# The U.S. Advanced Manufacturing Initiative

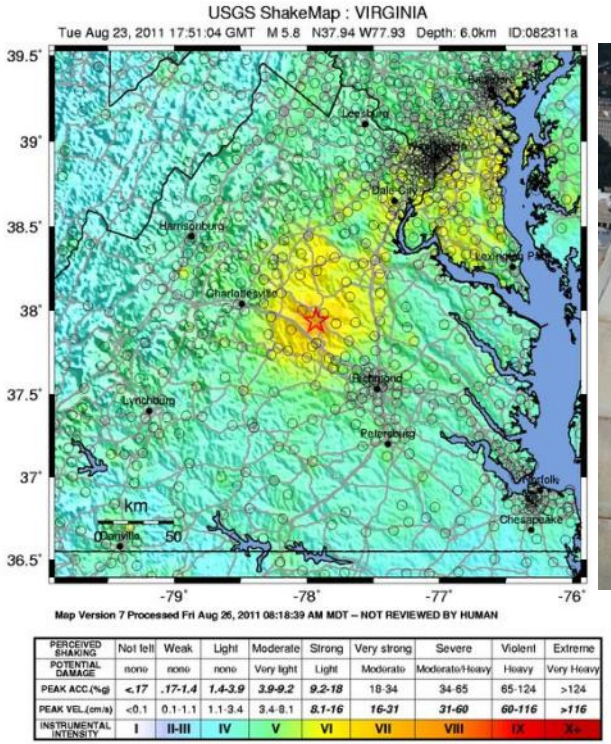
## Federal Resources and Opportunities for Public/Private Partnerships

Michael F. Molnar
Chief Manufacturing Officer
National Institute of Standards and Technology
US Department of Commerce

# Shaken, Stirred, joined Commerce…

Moved family from “industrial heartland” late August

- 5.8 magnitude earthquake
- Hurricane Irene
- Welcome to Government Service!




National Parks Service

NASA, NOAA GOES Project

# Agenda

- NIST overview and special role with manufacturing
- PCAST's Report to the President on Advanced Manufacturing
- The President's Advanced Manufacturing Partnership
- NIST activities supporting AMP
- Public/Private Partnerships - what YOU can do today

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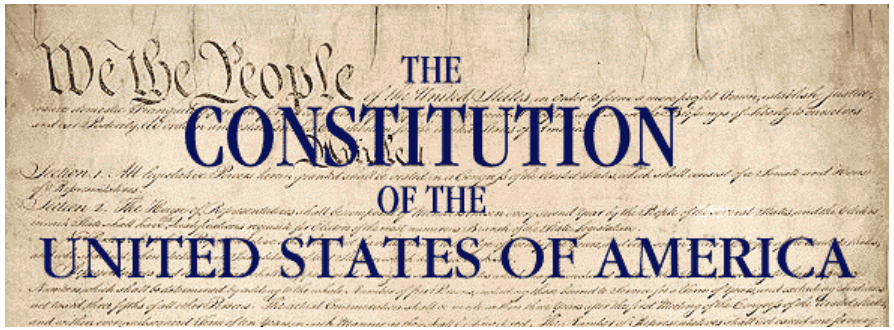
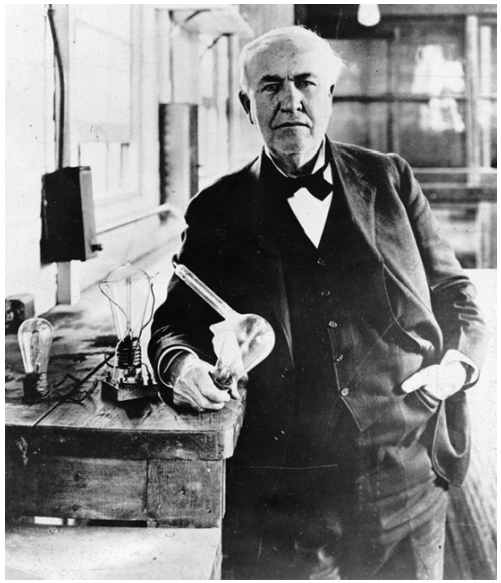
# Authority for / Importance of Standards




Article I, Section 8: The Congress shall have the power to… *fix the standard of weights and measures*

## National Bureau of Standards established by Congress in 1901

- Eight different "authoritative" values for the gallon
- No standards for nascent electrical industry
- American instruments sent abroad for calibration
- Consumer products and construction materials uneven in quality and unreliable



Estimated that 80% of global merchandise trade is influenced by testing and other measurement-related requirements of regulations and standards

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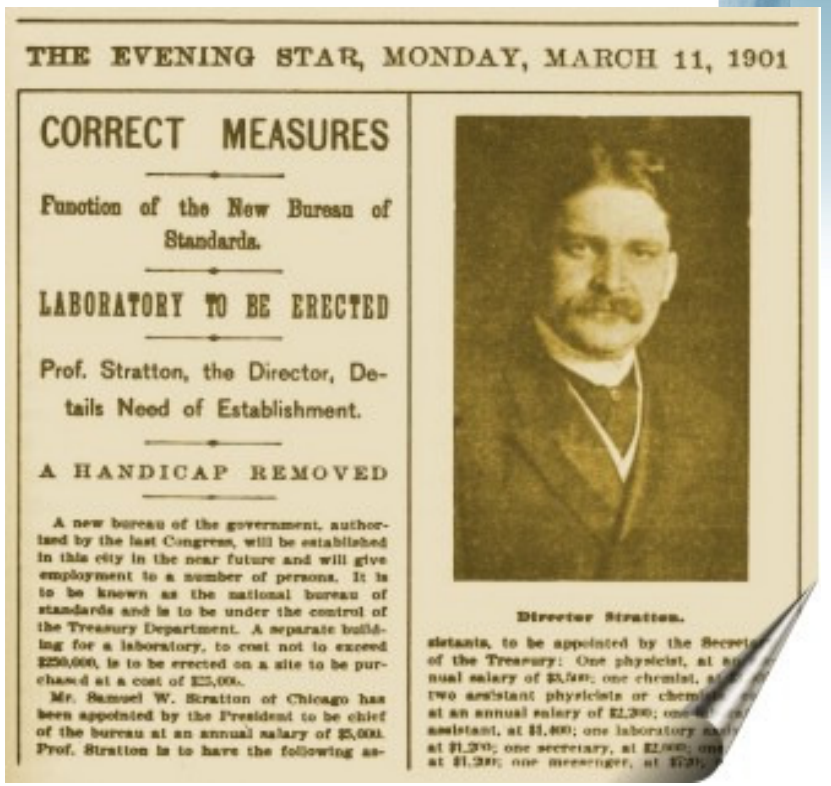
# NBS: The Founding Charge

"It is therefore the unanimous opinion of your committee that no more essential aid could be given to

- manufacturing
- commerce
- the makers of scientific apparatus
- the scientific work of Government
- schools, colleges, and universities

than by the establishment of the institution proposed in this bill."



THE EVENING STAR, MONDAY, MARCH 11, 1901

CORRECT MEASURES

Function of the New Bureau of Standards.

LABORATORY TO BE ERECTED

Prof. Stratton, the Director, Details Need of Establishment.

A HANDICAP REMOVED

A new bureau of the government, authorized by the last Congress, will be established in this city in the near future and will give employment to a number of persons. It is to be known as the national bureau of standards and is to be under the control of the Treasury Department. A separate building for a laboratory, to cost not to exceed $250,000, is to be erected on a site to be purchased at a cost of $25,000.

Mr. Samuel W. Stratton of Chicago has been appointed by the President to be chief of the bureau at an annual salary of $5,000. Prof. Stratton is to have the following as-

Director Stratton.

sistants, to be appointed by the Secretary of the Treasury: One physicist, at an annual salary of $3,500; one chemist, at [illegible]; two assistant physicists or chemists at an annual salary of $1,200; one assistant, at $1,400; one laboratory [illegible] at $1,200; one secretary, at $2,000; one at $1,200; one messenger, at $720;

***House Committee on Coinage, Weights and Measures, May 3, 1900, on the establishment of the National Bureau of Standards (now NIST)***

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# NBS to NIST: The Charge Expands

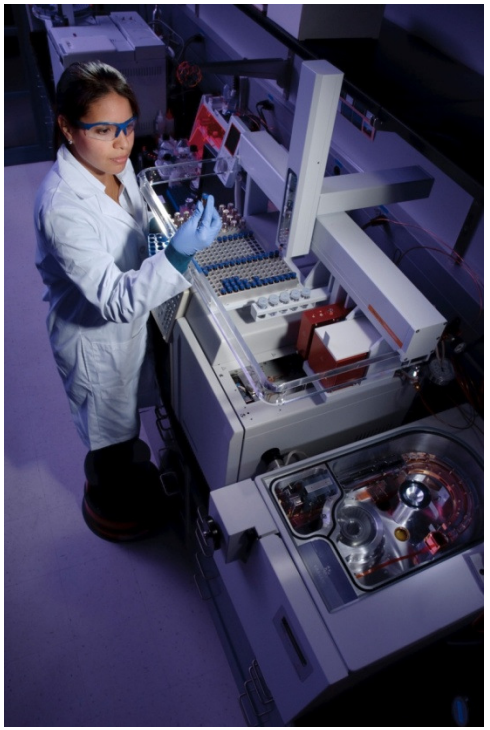
## The Congress finds and declares …

- The future well-being of the United States economy depends on a strong manufacturing base and requires continual improvements in manufacturing technology, quality control, and techniques for ensuring product reliability and cost-effectiveness.

- Improvements in manufacturing and product technology depend on fundamental scientific and engineering research to develop
  a) the precise and accurate measurement methods and measurement standards needed to improve quality and reliability, and
  b) new technological processes by which such improved methods may be used in practice to improve manufacturing and to assist industry to transfer important laboratory discoveries into commercial products.

*NIST Organic Act - 15 U.S.C 271, Section 1, 1988*

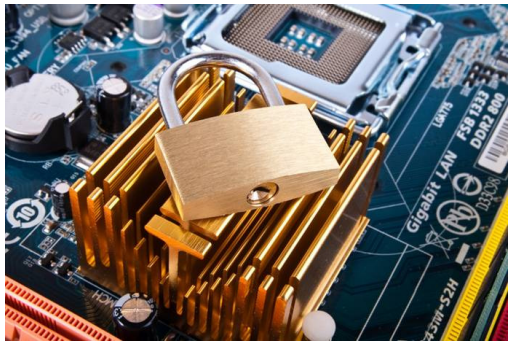




# NIST's Unique Mission

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.

- Mission focus: Targeting Investments to Advance U.S. Innovation and Boost Economic Recovery
- Deep research expertise underpins technological innovation – e.g. lasers, memory, GPS, wireless
- Non-regulatory status enables important role as a convener that facilitates collaboration between industry and government

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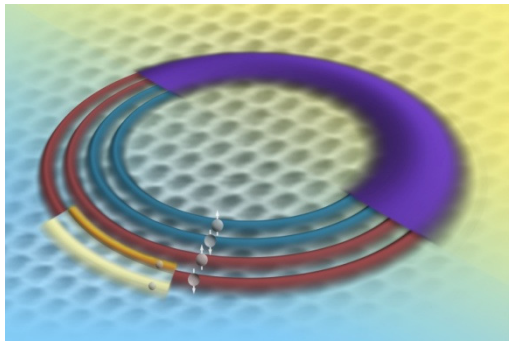
**Cybersecurity**: Improved response to cyber threats



**Nanomanufacturing:** New measurement tools for advanced materials manufacturing


techibuzz.com/GM Autos

**Energy:** Measurements and standards for energy security

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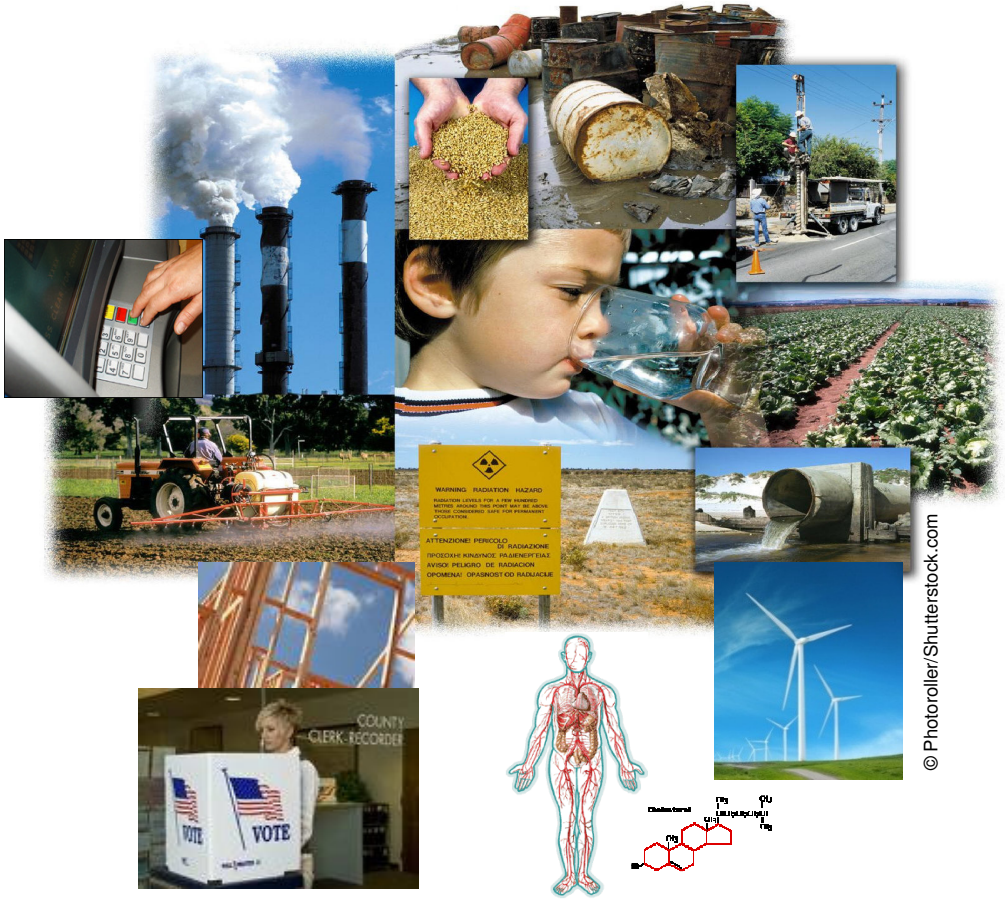
# Since inception, NBS/NIST focused research and measurement services on societal needs

1901 → 2011

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Guiding Principle: Always Provide Objective, Correct Science
to foster technology adoption, manufacturing and trade, and policy development

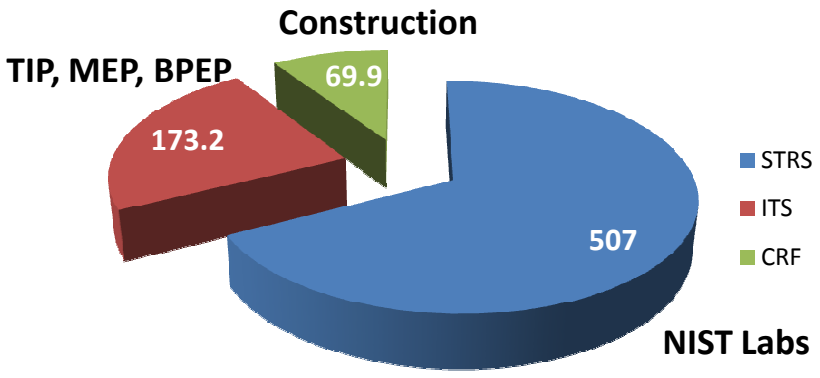
# NIST at a Glance…

## Major assets

- ~ 2800 federal employees
- ~ 2600 associates and facilities users/year
- ~ 1600 field staff in partner organizations (Manufacturing Extension Partnership)
- Two main locations, MD and CO
- Four collaborative Institutes (basic physics, biotech, quantum, marine)

Courtesy HDR Architecture, Inc./Steve Hall © Hedrich Blessing

## FY 2011 – Total NIST $750 M

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# NIST's role in the President's Science and Innovation Agenda

***NIST is strategically positioned to help the Nation improve its innovation performance and respond effectively and efficiently to national priorities.***

**NIST programs in support of Administration priorities**

| Presidential Priorities | NIST Strategic Priorities |
|---|---|
| • *Manufacturing* | • *Manufacturing* |
| • *Innovation and competiveness* | • *Physical Infrastructure* |
| • *Smart Grid* | • *Energy* |
| • *Health IT* | • *Environment* |
| • *Cyber-security* | • *Health care* |
| | • *Secure IT & Communications* |

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# In Short… NIST and Manufacturing

- ***NIST is Industry's National Laboratory***
- ***Manufacturing is NIST's top priority***
- ***NIST will be playing a major role in the upcoming Advanced Manufacturing Initiative***

***Message to imX from Dr. Patrick Gallagher***
*Under Secretary of Commerce for Standards and Technology and Director of NIST*

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

# Agenda

- NIST overview and special role with manufacturing
- **PCAST's Report to the President on Advanced Manufacturing**
- The President's Advanced Manufacturing Partnership
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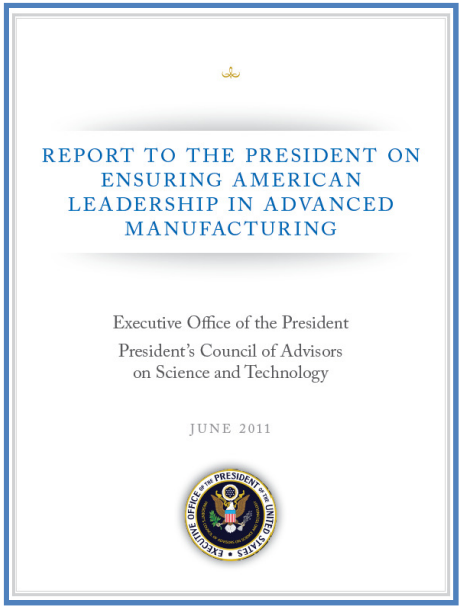
- Public/Private Partnerships - what YOU can do today

# REPORT TO THE PRESIDENT
# Ensuring American Leadership In Advanced Manufacturing

Executive Office of the President
President's Council of Advisors on Science and Technology

# Summary of Key Conclusions

- The United States is losing leadership in manufacturing
  - not just in low-tech industries and products and not just due to low wages abroad, but losing ground in the production of high-tech products, including those resulting from U.S. innovation and inventions, and in manufacturing-associated R&D.
- Other nations are investing heavily in advancing their manufacturing leadership, innovation systems, and R&D.
- The United States lags behind competitor nations in providing the business environment and skilled workforce needed for advanced manufacturing.
- A strong advanced manufacturing sector is essential to national security.
- Advanced manufacturing has the potential to create and retain high-quality jobs in the United States.

# Summary of Key Conclusions (cont'd)

- The Nation's long-term ability to innovate and compete in the global economy greatly benefits from co-location of manufacturing and related R&D activities in the United States. The loss of these activities will undermine our capacity to invent, innovate, and compete in global markets.

- Federal investments in new technologies, shared infrastructure, and design tools have been crucial to the birth and growth of major new industries.
- Individual companies cannot justify the investment required to fully develop many important new technologies that will have spillover benefits or to create the full infrastructure needed to support manufacturing. Private investment must be complemented by public investment to overcome market failures. *Key opportunities include*

    *1) investing in the advancement of new technologies with transformative potential*

    *2) supporting shared infrastructure*

    *3) accelerating the manufacturing process through targeted support for new methods and approaches.*

# Principles for Promoting Advanced Manufacturing in the US

**(1) Create a fertile environment for innovation here.**

- Encourage firms to locate R&D and manufacturing activities in the US through tax and business policies
- Support a robust basic research enterprise
- Ensure a supply of skilled workers, through policies that cultivate and attract high-skilled talent

# Principles for Promoting Advanced Manufacturing in the US

**(2) Invest to overcome market failures, to ensure new technologies are developed here and technology-based enterprises have the infrastructure to flourish here.**

- Support applied research programs in most promising new technologies
- Co-invest in public/private partnerships to facilitate development of broadly-applicable technologies with transformative potential
- Develop and disseminate design methodologies that decrease the time and lower the barriers to make products
- Invest in shared technology infrastructure that would help U.S. companies improve their manufacturing

# Recommendations

## 1) Launch a Federal Advanced Manufacturing Initiative

- Concerted, whole-of-government effort, led by DOC, DOD and DOE
- Report to President on priority needs for Federal investments, including:
  - Coordinated Federal support to academia and industry for applied research on new technologies and design methodologies
  - Development and dissemination of design methodologies
  - Shared facilities and infrastructure to help small and medium-sized firms compete globally
  - Public/Private Partnerships (PPPs) to advance such technologies through pre-competitive consortia

## 2) Improve Tax Policy

- Reform corporate income taxes, extend the R&D tax credit permanently and increase the rate to 17%, as advocated in the President's Innovation Strategy.

## 3) Support Research

- Strengthen research of three key science agencies: NSF, DOE Office of Science, NIST

## 4) Strengthen the Workforce

- Strengthen science, technology, engineering and mathematics (STEM) education

# PCAST Recommended Critical Investments

1. Invest in shared infrastructure facilities, including Federal and university laboratories, which could be easily accessed by small and medium-sized firms and would facilitate significant productivity gains by allowing those companies to rapidly prototype, customize, test and produce new products;

2. Support the development of advanced manufacturing processes that cut across multiple industry sectors and could be used by an array of companies to dramatically reduce product development time and increase entrepreneurs' ability to design and transition their inventions into products made in the United States; and

3. Participate in **partnerships with industry and academia** that identify and invest in broadly-applicable, precompetitive, emerging technologies that have the potential to transform the manufacturing sector.

http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-advanced-manufacturing-june2011.pdf

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# Advanced Manufacturing Partnership

- June 24, 2011 President launches Advanced Manufacturing Partnership (AMP)

- Public/private partnership with industry, universities and federal agencies to identify, fund, and promote manufacturing in emerging technology areas

- Specifically, includes:
  - National security industries
  - Materials Genome initiative
  - Next-generation robotics
  - Energy-efficient manufacturing
  - Includes NIST AMTech Program

# AMP Overview

- A national effort bringing together industry, universities, and the federal government to invest in the emerging technologies that will create high quality manufacturing jobs and enhance our global competitiveness.
- AMP leverages existing programs and proposals, and invests more than $500 million to jumpstart this effort.

## Industry

- Allegheny Technologies
- Caterpillar
- Corning
- Dow Chemical
- Ford
- Honeywell
- Intel
- Johnson & Johnson
- Northrop Grumman
- Procter & Gamble
- Stryker

## Government

- Department of Agriculture
- Department of Commerce
- Department of Defense
- Department of Energy
- Department of Homeland Security
- National Aeronautics and Space Administration
- National Institutes of Health
- National Science Foundation

## Academia

- Massachusetts Institute of Technology
- Carnegie Mellon University
- Georgia Institute of Technology
- Stanford University
- University of California-Berkeley
- University of Michigan

# AMP – Key Steps

**Building domestic manufacturing capabilities in critical national security industries**
Co-invest with industry in innovative technologies that will jumpstart domestic manufacturing capability essential to our national security and promote the long-term economic viability of critical U.S. industries.

**Reducing the time to develop and deploy advanced materials**
The Materials Genome Initiative, would invest more than $100M in research, training and infrastructure to enable U.S. companies to discover, develop, manufacture, and deploy advanced materials at twice the speed that is possible today, at a fraction of the cost.

**Investing in next-generation robotics**
Invest $70 million to support research in next-generation robots. These investments will help create the next generation of robots that will work closely with human operators – enhancing the capabilities of factory workers, healthcare providers, soldiers, surgeons and astronauts.

**Developing innovative energy-efficient manufacturing processes**
The Department of Energy will launch an effort to leverage invest $120 million to develop innovative manufacturing processes and materials to enable companies to cut the costs of manufacturing, while using less energy.

# AMP – Complementary Steps

## Invest in the domestic manufacturing workforce

- Form a multi-university collaborative framework to educate and train workers in critical manufacturing skills
- Use the Department of Energy's National Training & Education Resource to educate and train a new generation of manufacturers

## Invest in Innovation

- Explore new approaches to dramatically reduce – by up to a factor of 5 – the time required to design, build, and test manufactured goods to meet critical defense needs
- Define research opportunities and build a collaborative roadmap for identifying key technology priorities (manufacturers, universities, government agencies).
- Provide small and medium American companies access to highly valuable digital design tools through the Midwest Modeling and Simulation consortium
- Invest $24M in FY11, in domestic manufacturing technologies that address urgent operational needs including improvements for transparent armor, stealth technology, and targeting systems
- Develop an online marketplace to increase domestic manufacturing capacity in industries critical to our national security by connecting U.S. manufacturers with product needs at DOD and other federal agencies.
- Develop an **advanced manufacturing technology consortium,** starting with $12M in FY12, to identify public/private partnerships to tackle common technological barriers to the development of new products

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- **NIST activities supporting AMP**
  - **NIST Laboratories and Services**
  - **Hollings Manufacturing Extension Partnership**
  - **Baldrige Performance Excellence Program**
  - **Technology Innovation Program**
  - **Advanced Manufacturing Technology Consortia (AMTech)**
- Public/Private Partnerships - what YOU can do today

# NIST Industry Programs

## NIST Laboratories and Services

- Providing measurement solutions for industry and the Nation

## Hollings Manufacturing Extension Partnership

- MEP's nationwide network of resources helping smaller manufacturers compete globally

## Baldrige Performance Excellence Program

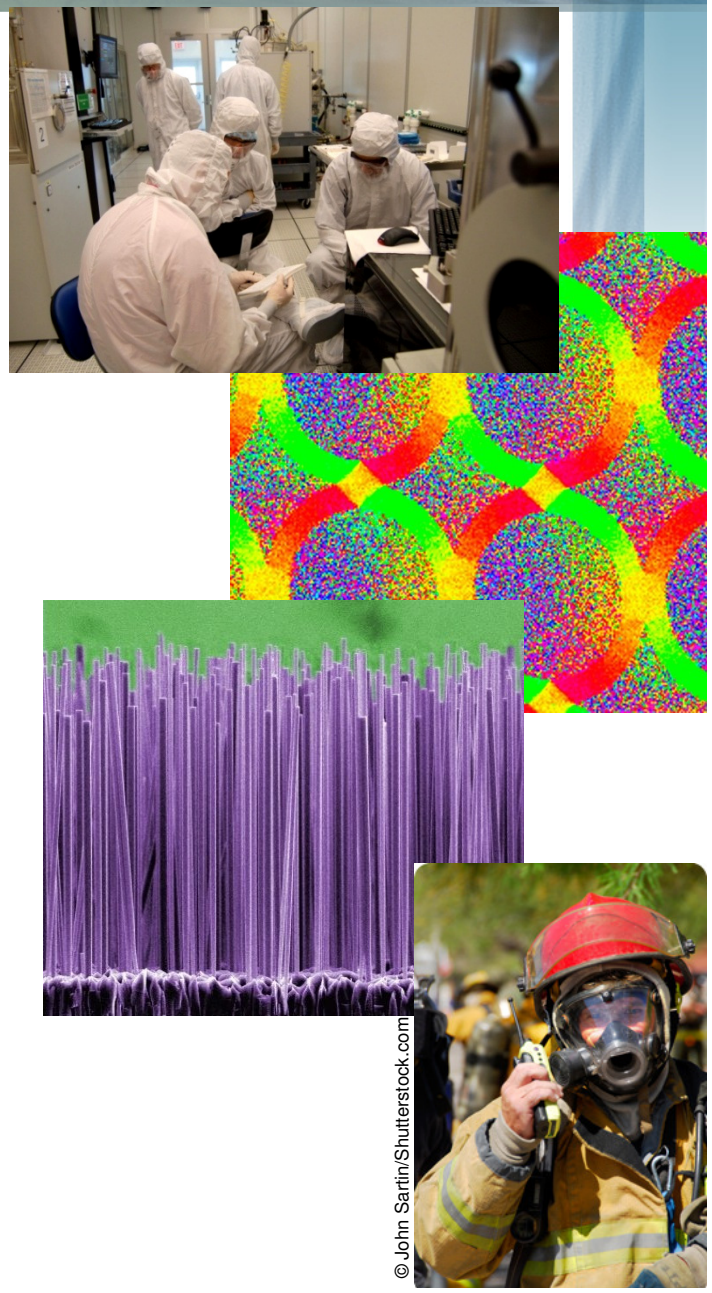
- Strengthening performance excellence in U.S. business

## Technology Innovation Program

- Early stage transformative Technology Innovation Program (TIP) to meet key societal challenges

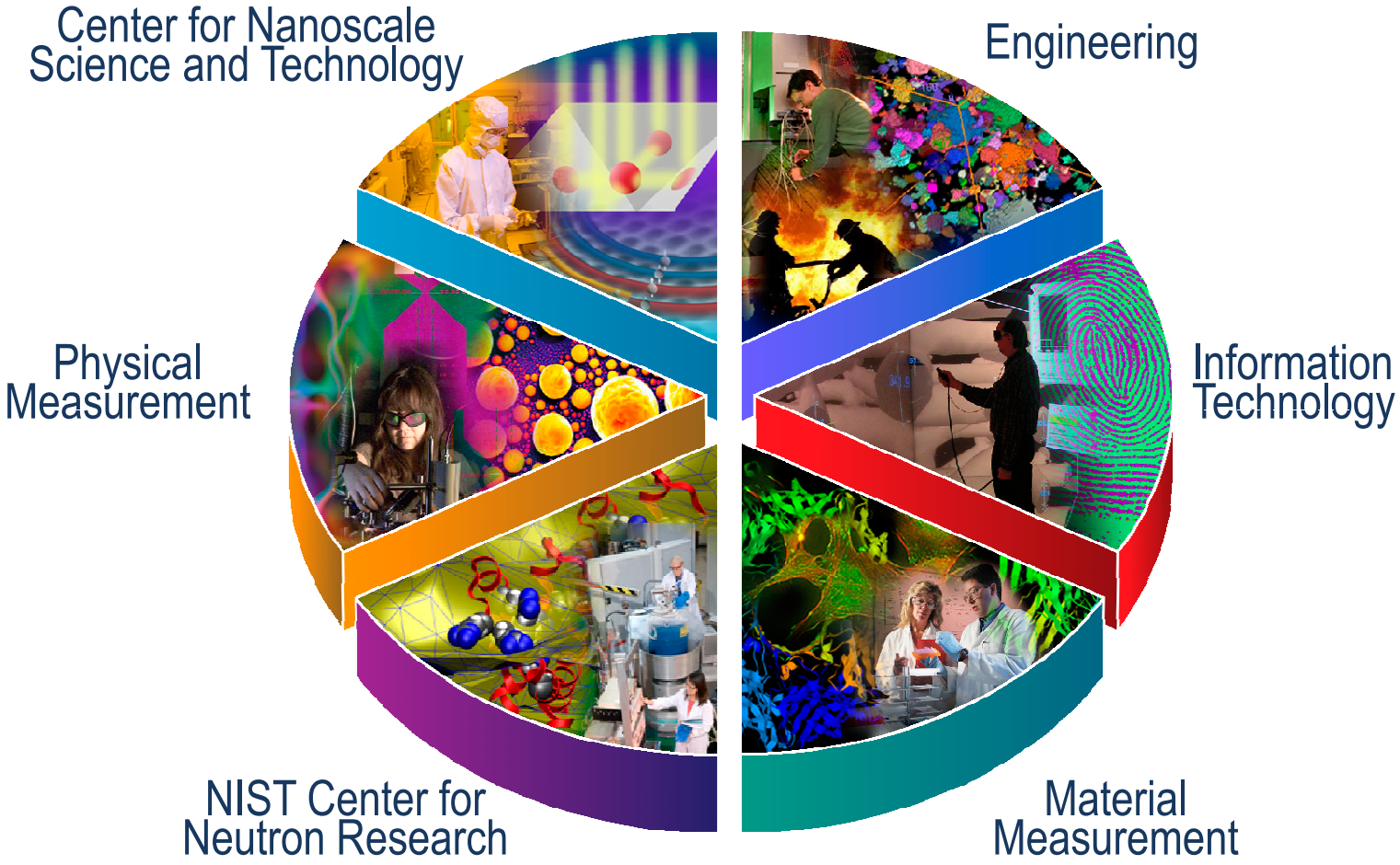
## Advanced Manufacturing Technology Consortia

- AmTech supporting R&D in advanced manufacturing and strengthening US leadership in critical technologies



# The NIST Laboratories

***Providing measurement solutions for industry and the Nation***




**NIST's Laboratory Programs address manufacturing needs that**

- are cross-cutting
- support entire Industry Sectors
- touch all levels/phases of the manufacturing enterprise
- enable the emergence of new processes and products

# NIST Measurement Services

For over a century, the measurement services programs of NIST have ensured the accuracy and reliability of nearly all measurements in the United States.

- **U.S. Industry and the Consumer**

  NIST distributes over 1,200 different Standard Reference Materials that assure the accuracy of millions of measurements made daily in manufacturing plants, industrial labs and medical clinics throughout the United States.

- **Federal Agencies**

  NIST measurement programs provide critical federal agencies such as the DoD, DoE, FAA, EPA, and NASA, with the measurement support necessary to carry out their mission.


- **State Agencies**

  NIST calibrations are critical for all state weights and measures offices.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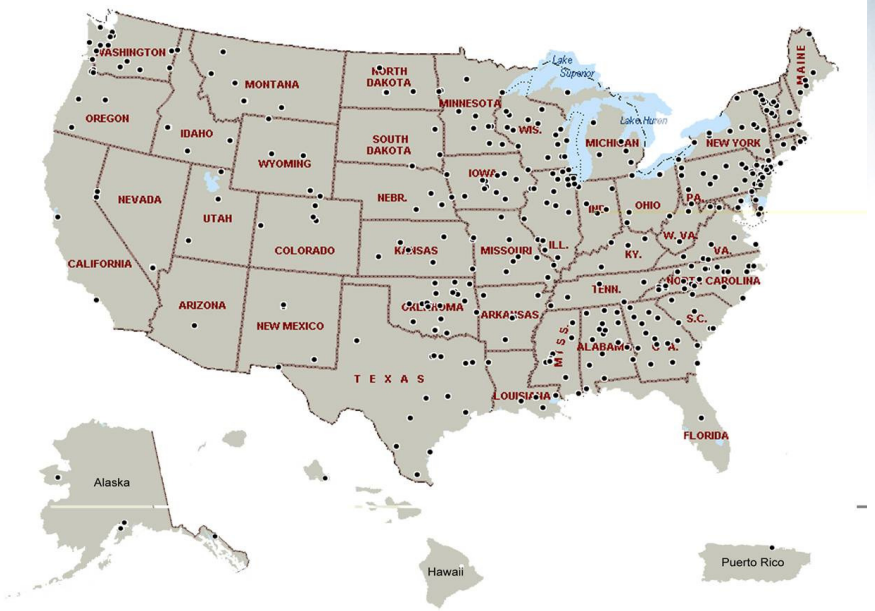
# Manufacturing Extension Partnership

Providing small manufacturing companies the Training, Tools and Connections to ACCELERATE INNOVATION;
Leading to new opportunities in domestic & export markets


## Today, 59 centers with ~ 400 field locations

- System-wide, Non-Federal staff is ~ 1,600
- Contracting with over 2,400 third party service providers

**Performance-based Partnership Model – 1/3 Federal, 2/3 State and Industry (fees for services)**

## MEP Impact

- FY 2009 survey of MEP clients: $8.4 B in increased/retained sales; 72,000 jobs created/retained

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# Baldrige Performance Excellence Program

***The nation's public/private partnership dedicated to performance excellence.***

**To improve the competitiveness and performance of U.S. organizations** for the benefit of all U.S. residents, the Baldrige Performance Excellence Program is a customer-focused federal change agent that:

- Develops and disseminates evaluation criteria
- Manages the Malcolm Baldrige National Quality Award
- Promotes performance excellence
- Provides global leadership in the learning and sharing of successful strategies and performance practices, principles, and methodologies

Courtesy Steuben

# Technology Innovation Program (TIP)

## *TIP's Mission*

- Assist United States businesses and institutions of higher education or other organizations, such as national laboratories and nonprofit research institutions

- Support, promote, and accelerate innovation in the United States through high-risk, high-reward research

- In areas of critical national need

*America COMPETES Act (PL 110-69)*

*August 9, 2007*

Funding Transformational Research for Critical National Needs

# Advanced Manufacturing Technology Consortia (AMTech)

*AMTech is Key part of President's Advanced Manufacturing Partnership*

## Support R&D in advanced manufacturing and strengthen long term US leadership in critical technologies leading to sustainable economic growth and job creation

- Convene key players on eliminating critical barriers to innovation, increasing efficiency of domestic innovation efforts and collapsing time scale to deliver new products and services based on scientific and technological advances
- Promotes the development of technology roadmaps and the formation of new, industry-led consortia to address critical, long-term industrial research needs.
- Consortia will develop road-maps of critical long-term industrial research needs as well as fund facilities, equipment and research at leading universities and government laboratories
- Based on NIST's experience with the Nanoelectronics Research Initiative (NRI) partnership with the Nation's semiconductor industry





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# AMTech Consortia

## AMTech consortia envisioned to:

- Foster dialogue and create consensus on the top critical issues facing industry
- Catalyze and increase industry leadership and participation in R&D planning and investment
- Provide active portfolio management of long-term R&D investment against common platform technologies
- Accelerate knowledge and technology transfer between industry, academia, and government

**TELL US HOW THIS SHOULD WORK!**

NIST published a *Federal Register* notice on 7/22/2011, seeki[illegible]formation from the public about the best ways to structure AMTech
(http://www.gpo.gov/fdsys/pkg/FR-2011-07-22/pdf/201[illegible]

Comments will be accepted by email only to AMtechR[illegible]
Sept. 20, 2011. All comments will be made publicly ava[illegible]

Announcing:
We are extending response deadline to October 20th

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# Opportunities for YOU today

- **US Manufacturing Image**
  - Help educate your local community and leaders
  - Consider open house/site tours for public, students

- **The President's Advanced Manufacturing Partnership**
  - Provide input on participation
    - AMP website launched shortly
  - Consider participating at AMP Regional Meetings
    - First meeting: October 14th, hosted by Georgia Tech

- **The Advanced Manufacturing Technology Consortia**
  - Provide input to the RFI by October 20th
    - How should AMTech be structured?
    - Who should be consortia members?
    - What criteria should be used for AMTech funding proposals?
    - How should performance and effectiveness be measured?

# Any Questions?

*Thank you*

***Mike Molnar***

***Telephone: 301-975-2300***

***Email: mike.molnar@nist.gov***

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# Profiles of NIST Laboratories and Centers

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# Physical Measurement Laboratory

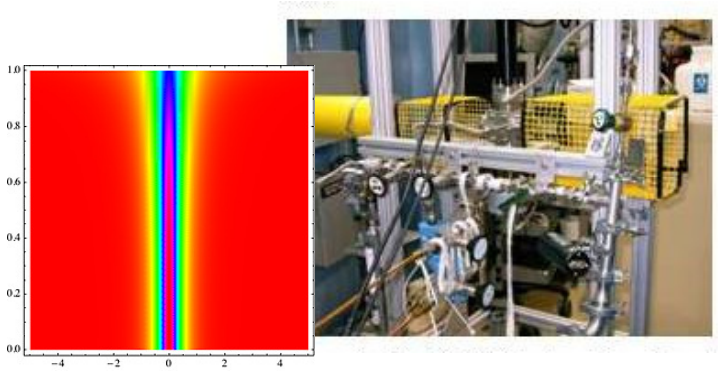
## Core Functions

- Fundamental units
- Applied measurements
- Calibrations
- Metric program
- State weights & measures programs

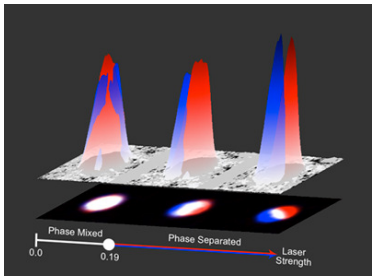
## Priorities and Future and Growth Areas

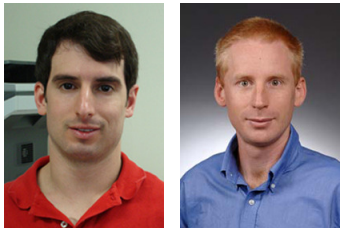
- Strengthened metrology
- Medical imaging
- GHG and Climate measurements
- Measurements to support advanced photovoltaics
- Science and engineering beyond Moore's Law


Joint Quantum Institute



***November, 2010*: JQI Fellows Receive Presidential Early Career Awards for Scientists and Engineers (PECASE)**



*Edo Waks* *Ian Spielman*

# Material Measurement Laboratory

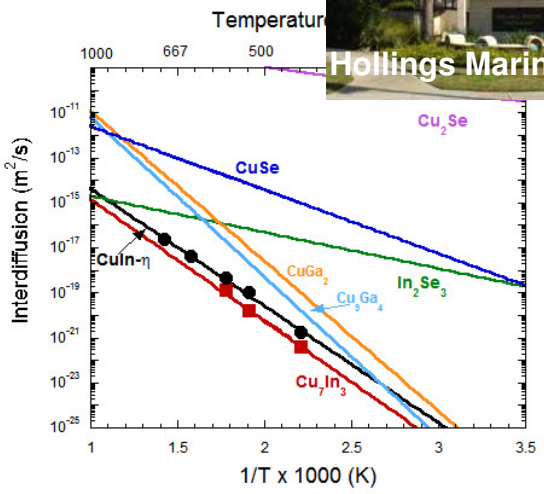
## Core Functions

- Material composition & properties
- Validated methods & data
- Standard reference materials
- Laboratory accreditation

## Priorities and Future Growth Areas

- Biopharmaceutical manufacturing
- GHG and climate measurements
- Environmental, health, and safety of nanotechnology-based products
- Food safety and nutrition
- Advanced materials for industry – modeling and simulation
- Nanomanufacturing



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# Information Technology Laboratory

## Core Functions

- IT Measurement, accreditation, and testing
- Mathematical and statistical analysis
- Modeling and simulation for measurement science
- IT standards development and deployment

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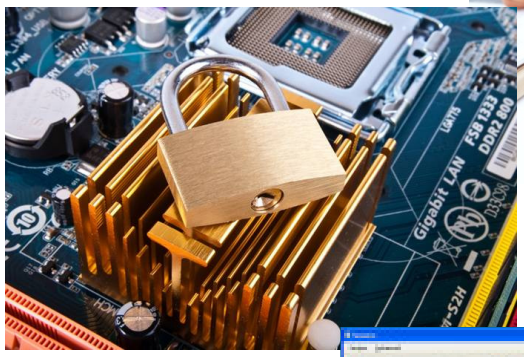

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## Priorities and Future Growth Areas

- Cybersecurity
- Cloud computing
- Identity management
- Computer forensics
- Wireless communications
- Health IT

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# Engineering Laboratory

## Core Functions

- Building technologies
- Fire research
- Smart grid & energy technology
- Advanced manufacturing technology

## Priorities and Future Growth Areas

- Sustainable manufacturing
- Net Zero energy, high- performance buildings
- Cyberphysical systems
- Smart grid
- Disaster resilient structures

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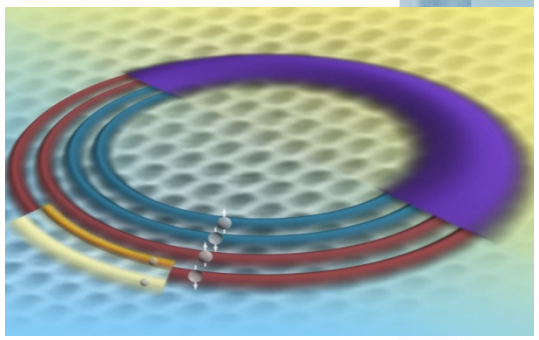
Building Science Corporation

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

# Center for Nanoscale Science & Technology

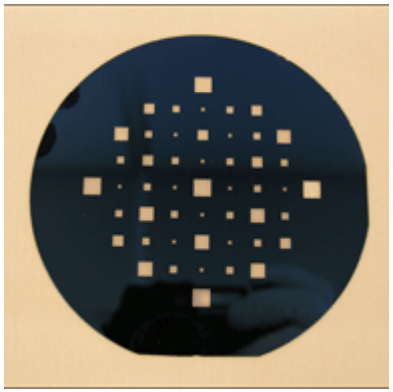
## Core Functions

- Collaborative research & shared-access nanofabrication facility
- NanoFab established in 2007
- Large & growing industrial and academic use base



## Priorities and Future Growth Areas

- Battery technology
- High-throughput measurement and imaging
- Future electronics
- NanoFab: Continued investment in state-of-the-commercial-art instrumentation



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# NIST Center for Neutron Research

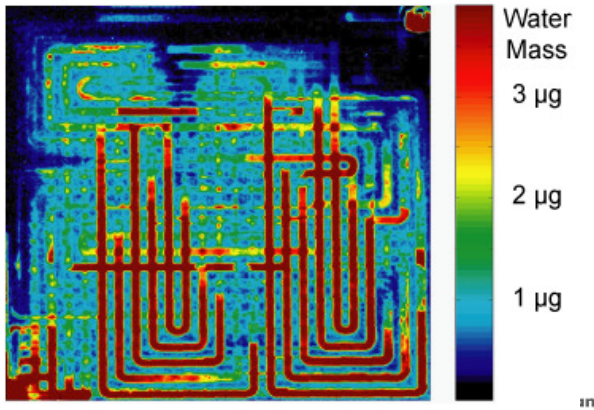
## Core Functions

- Provide neutron measurement capability to US researchers by operating as a national user facility
- Serving 2300 Research Participants annually from industry, academia, and government agencies

## Priorities and Future Growth Areas

- Complete the expansion of cold neutron measurement capacity & capability
- Biology & biotechnology
- Soft materials manufacturing
- Development of new neutron measurement techniques and application to technologically-relevant problems

*Peering inside an operating hydrogen fuel cell*

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