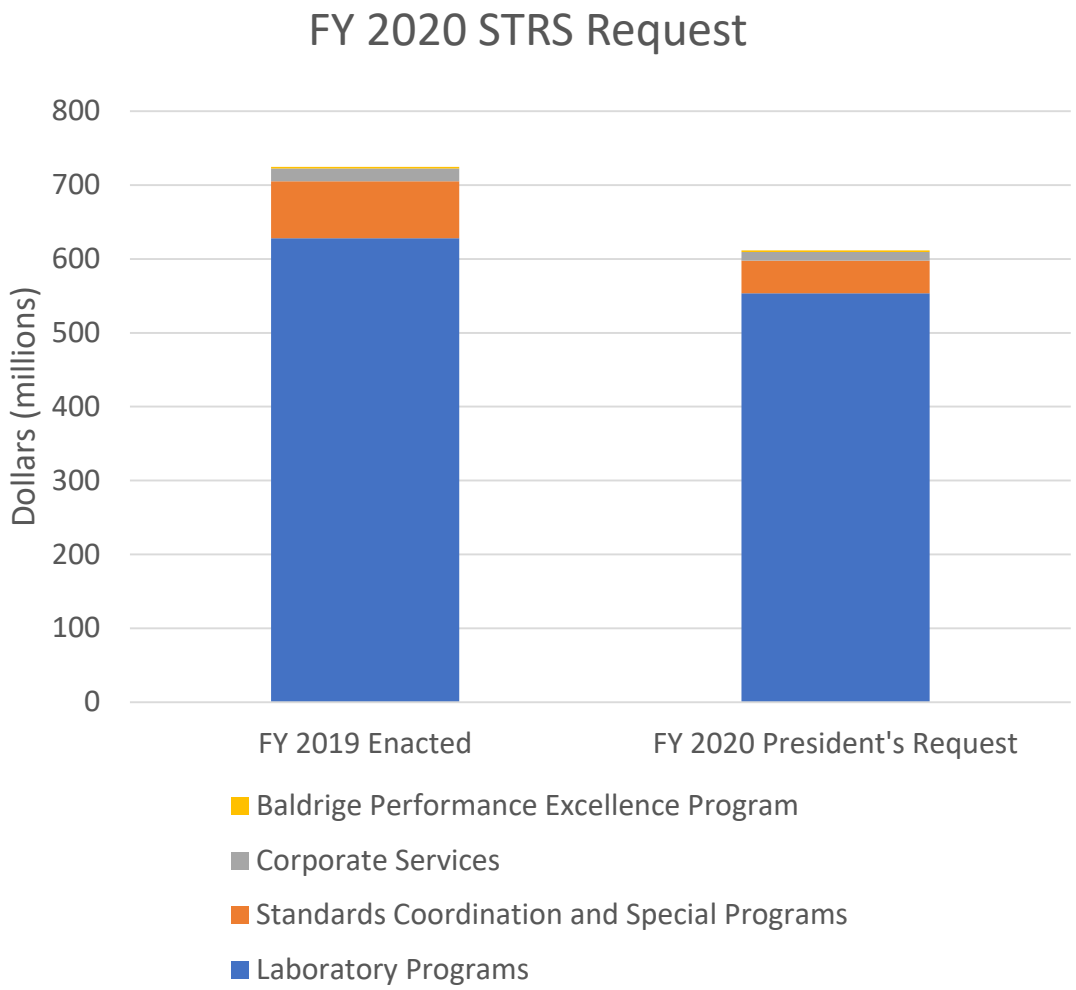
		FY 2018 Enacted		FY 2019 Enacted		FY 2020 Request	FY 2020 Request +/(-) Over FY 2019 Enacted	% Over FY 2019 Enacted
STRS		**$724.5**		**$724.5**		**$611.7**	**($112.8)**	**-15.6%**
Laboratory Programs		628.0		628.1		553.7	(74.4)	-12%
Corporate Services		17.3		17.3		11.9	(5.4)	-31%
Stds Coord & Special Pgms	*	79.2		79.1		46.1	(33.0)	-42%
ITS		**$155.0**		**$155.0**		**$15.2**	**($139.8)**	**-90.2%**
Hollings Mfg Ext Partnership		140.0		140.0	**	0.0	(140.0)	-100.0%
Manufacturing USA		15.0		15.0		15.2	0.2	1.3%
CRF		**$319.0**		**$106.0**		**$59.9**	**($46.1)**	**-43.5%**
Construc & Major Renovations		255.0		31.0		19.2	(11.8)	-38%
Saf, Cap, Maint & Maj Repairs		64.0		75.0		40.7	(34.3)	-46%
Total, NIST Discretionary		**1,198.5**		**985.5**		**686.8**	**(298.7)**	**-30.3%**

* Includes $2.2M Baldrige Performance Excellence Program funding.

** Without a $2M rescission of prior year unobligated balance to reduce budget authority.

STRS: $611.7 M (-$112.8 M and -421 Positions)

- Supports Administration priorities in quantum science, artificial intelligence, and microelectronics
- A reduction 16% from FY 2019 levels for NIST research programs
- Would necessitate a reduction of 400 staff which about 17 % reduction in scientists and engineers

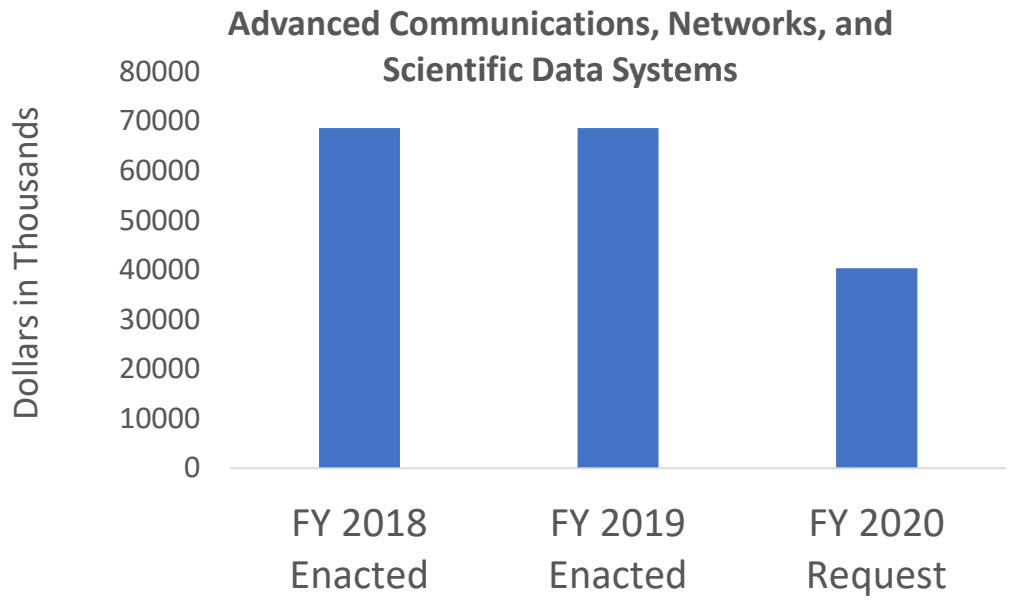


STRS Spending Changes by Focus Area

Budget (Dollars in thousands)	FY 2019 Enacted	FY 2020 Request	Difference	
Advanced Communications, Networks, and Scientific Data Systems	$68,643	$40,323	($28,320)	-41.2%
Advanced Manufacturing and Material Measurements	$147,874	$117,555	($30,319)	-20.5%
Cybersecurity and Privacy	$82,779	$83,997	+$1,218	+1.4%
Exploratory Measurement Science	$66,821	$65,804	($1,017)	-1.5%
Fundamental Measurement, Quantum Science, and Measurement Dissemination	$218,300	$191,438	($26,862)	-12.3%
Health and Bioscience	$19,536	$16,823	($2,713)	-13.8%
NIST User Facilities	$51,377	$47,036	($4,341)	-8.4%
Physical Infrastructure and Resilience	$66,969	$46,543	($20,426)	-30.5%
Totals:	**$722,299**	**$609,519**	**(-$112,780)**	**-15.6%**

Totals do not include the $2.2 M for BPEP

Advanced Communications, Networks, and Scientific Data Systems



FY 2019 Enacted	FY 2020 Request	Difference	
$68,643	$40,323	($28,320)	-41.2%

To focus on AI and 5G needs NIST will propose to eliminate programs addressing multiple IT and data challenges including internet infrastructure protection, cloud computing, medical record interoperability, data visualization and cyber physical systems interoperability.