Mike Molnar
Advanced Manufacturing National Program Office
www.manufacturing.gov

The National Network for Manufacturing Innovation
A Status Update and Linkage to I/UCRCs

NSF I/UCRC Annual Meeting
January 9, 2014
Agenda

1. I/UCRCs, MEPs, NNMI – complementary partnership
2. Manufacturing, Innovation and US Policy
3. Presidential Initiative & Pilot Institute
4. NNMI Design with Public Input
5. 2014 Manufacturing Institutes
6. Next Steps
The Industry/University Cooperative Research Centers (I/UCRC) Program

Mission:
• To contribute to the nation’s research infrastructure base by developing long-term partnerships among industry, academe and government
• To leverage NSF funds with industry to support graduate students performing industrially relevant research

Vision:
• To expand the innovation capacity of our nation’s competitive workforce through partnerships between industries and universities

Over 30 years of fostering and growing long-term trusted relationships between Industry and academe based on shared value
Technology Acceleration Ecosystem
Interventions supporting movement of technologies for new products, processes toward market and supply chain needs
Interagency Advanced Manufacturing National Program Office (AMNPO)

Executive Office of the President

Advanced Manufacturing National Program Office (housed at DOC - NIST)

Advanced Manufacturing Partnership (AMP)

Advanced Manufacturing Agency Leaders (NSTC)
The NNMI Story Today...

15 IMIs + Pilot

Public Comment

3 x 2013 Institutes

Vision of 45 Institutes

Congressional Authorization

Formation of Network and New Institutes

March 2012

January 2013

Next Steps

PCAST: Manufacturing Linked to Innovation

Additive Mfg Pilot

PCAST/AMP Call for NNMI

NNMI Framework

Digital Mfg Inst.

Power Electr. Inst.

Light-weight Metals Inst.

IP Guidelines

Perf. Metrics

...
U.S. Trade Balance of Advanced Technology

Swung to historic deficit, lost 1/3rd of workforce

- 11% of U.S. GDP, 12 million U.S. jobs
- Nearly 20% of the world’s manufactured value added
- ~ half of U.S. Exports
Products invented here, now made elsewhere

*not driven by labor cost*
The Scale-up Gap or Missing Middle

Common terms
The “valley of death”
The “missing Bell Labs”
The “industrial commons”
Changing technology and business models are transforming manufacturing, design, innovation.

MDI: the nexus of manufacturing, design, and innovation, which delivers value that is enabled by a physical product.
A healthy MDI ecosystem is essential to Economic Security

Driving Forces
- Customer Behavior & Expectations
- Globalization
- Education Systems
- Financial Systems
- Legal & Regulatory Systems

Manufacturing, Design, and Innovation Ecosystem
- Understanding Customers
- Shared Infrastructure
- Workforce Skills
- Product Innovations
- Process Innovations
- R&D
- Design
- Services
- Distribution
- Access to Markets
- Access to Capital
- Energy & Resource Use

Making Value

National Well-being
- Economic Growth
- Employment
- Quality of Life
- Sustainability
- Access to Markets
- Access to Capital
- Energy & Resource Use
- Distribution
- Design
- R&D
- Product Innovations
- Process Innovations
- Services
- Workforce Skills
- Understanding Customers
- Shared Infrastructure

A healthy MDI ecosystem is essential to Economic Security.
Designing, Building and Growing the NNMI

2) US Manufacturing Policy Milestones

15 IMIs + Pilot

Public Comment

3 x 2013 Institutes

Vision of 45 Institutes

March 2012

January 2013

Next Steps

Congressional Authorization

Formation of Network and New Institutes

PCAST: Manufacturing Linked to Innovation

PCAST/AMP Call for NNMI

NNMI Framework

Digital Mfg Inst.

Power Electr. Inst.

Light-weight Metals Inst.

IP Guidelines

Perf. Metrics

...
U.S. should strive to revitalize advanced manufacturing because:

- **Jobs**: Manufacturing provides high-quality, good-paying jobs for American workers.

- **Innovation**: By keeping manufacturing local, design, engineering, scale-up, and production processes feed back on the conception and innovation sectors to generate new ideas and novel second- and third-generation products.

- **Security**: Domestic manufacturing capabilities using advanced technologies and techniques are vital to maintaining national security and critical resources.

**NEED**: Coordinated Federal Focus on a National Manufacturing Initiative
Many specific actions, emphasis on HOW....

Partnership

*Industry – Academia – Government*

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

And when... NOW

We can’t wait to restore US Manufacturing Leadership
# 2012 AMP Report to the President

**Calling for Industry-led Manufacturing Innovation Institutes**

## I. Enabling Innovation

- Establish a National Network of Manufacturing Innovation Institutes (NNMI)
- Establish a national advanced manufacturing portal
- Establish a national advanced manufacturing strategy
- Increase R&D funding in top cross-cutting technologies
- Empower enhanced Industry/University collaboration in advanced manufacturing research
- Foster a more robust environment for Commercialization of Advanced Manufacturing Technologies

## II. Securing the Talent Pipeline

- Improve public perceptions about manufacturing
- Tap the talent pool of returning veterans
- Invest in community college level education
- Partner to provide skills certifications and accreditation
- Enhance advanced manufacturing university programs
- National manufacturing fellowships and internships

## III. Improving the Business Climate

- Enact tax reform
- Streamline regulatory policy
- Improve trade policy
- Update energy policy

---

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

**JULY 2012**

*Report to the President: Capturing Domestic Competitive Advantage in Advanced Manufacturing*
Focus on Scale Up – The Missing Middle

Basic science
Largely government funded

Commercialization
Private sector owned/funded
Designing, Building and Growing the NNMI

3) Presidential Initiative and Pilot

- 15 IMIs + Pilot
- Additive Mfg Pilot
- PCAST/AMP Call for NNMI
- Linked to Innovation

NNMI Framework

January 2013

3 x 2013 Institutes
- Digital Mfg Inst.
- Power Electr. Inst.
- Light-weight Metals Inst.

Vision of 45 Institutes

Congressional Authorization
- Formation of Network and New Institutes

IP Guidelines
- Perf. Metrics
- ...
National Network for Manufacturing Innovation

“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 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
DOD-led Pilot Manufacturing Institute on Additive Manufacturing

April 13  May 8  May 16  August 16
SN   BAA  Industry Day  Award

Industry Day Award
Additive Manufacturing Innovation Institute
Youngstown Ohio

Prime Awardee: National Center for Defense Manufacturing and Machining

- $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
NAMII Initial Partners

**Industry**
- AM Materials
  - Allegheny Technologies
  - FMW Composite Systems
  - Lubrizol
  - Oxford Performance Materials
  - Plextronix
  - RII
  - Touchstone
- AM Equipment
  - ExOne
  - Laser Technology Associates
  - MicroFab Technologies
  - nScript
  - Optomec
  - POM
  - Sciaky
  - Stratasys
- AM Manufacturing
  - AlphaMicron
  - FMW Composite Systems
  - Kent Displays
  - Morris Technologies
  - Paramount Industries
- Platform Systems
  - Boeing
  - GE Transportation
  - General Dynamics
  - Goodyear
  - Honeywell
  - Johnson Controls
  - Kennametal
  - Lockheed-Martin
  - Northrop Grumman
  - OSRAM Sylvania
  - Parker Hannifin
  - Timken
  - Westinghouse Nuclear
- Inspection
  - M-7 Technologies
  - Stratonics
- Software
  - AS12
  - Autodesk
  - IBM

**Manufacturing Support**
- Manufacturing Extension Partners
  - PA MEP Network (IRC’s)
  - OH MEP Network
- Industry Organizations/TBEDs
  - BFTP
  - EIO
  - JumpStart
  - Nortech
  - Western Associates

**Workforce Training**
- North Eastern Ohio
  - Eastern Gateway CC
  - Lorain CCC
  - Youngstown State Univ.
- Western Pennsylvania
  - CC of Allegheny C
  - Robert Morris Univ.
  - Westmoreland CCC
- Eastern Pennsylvania
  - Northampton CC
  - Penn College of Technology
  - Penn State University
  - West Virginia
  - RCWI @ Marshall Univ.
- Research Universities*
  - Carnegie Mellon University
    (Automation)
  - Case Western Reserve University
    (Micro/Nano)
  - Kent State University
    (Sensors)
  - Lehigh University
    (Composites)
  - Penn State University, ARL
    (Metal SLS, E-beam)
  - University of Akron
    (Polymer/Ceramic LDM)
  - University of Pittsburgh
    (Medical)

**Government**
- Army ARDEC
- ECDC
- ManTech
- NETL
- NUWC

**Manufacturing & Standards Organizations**
- AMT
- MTConnect Institute
- NDMEC
- NIST
- SME

*N Proposed thrust lead area in parentheses*
2014 Additive Mfg Institute Consortia

*based on 2012 Wohlers Report of active AM organizations and NAMII discussions to date
Designing, Building and Growing the NNMI

4) Public Input and the NNMI Design

- 15 IMIs + Pilot
- Public Comment
- 3 x 2013 Institutes
- Vision of 45 Institutes

March 2012

PCAST: Manufacturing Linked to Innovation
Additive Mfg Pilot
PCAST/AMP Call for NNMI

NNMI Framework

IP Guidelines
Perf. Metrics

Congressional Authorization
Formation of Network and New Institutes

Next Steps
Public Engagement on Design
Workshops & Request for Information

Broad & Diverse Stakeholder Input
1,200 voices on the NNMI Design!

- Industry: 31%
- Academia: 31%
- Economic Development: 6%
- Research & non-profits: 8%
- Federal State & Local Gov’t: 14%
- All Other: 10%

University of Colorado
Boulder, Colorado

Cuyahoga Community College
Cleveland Ohio

National Academies Beckman Center
Irvine California

Rensselaer Polytechnic Institute
Troy New York

U.S. Space and Rocket Center
Huntsville, Alabama
Partnerships are Essential

- Large companies
- Small and medium enterprises

- State
- Regional
- Local

Participation and Co-investment by partners is essential
The Institute Design
Creating the space for Industry & Academia to collaborate

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
Designing, Building and Growing the NNMI

5) State of the Union – 2014 Institutes

- 15 IMIs + Pilot
- Public Comment
- 3 x 2013 Institutes
- Vision of 45 Institutes

Next Steps

Congressional Authorization
Formation of Network and New Institutes

March 2012

- PCAST: Manufacturing Linked to Innovation
- Additive Mfg Pilot
- PCAST/AMP Call for NNMI

January 2013

- NNMI Framework
- Digital Mfg Inst.
- Power Electr. Inst.
- Light-weight Metals Inst.

Public Comment

IP Guidelines

Perf. Metrics
Our first priority is making America a magnet for new jobs and manufacturing. Last year, we created our first manufacturing innovation institute in Youngstown, Ohio. A once-shuttered warehouse is now a state-of-the-art lab where new workers are mastering the 3D printing that has the potential to revolutionize the way we make almost everything. There’s no reason this can’t happen in other towns.

So tonight, I’m announcing the launch of three more of these manufacturing hubs, where businesses will partner with the Departments of Defense and Energy to turn regions left behind by globalization into global centers of high-tech jobs.

And I ask this Congress to help create a network of fifteen of these hubs and guarantee that the next revolution in manufacturing is Made in America.

Three full scale institutes, to be awarded in 2013
$200M federal investment over five years

President Obama
February 13, 2013
Wide bandgap (WBG) semiconductors

- operate at much higher temperatures, voltages, and frequencies compared to Si.
- allow for smaller, lighter, faster, and more reliable power electronic components.
- enable more efficient distribution and use of electric power.
- need cutting-edge manufacturing processes that can produce high-quality, affordable devices.

<table>
<thead>
<tr>
<th>Material</th>
<th>Chemical Symbol</th>
<th>Bandgap Energy (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germanium</td>
<td>Ge</td>
<td>0.7</td>
</tr>
<tr>
<td>Silicon</td>
<td>Si</td>
<td>1.1</td>
</tr>
<tr>
<td>Silicon Carbide</td>
<td>SiC</td>
<td>3.3</td>
</tr>
<tr>
<td>Gallium Nitride</td>
<td>GaN</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Poised to revolutionize the next generation of power electronics and clean energy innovations.

Image source: DOE Oak Ridge National Laboratory

iStock/19221337, 18866928, 15649881
Lightweight and Modern Metals Manufacturing Innovation Institute

- New structural alloys face tremendous barriers to application due to lack of design guides and certifications as well as cost and scale-up challenges.

- The goal is to develop an advanced lightweight-metal supplier base for the U.S. to compete in the global market.

- Enable DOD to realize significant fuel reduction, increased payloads, and greater speed and agility of manned, unmanned, and soldier systems as well as benefits for commercial applications and energy savings.
Digital Manufacturing and Design Innovation Institute

- Provide the proving ground to link promising information technologies, tools, standards, models, sensors, controls, practices and skills, and then transition these capabilities to the industrial base for full-scale application.

- For example, proving and progressing intelligent electro-mechanical design and manufacturing capabilities from laboratory to prototype factory environments would improve production efficiencies and costs.

- Focus is the smart and comprehensive use of the ‘digital thread’ throughout design, production and support.
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

**NNMI Vision – 45 institutes**

**With Congressional Legislation**

- Open competition on ANY topic proposed by Industry and Academia
- Selection of topics made on merit
  - let best proposals of greatest impact to US industry move ahead
- Institutes by Administrative Action limited to topics Federal agencies need
- Creates capability for enough institutes to form a value-added network
- Provides stable funding and certainty for consortia – path to sustainability
NNMI Bipartisan/Bicameral Legislation

Revitalize American Manufacturing & Innovation Act of 2013

Lead Sponsors

Sen. Sherrod Brown  
D Ohio

Sen. Roy Blunt  
R Missouri

Rep. Tom Reed  
R NY-23

Rep. Joe Kennedy  
D MA-4

Senate Commerce Committee Hearing Nov. 13, 2013

House Science Committee, Subcommittee on Research & Technology Hearing Dec. 12 2013

Joint press release: “Their landmark bill would establish a Network for Manufacturing Innovation to position the United States, once again, as the global leader in advanced manufacturing and ensure that the U.S. can out-innovate the rest of the world while creating thousands of high-paying, high-tech manufacturing jobs.”
The Design Continues
please stay tuned for upcoming announcements!

Advanced Manufacturing National Program Office

Draft Guidance on Intellectual Property Rights for the National Network for Manufacturing Innovation

Draft Institute Performance Metrics for the National Network for Manufacturing Innovation

Digital Manufacturing Institute

Power Electronics Institute

Light-weight Metals Institute

Partnership
Industry – Academia – Government

Working better, together to create transformational technologies and build new products and industries
Thank you

For questions or comments, please contact the Advanced Manufacturing National Program Office

amnpo@nist.gov

www.manufacturing.gov

301-975-2830

Unless otherwise labeled, images are courtesy of The White House, the National Institute of Standards and Technology, and Shutterstock