Working with Industry to Promote U.S. Innovation and Industrial Competitiveness

Roger D. Kilmer
Chief Manufacturing Officer

National Institute of Standards and Technology
Department of Commerce

roger.kilmer@nist.gov
The Importance of Manufacturing to the U.S.

• U.S. manufacturing sector generated $1.8 trillion in GDP in 2011

• Manufactured goods accounted for 86% of all U.S. goods exported in 2011

• U.S. manufacturing sector employs nearly 12 million workers

• Manufacturing is responsible for nearly 70% of U.S. private R&D funding

• Manufacturing has made up 26% of total economic growth since 2009

Source: http://www.manufacturing.gov
U.S. Innovation Agenda: Manufacturing is a Key

“We also have the chance, right now, to beat other countries in the race for the next wave of high-tech manufacturing jobs.”

“We know that the nation that goes all-in on innovation today will own the global economy tomorrow. This is an edge America cannot surrender.”

President Barack Obama delivers the State of the Union address January 28, 2014

(Official White House Photo by Pete Souza)
Advanced manufacturing is . . .

. . . a family of activities that (a) depend on the use and coordination of information, automation, computation, software, sensing, and networking, and/or (b) make use of cutting-edge materials and emerging capabilities enabled by the physical and biological sciences, for example nanotechnology, chemistry, and biology. This involves both new ways to manufacture existing products, and especially the manufacture of new products emerging from new advanced technologies.

President’s Council of Advisors on Science and Technology Report, June 2011

This requires:

✓ Innovative Approaches
✓ Multidiscipline Expertise
✓ Technology Adoption
✓ Partnerships and Collaboration
The National Institute of Standards & Technology

NIST
The NIST Mission

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.

"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 THE GOVERNMENT, OF SCHOOLS, COLLEGES AND UNIVERSITIES, THAN BY THE ESTABLISHMENT OF THE INSTITUTION PROPOSED IN THIS BILL."

REPORT ON BILL TO ESTABLISH THE NATIONAL BUREAU OF STANDARDS
HOUSE OF REPRESENTATIVES
MAY 14, 1900
NIST Core Competency – Measurement Science

**Measurement** is key to technological innovation

- ✓ Understand how things work
- ✓ Improve the design
- ✓ Optimize control
- ✓ Validate & certify
NIST’s Programs That Support Manufacturing

- **Basic Research** – NIST Laboratories
- **User Facilities** – CNST & NCNR
- **Centers of Excellence** – Cybersecurity & Advanced Materials
- **Consortium Building** – AMTech
- **Partnerships for Technology Development** – NNMI
- **Regional Partnerships for Technology Adoption** – MEP

This provides multiple resources and connection points to identify, develop and adopt innovative technology.

http://www.nist.gov
Spanning Research to Commercialization

NIST Laboratories
Measurement Science  Standards Development  Calibration Services

AMTech
Consortia Formation and Technology Roadmaps

NNMI
Applied Research, Development, & Demonstration; Scale-Up

MEP
Technology Deployment and Adoption

Research  ➔  Commercialization
NIST Laboratory Program

Standards Coordination Office
Standards Services Division
NIST Quality Manager

Associate Director for
Laboratory Programs

Special Programs Office
Law Enforcement Standards, National Security
Standards, Climate Assessment & Advanced
Communications Programs

Material Measurement Laboratory
Physical Measurement Laboratory
Engineering Laboratory
Information Technology Laboratory
Communication Technology Laboratory
Center for Nanoscale Science and Technology
NIST Center for Neutron Research

Metrology Laboratories
Driving innovation through
Measurement Science and Standards

Technology Laboratories
Accelerating the adoption and deployment of
advanced technology solutions

National User Facilities
Providing world class, unique, cutting-edge
research facilities

New Lab Initiative Funding for Advanced Manufacturing:

- FY2012 – $19M
- FY2013 – $15M
- FY2014 – $30M
Advanced Materials Center of Excellence

- Center for Hierarchical Materials Design (CHiMaD) Consortium lead by Northwestern
  - University of Chicago
  - Northwestern-Argonne Institute of Science and Engineering (partnership between Northwestern and DoE’s Argonne National Lab)
  - The Computation Institute (partnership between University of Chicago and Argonne National Lab)
- $5 million NIST award with $4.65 million consortium contribution
- CHiMaD will focus on the discovery of novel hierarchical materials. Hierarchical materials exploit distinct structural details at various scales from the atomic on up to achieve special, enhanced properties.
The Advanced Manufacturing Technology Consortia

AMTech
What is AMTech?

The Advanced Manufacturing Technology Consortia (AMTech) Program

Newly launched by NIST in FY 2013

- To incentivize the formation of industry-led consortia and provide resources to:
  - To support road-map development and basic and applied research
  - On long-term, pre-competitive and enabling technology

- $15M annual program

AMTech-supported consortia will strengthen the capacity of U.S. industry and the nation to compete in global markets
FY13 Competition Results

- 82 applications received, requesting $36M
- 19 awards
  - $9M total value
  - Combination of 11 new and 8 existing consortia
  - 10 academia, 9 not-for-profit recipients
  - Total of 76 funded participants
- PCAST AMP Crosscutting Technology Area (# of awards)
  Additive Manufacturing (1)
  Advanced Forming & Joining Technologies (2)
  Advanced Manufacturing & Testing Equipment (7)
  Advanced Materials Design, Synthesis & Processing (2)
  Advancing Sensing, Measurement & Process Control (1)
  Biomanufacturing & Bioinformatics (1)
  Flexible Electronics Manufacturing (1)
  Sustainable Manufacturing (2)
  Visualization, Informatics & Digital Manufacturing Technologies (2)

For competition results and awardee information –

http://www.nist.gov/amo/fundedawards.cfm
Example Consortium - Composites Mfg.

Composites Manufacturing Technology Roadmap

- **Awardee:** University of Massachusetts – Lowell, Lowell MA
- **Consortium:** FIBERS – Facilitating Industry By Engineering, Road-mapping and Science to Advance U.S. Manufacturing of Composites
  - Partners (funded participants, green) – **12**, including 5 MEP centers as subcontractors
  - Collaborators (unfunded participants, blue) – **43**, including 2 national labs
Opportunities to Interact with Funded Consortia

• Each award will offer a number of workshops, planning sessions and other activities

• These activities provide opportunities to work with the consortia and contribute to these technology roadmaps aligned to critical technologies

• AMTech website will contain a master calendar, interactive consortia maps and project details. Click on award number in list –

  http://www.nist.gov/amo/fundedawards.cfm
The National Network for Manufacturing Innovation

NNMI
President’s Council of Advisors on Science and Technology

Advanced Manufacturing Partnership

AMP Co-chairs
Andrew Liveris
CEO, Dow Chemical

Susan Hockfield
President, MIT

PCAST / AMP report released July 17, 2012 on whitehouse.gov

• 16 Recommendations in three areas: innovation, talent, and policy

Two early actions announced by Administration:
1) Coordinated “whole of government” effort via Advanced Manufacturing National Program Office
2) Pursue the “missing middle” via manufacturing innovation hubs
Advanced Manufacturing National Program Office (AMNPO)

Executive Office of the President

Advanced Manufacturing National Program Office (housed at DOC - NIST)
The Scale-up Gap or Missing Middle

Common terms
valley of death, missing Bell Labs, industrial commons
Institute Design

National Network of IMIs

Institute For Manufacturing Innovation
Prototype lab/shops
Research facility
Computer lab

Shared Use Facility
Mfg. Demonstrations
Workforce Development

Academia
- Universities
- Community Colleges

Government
- Federal Government
- State/Local Government
- Economic Development Organization

Industry
- Large Manufacturing Companies
- Small & Medium Enterprise (SMEs)
- Start-ups

White House Report
NNMI Framework Design
January 2013
Institute Activities

Not just Applied R&D – solutions, access & workforce

Applied Research & Demo projects for
• reducing cost/risk on commercializing new tech.
• Solving pre-competitive industrial problems

Tech Integration - Development of innovative methodologies and practices for supply chain integration

Small/Medium Enterprises
• Engagement with small and medium-sized manufacturing enterprises (SMEs).

Education, technical skills and Workforce development
Education and training at all levels for workforce development
National Network for Manufacturing Innovation

introduced March 2012

“Sparking this network of innovation across the country, it will create jobs and will keep America leading in manufacturing...”

President Obama, March 9, 2012

• The President’s Budget proposes a $1 billion investment over 9 years to create this new National Network for Manufacturing Innovation, creating up to 15 manufacturing institutes for Industry

• We Can’t Wait: 2012 Pilot Institute – on Additive Manufacturing
Additive Manufacturing Innovation Institute
Youngstown Ohio

Prime Awardee: National Center for Defense Manufacturing and Machining

- Initial $30M federal investment matched by $40M industry, state/local
- Strong leveraging of equipment, existing resources
- Strong business development
- Ties to many organic facilities
- Tiered membership-based model, low cost to small business and nonprofits

The pilot institute, in Youngstown, OH
In my State of the Union Address, I also asked Congress to build on a successful pilot program and create 15 manufacturing innovation institutes that connect businesses, universities, and federal agencies to turn communities left behind by global competition into global centers of high-tech jobs.

“Today, I’m asking Congress to build on the bipartisan support for this idea and triple that number to 45 – creating a network of these hubs and guaranteeing that the next revolution in manufacturing is Made in America.”
July 30, 2013

With Congressional Legislation

- Open competition on ANY topic proposed by Industry and Academia
- Selection by merit, evaluation by external industry/academic panels
Next Generation Power Electronics
Manufacturing Innovation Institute

$70M public investment, $70M match

Lead: North Carolina State University
Hub Location: Research Triangle Park, NC

• 17 Industry Partners
• 5 Universities
• 3 Labs and Other Organizations

Mission: Develop advanced manufacturing processes that will enable large-scale production of wide bandgap semiconductors, which allow power electronics components to be smaller, faster and more efficient than silicon.

Poised to revolutionize the energy efficiency of power control and conversion
We also have the chance, right now, to beat other countries in the race for the next wave of high-tech manufacturing jobs. My administration has launched two hubs for high-tech manufacturing in Raleigh and Youngstown, where we’ve connected businesses to research universities that can help America lead the world in advanced technologies.

Tonight, I’m announcing we’ll launch six more this year. Bipartisan bills in both houses could double the number of these hubs and the jobs they create. So get those bills to my desk and put more Americans back to work.

President Barack Obama
January 28, 2014
The federal government is launching a National Network for Manufacturing Innovation. The full network, which requires legislation from Congress, would be developed over a decade and consist of up to 45 regional hubs.
Lightweight and Modern Metals Manufacturing Innovation Institute

$70M public investment, $70M match
Lead: EWI
Hub location: Canton, Michigan
Regional location: I-75 Corridor

• 34 Industry Partners
• 9 Universities and Labs
• 17 Other Organizations

Mission: Provide the National focus on expanding US competitiveness and innovation, and facilitating the transition of these capabilities and new technologies to the industrial base for full-scale application.

Positioned to expand the US Industrial base for new products and technologies for commercial and USG demands that utilize new, lightweight high-performing metals.
Digital Manufacturing and Design Innovation Institute

$70M public investment, ~$240M match

Lead: UI Labs

Hub location: Chicago, Illinois

• 41 Companies
• 23 Universities and Labs
• 9 Other Organizations

Mission: Establish a state-of-the-art proving ground that links IT tools, standards, models, sensors, controls, practices and skills, and transition these tools to the U.S. design & manufacturing base for full-scale application

Over 3:1 Industry Cost Share
**Funding Opportunity Announcement:**
Advanced Composites Manufacturing Innovation Institute

$70M public investment over five years

**Objective**
Develop and demonstrate innovative technologies that will, within 10 years, make advanced fiber-reinforced polymer composites at...

<table>
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<th>Application</th>
<th>Estimated Current CFC Cost</th>
<th>Institute CFC Cost Reduction Target (2018)</th>
<th>CFC Ultimate Cost Target (2024)</th>
<th>CFC Tensile Strength</th>
<th>CFC Stiffness</th>
<th>Production Volume</th>
<th>Cycle Time</th>
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<td>Vehicles (Body Structures)</td>
<td>$26-33/kg</td>
<td>&gt;35%</td>
<td>&lt;$11/kg by 2025 ~60%</td>
<td>0.85GPa (123ksi)</td>
<td>96GPa (14Msi)</td>
<td>100,000 units/yr</td>
<td>&lt;3min cycle time</td>
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<td>Wind (Blades)</td>
<td>$26/kg</td>
<td>&gt;25%</td>
<td>$17/kg ~35%</td>
<td>1.903 GPa (276ksi)</td>
<td>134GPa (19.4Msi)</td>
<td>10,000 units/yr</td>
<td>&lt;5min cycle time (glass)</td>
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<tr>
<td>Compressed Gas Storage (700 bar – Type IV)</td>
<td>$20-25/kg</td>
<td>&gt;30%</td>
<td>$10-15/kg ~50%</td>
<td>2.55 GPa (370ksi)</td>
<td>135 GPa (20Msi)</td>
<td>500,000 units/yr (carbon fiber)</td>
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Clean Energy Manufacturing Innovation Institute for Composites Materials and Structures

Solicitation Status

Information on www.manufacturing.gov and DOE Advanced Manufacturing website

Funding Number: DE-FOA-0000977  $70M

Open Date: 02/25/2014
Close Date: **04/22/2014** Concept papers are due.
Close Date: **06/19/2014** Full applications are due.
AMP 2.0
Advanced Manufacturing Partnership
AMP Mission: Encourage approaches that sustain and grow U.S. leadership in advanced manufacturing

AMP 1.0 – 16 Recommendations
- Pillar I: Enabling Innovation
- Pillar II: Securing the Talent Pipeline
- Pillar III: Improving Business Climate

AMP 2.0 focused on Implementation kickoff Sept 30, 2013
- Regional engagement and outreach
- Implementation on national initiatives
- Five active Working Teams to issue “letter-reports”

AMP 2.0 Working Teams
1. Transformative manufacturing technologies
2. Demand-driven workforce solutions
3. Supporting implementation of NNMI
4. Technology scale-up policy
5. Improving the Manufacturing image
The Advanced Manufacturing Partnership will reveal a series of recommendations at its final meeting

**Recommendations span five working teams**

- *Manufacturing Technologies*: Releasing letter reports on three technology areas: advanced materials, advanced sensors, and digital manufacturing
- *Workforce*: Launching pilots to address career pathways in manufacturing, apprenticeship, credentialing efforts, and veterans’ skills credentialing
- *NNMI*: Providing input into interagency team standing up the NNMI on IP, network governance, and communications
- *Scale-up Policy*: Recommending increasing the visibility of funding for main street manufacturers and public-private funding for scale-up of new companies
- *Manufacturing Image*: Will launch a public-private imaging campaign to change the image of manufacturing and will leverage Manufacturing Day for regional mobilization

**Upcoming Events:**

**Advanced Manufacturing Partnership will have a National Meeting on June 9th in Detroit:**
- Will announce new manufacturing image campaign using Manufacturing Day as a platform
- Will discuss plans to publish emerging technologies reports

**And a final meeting in the summer (between June and September)**
- Will publish a report summarizing recommendations and work
- Will launch or provide updates on public-private pilots
For questions or comments, please contact the Advanced Manufacturing National Program Office

Email: amnpo@nist.gov
http://www.manufacturing.gov
301-975-2830

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The Hollings Manufacturing Extension Partnership

MEP
Manufacturing Extension Partnership - MEP

Federal-State-Industry partnership that provides U.S. manufacturers with access to technologies, resources, and industry experts

- MEP Centers located in all 50 states and Puerto Rico
- Work directly with local manufacturing communities, as a strategic advisor to connect manufacturers to public and private resources essential for competitiveness and profitability

Current MEP efforts:

- Help manufacturers develop innovative practices to leverage resources to couple cost reduction strategies with company growth
- Expand focus to include technology transition services for small and mid-sized U.S. manufacturers
- Continue to partner with other Federal agencies, e.g., in support of sustainable manufacturing practices (E3) and overseas expansion (ExporTech)

Partnering to Drive a National Program

The MEP network focuses on solving manufacturers’ biggest challenges and identifying opportunities for growth.

Customers
Small and Medium Size Manufacturers

MEP Program
Integration, Knowledge Sharing, and Evaluation
How Centers work with Manufacturers

1. **Initial Contact**
   - Group sessions, referral

2. **Assessment**
   - Informal walk-through, detailed company analysis

3. **Identify**
   - Find potential issues, define proposed project and approach for solving it

4. **Negotiate**
   - Consult with company and sign project contract with fee paid to center

5. **Project Execution**
   - Center staff, partner organization, and/or third party consultants

After completion, project follow-up by center to assure customer satisfaction and explore further project opportunities.

Project impact data collected by contractor for NIST approximately 6 months after project completion.
MEP’s Program Initiatives

are aimed to help manufacturers identify opportunities that will accelerate and strengthen their growth and competitiveness in the global marketplace.
Technology Acceleration

Accelerating opportunities to leverage and adopt technology is the key to long-term business growth and productivity. MEP will serve as the connection between manufacturers and the technology opportunities and solutions they require to grow and compete in the global marketplace.
Supply Chain

The MEP Supply Chain initiative is based on helping manufacturers strategically understand, maintain and expand their positions in domestic and global supply chains. The MEP network proactively engages with U.S. manufacturing supply chains to systemically address the needs of:

• top-down overall supply chain
• individual manufacturers operating at every level of the supply chain
• company-to-company interfaces within the supply chain
Client Impacts

30,131 Manufacturers served in FY2013

JOBS SAVED
43,914

JOBS CREATED
18,789

RETAINED SALES
$6.2 Billion

NEW SALES
$2.2 Billion

COST SAVING
$1.2 Billion

CLIENT INVESTMENTS
$2.5 Billion
Future of Manufacturing

- **Advanced Manufacturing** relies on the development and adoption of technological innovations.

- Measurement is key to understanding, designing, controlling and validating these advanced manufacturing processes.

- Address current requirements while thinking strategically anticipating future needs.

- Multidiscipline – engineering, design, materials, sensors, computer control, workforce, etc.

- Collaboration and coordination across programs and organizations are needed to reduce development time and to do this affordably.

- Federal/State/Academia/Industry partnerships are critical for success.
Questions?