The Expanding Role of Partnerships
in the Delivery of NIST's Measurement Science Mission

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

Measurement Science is Core to NIST

NIST's 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.

NIST's vision

NIST will be the world's leader in creating critical measurement solutions and promoting equitable standards. Our efforts stimulate innovation, foster industrial competitiveness, and improve the quality of life.

NIST's core competencies

- Measurement science
- Rigorous traceability
- Development and use of standards

Image: Creative Commons License

Institutional Characteristics

- **NIST is primarily an intramural lab research organization**
  - Requires dedicated infrastructure and staff
- **NIST's organizational structure is relatively static**
  - The last major reorganization took place in 2010 (22 years after the last major change)
  - NIST remains largely discipline-based
- **NIST labs have broad autonomy within respective scopes**
  - Must still maintain core activities (measurement traceability, etc.)

"(...) the Bureau's hands-on experimental capability is the primary basis for its reputation and usefulness. The laboratory focus is also reinforced by the unique expertise and facilities required by the basic mission and by the Bureau's role as an objective, independent third-party."

Long-Range Plan of NBS, 1981

What is the role of partnerships in a scientific institution like NIST?

Image credit: JILA

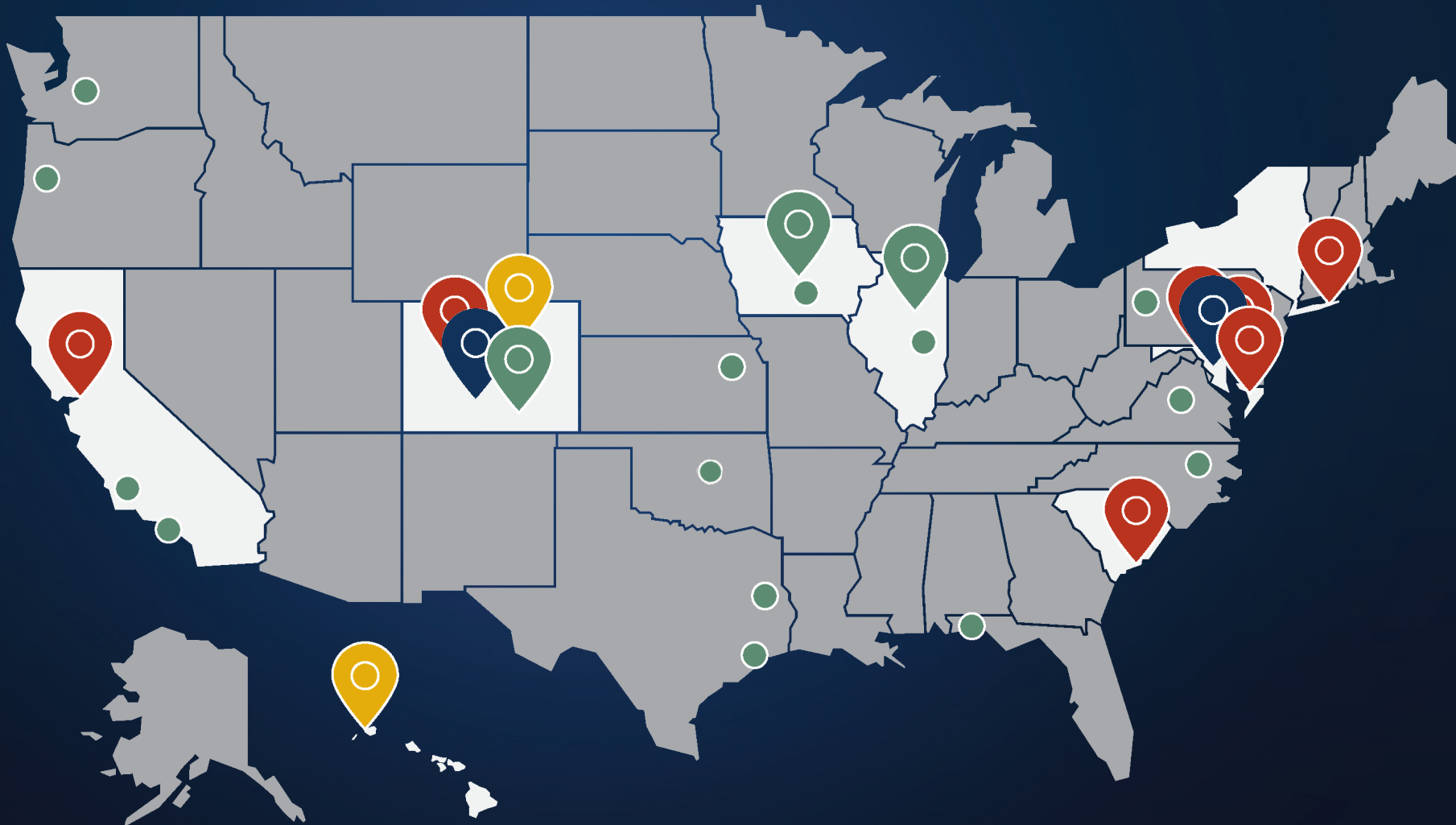# Growth in Partnerships

1962: JILA founded with Univ. CO

1987: CARB founded with Univ. MD

Today: Mix of institutes, centers, and other mechanisms

- Centers of Excellence
- Joint Institutes
- Grants Programs
- Frameworks
- Consortia
- Prize Competitions
- Products & Services

NIST Joint Institute and Center Locations

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

National Cybersecurity Center of Excellence (est. 2012)

NCCoE is the Department of Commerce's first Federally Funded Research and Development Center established in partnership with the State of Maryland and Montgomery County, MD

Advantages :

- Creation of practical cybersecurity solutions for specific industries

- Facile collaboration with industry and academia

- Can work with other NIST programs (e.g., Industrial Control Systems cybersecurity research with EL)

Challenges:

- Balance of NCCoE engagement with NIST vs. Work for Others

- Minimizing administrative burdens on partners and collaborators

- Evolving process and products to keep pace with a changing cyber landscape

Centers of Excellence Program (est. 2013)

Research partnerships with leading universities in materials science, resilience, and forensic science, supported with up to ten years of funding

Advantages :

- Close partnership and access to concentration of world-class expertise, data, access to facilities

- NIST can expand in new fields with great potential but possible risks without developing formal in-house capabilities

- Visible focus on priority NIST efforts

Challenges:

- Takes time to establish productive relationship

- Requires significant oversight and continued engagement by NIST program managers

- Sustainability after ten years of NIST investment

CHiMaD — Advanced Materials
Lead: Northwestern University (Chicago, IL)
Est. 2013, renewed for 5 yrs. in 2019

Resilience — Community Resilience
Lead: Colorado State University (Ft. Collins, CO)
Est. 2015, renewed for 5 yrs. in 2020

csafe Center for Statistics and Applications in Forensic Evidence — Forensic Science
Lead: Iowa State University (Ames, IA)
Est. 2015, renewed for 5 yrs. in 2020

Joint Institutes & Centers

Longstanding institutional commitments and embedded NIST staff with University of Colorado, University of Maryland, NOAA, Dept of Energy
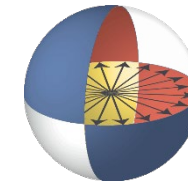
Advantages:

- Access to expertise/facilities; proximity to NIST campuses (for UMD and CU institutes)

- Ability to build long-term capabilities in technical areas with significant growth potential

- Provides a pipeline for future skilled workforce

- Ability to work with academia and industry in a flexible and effective manner

Challenges:

- Loss of NIST culture at off-site centers; embedded staff may not feel connected to NIST

- Difficult to disengage from commitment

Image credit: Baxley/JILA

Image credit: NIST

Image credit: Brookhaven National Laboratory

Grants Programs

NIST

Grants programs funded by Congress support NIST's mission in various research areas

Advantages:
- Expand reach of NIST programs
- Initiate new areas of research
- Build new partnerships

Challenges:
- Minimal engagement with NIST researchers
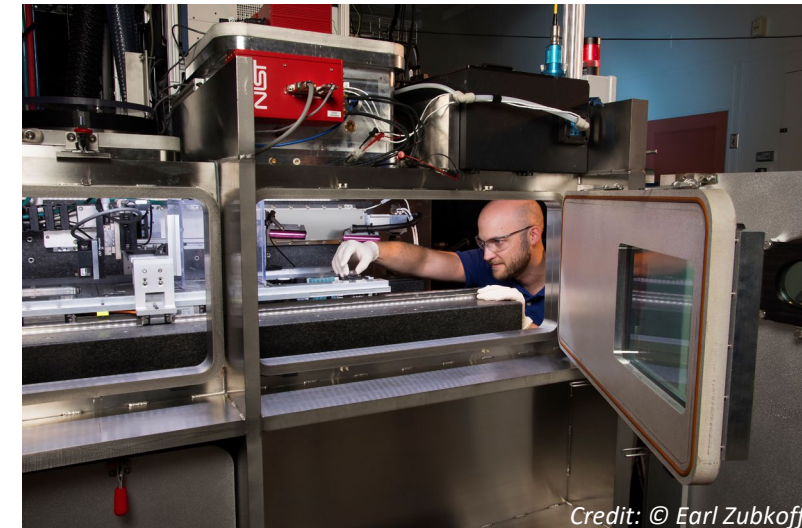- Monitoring to ensure alignment with NIST

Credit: Dept. of Homeland Security Science & Technology Directorate

Credit: © Earl Zubkoff

Disaster Resilience

Plastics Recycling

Additive Manufacturing

Partnering with NIST External Programs

Opportunities for the laboratory programs to leverage nationwide networks of manufacturing capability

➢ NIST laboratory staff serve as technical advisors for Manufacturing USA institutes

➢ Joint research projects between NIST and institutes

➢ MEP-Assisted Technology and Technical Resource (MATTR) joins MEP clients with NIST experts

Advantages:
- Win-win for NIST programs
- NIST labs get insights to real-world challenges

Challenges:
- Bridging different program goals and styles

Mechanisms of Engaging with Stakeholders and Customers

Frameworks

Voluntary frameworks developed with extensive stakeholder engagement provide standards, guidelines, and practices

Advantages:

- Target community is motivated to participate

- Target (industry) community has resources and is organized

- NIST can help drive communities forward faster

Challenges:

- NIST must have technical depth and respect in the community

- May detract efforts away from research to convening roles

- Increasingly a role that key stakeholders expect

Cybersecurity
Privacy
Smart Grid
Cyber-Physical Systems
Community Resilience
Big Data Interoperability
…

Consortia

Public-private partnerships to nurture a community and identify shared challenges

Advantages:

- NIST can align research programs and measurement services with community needs

- Access to small and large companies

Challenges:

- Stakeholder expectations that NIST will address key needs

- Continued management of agreements and funding structures to maintain some consortia

nSoft
Neutron measurements

QED·C
Quantum Economic Development Consortium

Genome in a Bottle
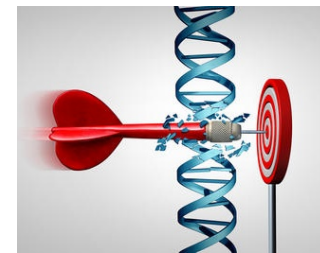
Gene Editing Consortium

5G mM Wave Channel Model Alliance

Prize Competitions

Award prizes competitively to stimulate innovation to advance the NIST mission

Advantages:

- Establish ambitious goal without predicting who is most likely to succeed

- Reach beyond the "usual suspects"
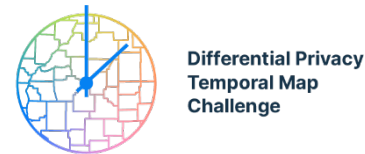
- Inspire risk-taking by offering a level playing field

21+ NIST challenges

Over $4 million awarded in prizes to date

Challenges:

- Requires prize competition expertise and infrastructure

- Sustaining the community and follow-on investments after competition ends

Delivering our Mission: Products and Services

1,200 Standard Reference Material (SRM) products

100 Standard Reference Data (SRD) products

600 measurement services

Every year:

32,000 SRM units sold

13,000 calibrations and tests

800 accreditations of testing and calibrations laboratories

Million-Pound Deadweight Machine

Credit: NIST

Spotlight: COVID-19 Measurement Products & Services

Research Grade Test Material
Interlaboratory Studies
Serology Reference Materials
Characterization

Final Thoughts

NIST

NIST has lots of tools to partner and advance our measurement science mission

How should we decide when to pursue partnerships? What mechanisms work best, and for what purpose?