Established Interagency Advanced Manufacturing Coordination and Activity: AMP, AMNPO, NSTC

Executive Office of the President

Advanced Manufacturing Partnership (AMP/PCAST)

Advanced Manufacturing National Program Office (hosted by DOC - NIST)

NSTC - Advanced Manufacturing Subcommittee
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
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.
The Institute Design
Creating the space for Industry & Academia to collaborate

White House Report
NNMI Framework Design
January 2013

NATIONAL NETWORK FOR MANUFACTURING INNOVATION: A PRELIMINARY DESIGN

Executive Office of the President
National Science and Technology Council
Advanced Manufacturing National Program Office

JANUARY 2013
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
Current NNMI Institutes - Portfolio

DMDII  Digital Manufacturing and Design Innovation

Education and Workforce Development

America Makes
3-D Additive Mfg.

Power America
Power Electronics

IACMI
Composites Mfg.

AIM-P
Integrated Photonics

Nextflex
Flexible Hybrid Electronics

AFFOA
Fibers & Textiles

Modeling, Simulation & Standardization

Enterprise

Domain - Specific

LIFT
Light-weight Metals

DMDII Digital Manufacturing and Design Innovation

Nextflex Flexible Hybrid Electronics

AFFOA Fibers & Textiles

Modeling, Simulation & Standardization

Education and Workforce Development

America Makes 3-D Additive Mfg.

Power America Power Electronics

IACMI Composites Mfg.

AIM-P Integrated Photonics

Nextflex Flexible Hybrid Electronics

AFFOA Fibers & Textiles
America Makes
Additive Manufacturing/3D Printing – Youngstown, OH

Est. August 2012; Hub location: Youngstown, OH
Lead: National Center for Defense Manufacturing and Machining (NCDMM)
Regional location: “TechBelt” Cleveland to Pittsburgh Corridor

Mission: Accelerate additive manufacturing innovation and widespread adoption by bridging the gap between basic research and technology development/deployment.

- 53 companies, 36 universities & labs, 26 other organizations
- $50M federal investment and 1:1 cost share pledged to support development and management of the institute plus applied research projects over 5 years
- 22 research projects underway with $13.5M federal funds plus $15M private funds so far
- Industry entrusted 14 machines to the institute
- Strong tech transition, workforce education & STEM focus
Mission: Digitize American Manufacturing

Est.: February 2014
Lead: UI LABS
Hub location: Chicago, IL
Current number of members: 201
Federal Funding: $70M
Cost Share (UI Labs): $248M

COMPETITIVENESS PERFORMANCE IMPROVEMENTS:

• Lower design costs through better collaboration with suppliers
• Lower manufacturing cost and capital requirements from better optimization of end-to-end product lifecycle
• Reduced time to market due to more rapid iteration
• Next-gen innovations first: digital design, digital factories, digital supply chains
• New and legacy products
LIFT
Lightweight and Modern Metals – Detroit, MI

Est. February 2014
Lead: ALMMII (American Lightweight Materials Manufacturing Innovation Institute)
Hub location: Detroit Metro, Michigan
Regional location: I-75 Corridor
Current number of members: 78
Federal Funding: $70M

Mission: Provide the National focus on expanding US competitiveness and innovation in lightweight metals manufacturing, 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.
AIM Photonics - American Institute for Manufacturing Integrated Photonics - Rochester, NY

Est: July 2015
Lead: RF SUNY
Hub location: Albany and Rochester, NY
Federal Funding: $110 M
Industry Cost Share: $503 M

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

This Institute will focus on developing an end-to-end photonics ‘ecosystem’ in the U.S., including domestic foundry access, integrated design tools, automated packaging, assembly and test, and workforce development.

All these developments will require cross-cutting disciplines of design, manufacturing, packaging, reliability and testing.
Flexible Hybrid Electronics: Highly tailorable devices on flexible, stretchable substrates that combine thinned CMOS components with components that are added via “printing” processes. This technology is identified as flexible-hybrid due to integration of flexible components such as circuits, communications, sensors, and power with more sophisticated Silicon based processors.

**Commercial**

**DOD Applications**

<table>
<thead>
<tr>
<th>Commercial</th>
<th>DOD Applications</th>
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<tbody>
<tr>
<td>Wearable Technologies</td>
<td>Warfighter information devices and sensors</td>
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<tr>
<td>Internet of Things</td>
<td>Unattended sensors, vehicle borne sensors</td>
</tr>
<tr>
<td>Medical prosthetics, medical sensing</td>
<td>Warfighter Training and performance monitoring. Soldier medical care</td>
</tr>
</tbody>
</table>
Announced: April 1 2016

Lead: Advanced Functional Fabrics of America.

Hub Location: Cambridge, Massachusetts.

Federal Funding: $75 Million

Industry cost share: $240 million

Objectives:

• Serve as a public-private partnership between government, academia and industry to address manufacturing challenges from design to end products

• Support an end-to-end innovation ‘ecosystem’ in the U.S. for revolutionary fibers and textiles manufacturing and leverage domestic manufacturing facilities to develop and scale-up manufacturing processes

• Provide rapid product realization opportunities, based on robust design and simulation tools, pilot production facilities, a collaborative infrastructure with suppliers, and workforce development opportunities through targeted training and curriculum programs

Transportation – Covers and Airbags  Geosynthetics – Construction

Military and Commercial Shelters

Military and Commercial Smart Clothing
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.

Goal: Achieve cost parity with Silicon in 5 years

Lead: North Carolina State University
Hub Location: Raleigh, NC
$70M public investment, $70M match

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

• Advantages
  ➢ Operate at Higher Temperatures
  ➢ Block Higher Voltages
  ➢ Switch Faster with less losses
  ➢ Smaller Passive components
  ➢ Potentially More Reliable
  ➢ Substantial System-Level Benefits
Objective
Develop and demonstrate innovative technologies that will, within 10 years, make advanced fiber-reinforced polymer composites at...

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
• 57 Companies, 15 Universities and Labs, 14 Other Entities, and 36 Consortia Members
1) Clear, unique Institute Focus

Each Institute has a clear mission based on a critical Industry need

Opportunity
Lightweight composites offer benefits to energy efficiency and renewable power generation, overcoming limitations through deployment of advanced technologies to make composite lower cost, faster, using less energy that can be readily recycled offer tremendous opportunities for US manufacturers.

Big Idea
The Institute will provide access to world-class resources to partner with industry and develop new low-cost, high-speed, and efficient manufacturing and recycling process technologies that will promote widespread use of advanced fiber-reinforced polymer composites.

At the new Institute, a world-class team of organizations from leading industrial manufacturers, material suppliers, software developers, government and academia will focus on lowering the overall manufacturing costs of advanced composites by 50 percent, reducing the energy used to make composites by 75 percent, and increasing the ability to recycle composites by more than 95 percent within the next decade.
2) Clear Industry Value Proposition

Each Institute creates value for industry participation and funding

- **Access to Shared RD&D Resources**: Leverage and provide access to equipment from lab to full-scale to enable demonstration and reduce risk for industry investment.

- **Applied R&D**: Leverage significant government, industry, and academic investments to develop innovative solutions to member challenges.

- **Composites Virtual Factory**: Provide access to end to end commercial modeling and simulation software for composite designers and manufacturers through a web based platform.

- **Workforce Training**: Provide specialized training to prepare current and future workforces for the latest manufacturing methods and technologies.
3) Strong Private-Public Partnership

Each Institute is operated by a consortium; serving a partnership of Industry, Academia and government

A partnership of world-class companies including:

- **Dow**
- **Ford**
- **GE** - The Chemical Company
- **BASF**
- **Dassault Systemes**
- **DowAkxa**
- **Boeing**
- **Lockheed Martin**
- **Volkswagen**
- **DuPont**
- **Local Motors**

Top universities including:

- **UT Research Foundation**
- **The University of Tennessee**
- **Vanderbilt University**
- **Purdue University**
- **Purdue University**
- **Colorado State University**
- **UK**
- **U of L**
- **Lehigh University**
- **Ohio State University**

Economic Development Council to leverage state support and investment

- **Collaboration of state development leaders seeding economies worth $2 trillion**

- **JobsOhio**
- **PureMichigan**
- **Economic & Community Development**
- **Kentucky Innovation Network**
- **Economic & Community Development**
- **TN Economic Development**
- **Economic Innovation Network**
4) Addressing Critical Challenges

By workshops and Technology Roadmaps, Each Institute works on the industry priorities and big challenges only solvable by collaboration

Five/Ten Year Technical Goals

- 25/50% lower carbon fiber–reinforced polymer (CFRP) cost
- 50/75% reduction in CFRP embodied energy
- 80/95% composite recyclability into useful products

Impact Goals

- Enhanced energy productivity
- Reduced life cycle energy consumption
- Increased domestic production capacity
- Job growth and economic development
## 5) Balanced Portfolio of Projects

From Technology Roadmaps and Strategic Investment Plan, Each Institute manages a balanced portfolio of real projects for Industry

<table>
<thead>
<tr>
<th>Activity</th>
<th>Result</th>
</tr>
</thead>
</table>
| **1. First Projects** Identified in proposal to DOE | • Strengthen infrastructure capacity:  
  - Materials and processing  
  - Modeling and simulation  
  
• Innovation and workforce development in strategic areas with national benefit:  
  - Automotive  
  - Wind  
  - Compressed gas storage |
| **2. Technology Roadmap** Driven by IACMI CTO, Industry and Technology Advisory Board | • Identifies key hurdles to high -impact, large scale advanced composites manufacturing  
  
• Prioritizes opportunities across the materials and manufacturing supply chain |
| **3. Strategic Investment Plan** Driven by IACMI BOD and Technical Advisory Board | • Changing the innovation cycle to enable rapid adoption and scale-up of advanced composites manufacturing |
| **4. Open Project Call**                     | • Aligns with strategic investment plan and technology roadmap  
  • Emphasis on projects with high near term impact.  
  **Project Call**- open NOW |
NNMI Network Status and 2016 Plans

Future Network Goal: 45 Regional Hubs

Upcoming 2016 Award

Flexible Hybrid Electronics
San Jose, CA

America Makes
Additive Manufacturing
Youngstown, OH

AIM Photonics
Rochester, NY

AFFOA - Fibers and Textiles, Cambridge MA

Smart Manufacturing

New Institutes Planned for 2016

Open topic competitions

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

Digital Manufacturing & Design
Chicago, IL

Lightweight Metal Manufacturing
Detroit, MI

Advanced Fiber-Reinforced Polymer Composites
Knoxville, TN

Wide Bandgap Semiconductors
Raleigh, NC
Next Institute Topics under Consideration

DoD
• Assistive and Soft Robotics in manufacturing
• Bioengineering for Regenerative Medicine
• Bioprinting across Technology Sectors
• Cybersecurity for Manufacturing
• Advanced Machine Tools and Control Systems
• Certification, Assessment, and Qualification

DoC
• Per RAMI legislation, DOC/NIST runs “open topic” institute competitions where any topic not already covered may be proposed.
• Institute competition is presently underway
• Subject to funding availability, intention is to award at least one institute from the 2016 competition

DoE
• Modular Chemical Process Intensification
• Sustainable Manufacturing - Recycling and Remanufacturing
• Materials for Harsh Service Conditions
• High Value Roll to Roll (R2R) Manufacturing

Topic selected – May 6
First NNMI Reports Now Released

First Annual Report
on the NNMI Program

First Strategic Plan
on the NNMI Program
NNMI: Enabling a U.S. Manufacturing Renaissance

Accelerating Discovery to Application to Production

- 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
Thank You! – How to connect

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