The National Network for Manufacturing Innovation

A U.S. Initiative for Sustainable Collaboration

NSF Workshop on Sustainable Manufacturing: Urgent Research Needs and Multidisciplinary Collaboration

Mike Molnar
Advanced Manufacturing National Program Office
August 20, 2015
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.

- **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

**Cybersecurity:** Improved response to cyber threats

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

**Energy:** Measurements and standards for energy security
Interagency Advanced Manufacturing National Program Office (hosted by DOC/NIST)
PCAST AMP and Manufacturing
Challenge: US losing leadership in Advanced Products

U.S. Trade Balance for Advanced Technology Products

US Trade Balance
Advanced Technology Products
($ Billion)

Source: Census Bureau
Products invented here, now made elsewhere - not driven by labor cost
PCAST: The independent basis of NNMI

President’s Council of Advisors on Science and Technology

PCAST 2011
Recommends Advanced Manufacturing Initiative as national innovation policy

PCAST 2012
Recommends Manufacturing Innovation Institutes to address key market failure

PCAST 2014
Recommends strong, collaborative network of Manufacturing Innovation Institutes
PCAST Message on **HOW.... Partnership**

*Industry – Academia – Government*

Working better, collaborating to create transformational technologies and build new products and industries

And when... **NOW**

We can’t wait to restore US Manufacturing Leadership
Interagency Federal Team supporting National Network for Manufacturing Innovation
NNMI: addressing the “Scale-up” Gap

Focus is to address market failure of insufficient industry R&D in the “missing middle” or “industrial commons” to de-risk promising new technologies.

Basic R&D

Commercialization
Public Engagement on Design
Workshops & Request for Information

Broad & Diverse Stakeholder Input
1,200 voices on the NNMI Design!
The Institute Design
Creating the space for Industry & Academia to collaborate

White House Report
NNMI Framework Design
January 2013

National Network of Institutes

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

Shared Use Facility

Academia
Universities & National Labs
Community Colleges

Industry
Large Manufacturing Companies
Small & Medium Enterprise
Start-ups

Government
Federal
State & Local
Economic Dev. Org.
The Institute Summary

Applied Research + Education/Workforce Skills + Development of Future “Manufacturing Hubs”

The Federal investment in the National Network for Manufacturing Innovation (NNMI) serves to create an effective manufacturing research infrastructure for U.S. industry and academia to solve industry-relevant problems. The NNMI will consist of linked Institutes for Manufacturing Innovation (IMIs) with common goals, but unique concentrations. In an IMI, industry, academia, and government partners leverage existing resources, collaborate, and co-invest to nurture manufacturing innovation and accelerate commercialization.

As sustainable manufacturing innovation hubs, IMIs will create, showcase, and deploy new capabilities, new products, and new processes that can impact commercial production. They will build workforce skills at all levels and enhance manufacturing capabilities in companies large and small. Institutes will draw together the best talents and capabilities from all the partners to build the proving grounds where innovations flourish and to help advance American domestic manufacturing.

Federal startup investment: $70M - $120M/institute over 5 years
Institute Consortium owners must have minimum 1:1 co-investment
The NNMI Mission

“The Network serves the Institutes, the Institutes connect through the Network, and the Program serves the Nation.”

Program Mission (Institutes + Network)
Advance American domestic manufacturing innovation by creating an effective manufacturing research and development infrastructure for U.S. industry and academia to solve industry-relevant problems.

Institute Mission
Create and strengthen American manufacturing hubs through sustainable industry-led innovation institutes that create, showcase, and deploy new capabilities.

Network Mission
Maximize the integrated impact of the manufacturing innovation institutes on U.S. manufacturing competitiveness.
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
- Tiered membership-based model, low cost to small business and nonprofits

- Now at $50M federal, $60M co-invested
- OVER 100 Participating partners!
2nd Institute: PowerAmerica
Next Generation Power Electronics, Raleigh NC

$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

President Obama
North Carolina State University, January 15, 2014
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.

$70M public investment, ~$110M match

Lead: UI Labs

Hub location: Chicago, Illinois

- 41 Companies
- 23 Universities and Labs
- 9 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.

4th Institute: LIFT
Lightweight and Modern Metals, Detroit MI

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

- 34 Industry Partners
- 9 Universities and Labs
- 17 Other Organizations
50% Lower cost
Using 75% Less Energy
And reuse or recycle >95% of the material

$70M Federal investment and more than $180 Non-Federal investment over five years

**Objective**
Develop and demonstrate innovative technologies that will, within 10 years, make game-changing advanced fiber-reinforced polymer composites. The Institute’s negotiation is led by University of Tennessee-Knoxville. The full team includes: 57 Companies, 15 Universities and Laboratories, 14 Other Entities, w/ 36 Consortia Members.

<table>
<thead>
<tr>
<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 Cycle Time</th>
</tr>
</thead>
<tbody>
<tr>
<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 &lt;3min cycle time (carbon) &lt;5min cycle time (glass)</td>
</tr>
<tr>
<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 (at &gt;60m length blades)</td>
</tr>
<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>
</tr>
</tbody>
</table>

"5th Institute: Advanced Composites Mfg
IACMI, Knoxville TN"
Integrated Photonics Institute for Manufacturing Innovation

- **Date Launched:** 7/27/2015
- **Founding Organization:** Research Foundation, State University of New York
- **Funding:** Federal $110m, Matching $500m
- **Partners:** 75

**Objective**
Develop and demonstrate innovative manufacturing technologies for:
- Ultra high-speed transmission of signals for the internet and telecommunications
- New high-performance information-processing systems and computing
- Sensors and imaging enabling dramatic medical advances in diagnostics, treatment, and gene sequencing
The NNMI Vision

“In my State of the Union Address, I 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.’”

- President Barack Obama, July 30, 2013
NNMI Authorized: Revitalize American Manufacturing & Innovation Act

Rep. Tom Reed
R NY-23

Rep. Joe Kennedy
D MA-4

Sen. Sherrod Brown
D Ohio

Sen. Roy Blunt
R Missouri

September 15, 2014 – Passed House
100 Cosponsors (51D, 49R)

December 11, 2014 – Passed Senate with 2015 Appropriations
18 Cosponsors (10D, 7R, 1I)

December 16, 2014 – Signed By President Obama

118 Bipartisan RAMI Bill Sponsors
Legislative Requirements: A Call To Action

The Revitalize American Manufacturing Innovation Act (RAMI) RAMI calls upon the U.S. Secretary of Commerce to establish:

– The “Network for Manufacturing Innovation Program” (*Network function*) - to convene and support a network of Institutes

– New “Centers for Manufacturing Innovation” (*Institutes*) - using an open topic, open competition process

– The National Program Office at NIST - to oversee and carry out the program (*coordination, network support, and reporting*)
Building the Network
Network Status and FY16 Plans

Current NNMI Institute Status

- **Forthcoming 2015**
  - Advanced Textiles
  - Smart Manufacturing
  - Flexible Hybrid Electronics

- **Future Network Goal: 45 Regional Hubs**

- **New Institutes Planned for FY16**
  - Additive Manufacturing (Youngstown, OH)
  - Integrated Photonics (Rochester, NY)
  - Digital Manufacturing & Design (Chicago, IL)
  - Lightweight Metal Manufacturing (Detroit, MI)
  - Advanced Fiber-Reinforced Polymer Composites (Knoxville, TN)
  - Wide Bandgap Semiconductors (Raleigh, NC)

Selected topic competitions supporting agency mission, using agency authorities and budgets

Open topic – filling mission gaps
Establish a presence, at scale, in the “missing middle” of advanced manufacturing research

Create an Industrial Commons, supporting future manufacturing hubs, with active partnering between all stakeholders

Emphasize/support longer-term investments by industry

Combine R&D with workforce development and training

**Overarching Objective:** Unleash new U.S. advanced manufacturing capabilities and industries – for stronger global competitiveness and U.S. economic & national security
Consortium for Advanced Manufacturing Foresights
Consortium for Advanced Manufacturing Foresights

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505203

What It Is

- A response to the Advanced Manufacturing Partnership 2.0 (AMP 2.0) recommendation #2:
  - “Create an Advanced Manufacturing Advisory Consortium to provide coordinated private-sector input on national advanced manufacturing technology research and development priorities.”

Why It Matters

- Provides private sector technical input to interagency initiatives and programs
- Build an “advanced manufacturing community” for all stakeholders
- Provides a new conduit for connections and collaboration
Advanced Manufacturing Foresights Consortium

Structure and Funding

• **Support and oversight**
  – NSF Cooperative Agreement, no cost-match required
  – NSF and NIST will coordinate oversight, with participation of other interested agencies
  – NSF and NIST funds base operations, up to $2 million/year

• **Base operations**
  – Establishment and maintenance of a standing committee that will meet approximately two times per year and whose members can be called upon for advice and to support the recruitment, guidance, and oversight of rapid response studies.
  – Operational staff and related expenses for management of logistics, recruitment of experts, and publication of studies.

• **Funding period**
  • Initial funding period will be 3 years, renewable based on progress

• **Additional funding**
  – Partners will be expected to secure incremental funding for individual studies from interested USG agencies, either single or multiple agencies.

• **Timing**
  – Solicitation published – 4/22/15  
  – Proposal review Panel - 8/10-8/11  
  – Proposal due date – 7/20/15  
  – Award – September, 2015
Thank you

Connecting with the Advanced Manufacturing National Program Office (AMNPO)

Phone: 301-975-2830
Email: amnpo@nist.gov
Web: www.manufacturing.gov
Twitter: @AdvMfgNPO