National Network for Manufacturing Innovation

Dr. Frank W. Gayle Deputy Director Advanced Manufacturing National Program Office

> Innovation in Materials & Manufacturing TMS 2013, San Antonio, Texas



Advanced Manufacturing Partnership

AMP Co-chairs

Andrew Liveris CEO, Dow Chemical Susan Hockfield President, MIT



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

Interagency Advanced Manufacturing National Program Office (AMNPO)



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

Agency Leaders in Advanced **Manufacturing** (NSTC)

Today

NNMI Milestones and Vision

- The Missing Middle Challenge NNMI Positioning
- NNMI Design Process
- Institute Design
- NNMI Characteristics
- Next Steps



Vision of the NNMI



\$1 billion proposal:

"institutes of manufacturing excellence where some of our most advanced engineering schools and our most innovative manufacturers collaborate on new ideas, new technology, new methods, new processes."

President Obama at Rolls-Royce Crosspointe Petersburg, VA, March 9, 2012



State of the Union Address, Feb. 12, 2013

Our first priority is making America a magnet for new jobs and manufacturing.

After shedding jobs for more than 10 years, our manufacturers have added about 500,000 jobs over the past three. Caterpillar is bringing jobs back from Japan. Ford is bringing jobs back from Mexico. And this year, Apple will start making Macs in America again.

There are things we can do, right now, to accelerate this trend. 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 <u>the launch of three more of these manufacturing hubs</u>, where businesses will partner with the Department 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 <u>a network of 15 of these hubs</u> and guarantee that the next revolution in manufacturing is made right here in America. We can get that done.

– President Barack Obama

Policy Milestones



Proposed NNMI Scope

- Up to 15 linked regional clusters of manufacturing innovation across the country, each with a unique focus
- Shared approaches to infrastructure, intellectual property, contract research, and performance metrics



As nodes of a network, the Institutes for Manufacturing Innovation complement each other's capabilities

Credit: B. Young/NIST



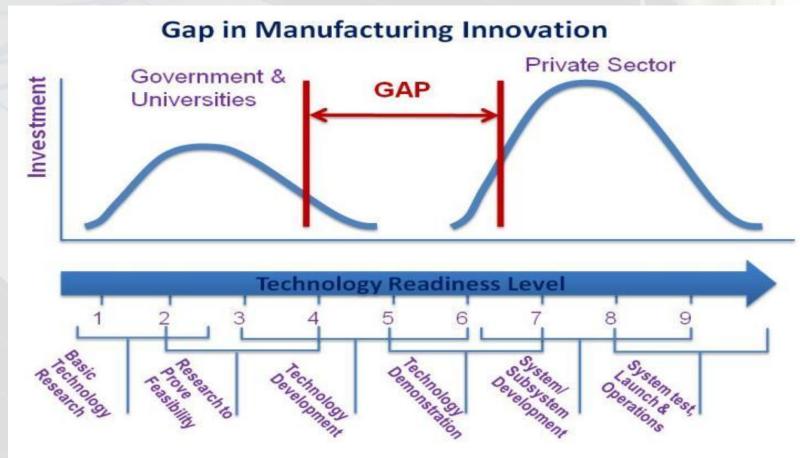
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The Missing Middle - Valley of Death

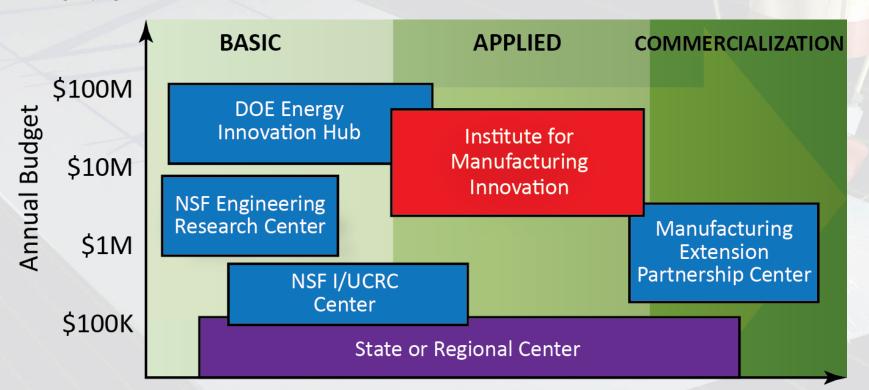
US gap in development in Technology Readiness Level 4-7





Focus on Scale Up – The Missing Middle

Basic science Largely government funded Commercialization private sector owned/funded



Manufacturing Maturity

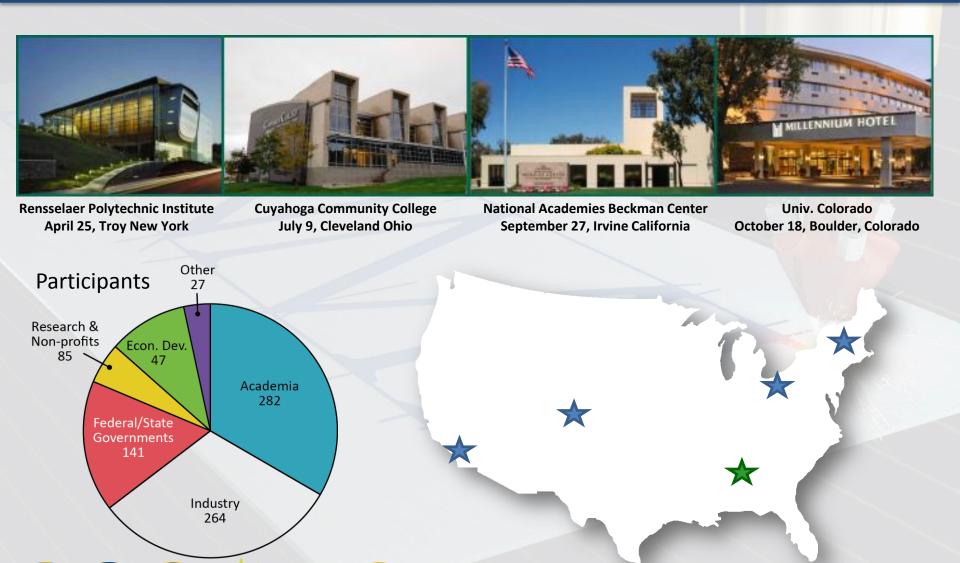




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Crowdsourcing: Design for Impact Workshops & RFI



NNMI Design Authors: ~900 strong!

Case Western Reserve Univer Case Western Reserve Univer City University of New York Columbia University Iowa State University Karsias State University Lorain County Community College Macomb Community College & Auto Communities Consorti National Institute for Pharmaceutical Technology and Educ Pennsylvania State University - Electro-Optics Center Purdue University The University of Akron University at Albany –1 University at Albany – CNSE University at Buffalo University of California Davis - College of Engineering University of California, Berkeley - College of Engineer University of Illinois University of North Carolina at Charlotte University of Rothester - Center for Emerging and Innova University of Southern California – Information Sciences University of Texas at Arlington Research Institute oungstown State University sbaschian, Reza, University of California, Riversid Abt, Steve, Colorado State University Adams, George, Purdue University Aiduri, Daryush, Clarkson University Alour, Juaryuan, Lamkon Lamkon Lawkon Anaya, Jose, Elizamio College Anderson, Dennis, North Dakota State University Anderson, Shrui, North Dakota State University Anthory, Brian W., Masachusetts Institute of Techn Agarnus, Matt, Lorain Courty Community College Agelian, Diran, Workester Polyachristic Isstitute Backate, Charlie, Beall Center for Innovation and Ent Backate, Charlie, Seal Conter for Innovation and Ent Nearch, Color, Bail Carlor for Instances and Energy Bail, A.S., Bornson, Y. & Kolor, Santon S., Santon, Sa Camelio, Jaime, Vinginia Polytechnic Institute : Camelio, Jaime, Vinginia Polytechnic Institute : Camp, Lisa, Case Western Reserve University Cantello, Craig, Edison Tech Center Canton, Giulia, University of California, Irvine Carron, Alice, Navajo Technical College Cetinkaya, Cetin, Clarkson University Chen, Shaochen, Univ of California, San Diego Chen, Julie, University of Massachusetts, Low Chen, Yong, University of Southern California Chiumento, Laurie, University of Rochester Churdweito, Lucia, University of Indonautie Church, Illoy, Locial County Community College Chyu, Ming King, University of Pittsburgh Comier, Denis, Rochester Institute of Technolog Corson, Paul, Locain County Community College Damoulakis, John, Information Sciences Institute DeSilva, Brett, Saddleback College Diaz, Bob, College of Southern Nevada Dory, Cnig, Bensselaer Polytechnic Institute Draka, Michael, University of California, Irvine Dessen, Tiff, University of California, Berkoley Ehmann, Kornel, Northwestern University Eller, Kathleen, University of California, Irvine Eisenbraum, Eric, University at Albamy-SUNY Emining, David, Onio Scare University Envin, Sarah, University of California, Los Angele Fancher, Michael, College of Nanoscale Science -University Farland, William, Colorado State University Farland, William, Colorado State University Fedder, Carry, Carnegio Mellou University Feng, Philip, Case Western Reserve University Figurelle, Wayne, The Pennsylvenia State University Forash, Stephen, The Pennsylvenia State University Franklin, Debra, Wichita State University Frederick, Dick, Rensselaer, Polytechnic Institute Freeman, Harold, North Carolina State University Gajewski, John, Cuyahoga Community College Garza, Wanda, South Texas College vood. David. Irvine Valley College Giles, Merle, NCSA

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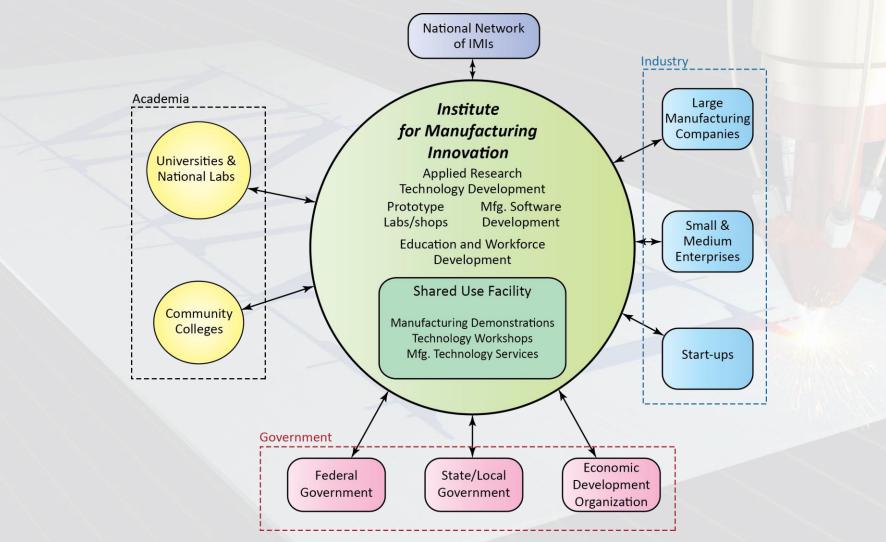
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Today

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- The Missing Middle Challenge NNMI Positioning
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- Next Steps

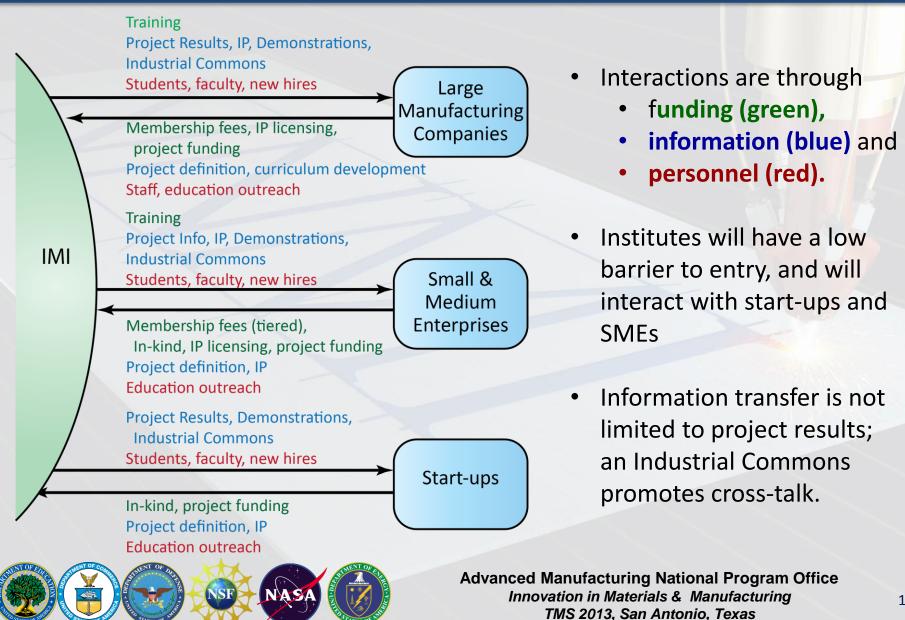


Institute Structure

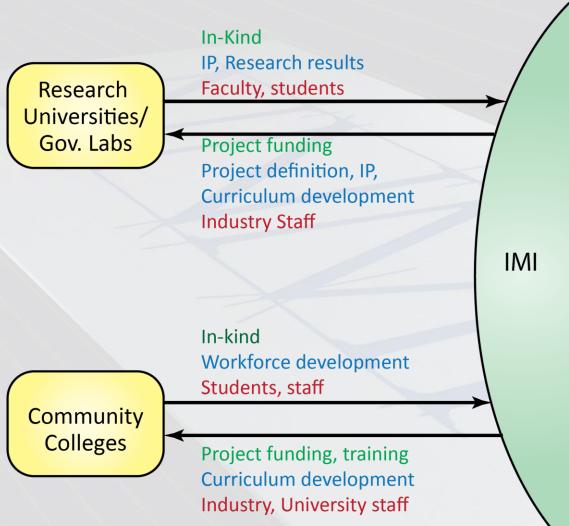




Detail: Industry Interactions



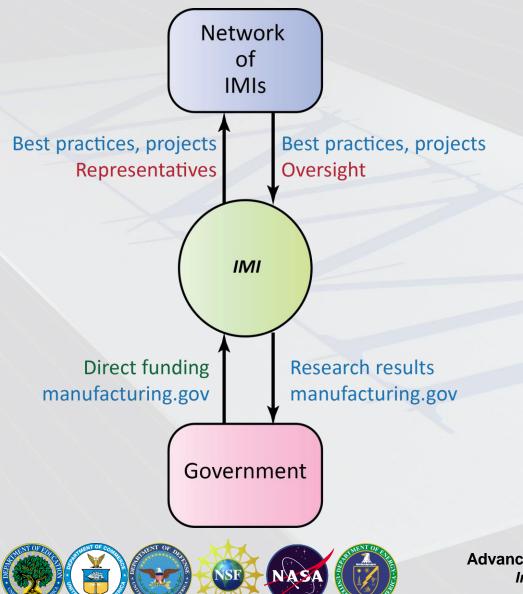
Academia Interactions





- Interactions are through
 - funding (green),
 - information (blue) and
 - personnel (red).
- Community colleges are essential for workforce development tasks.
 - Academia interactions are facilitated by the IMI.

Government and Network Interactions



- Each Institute will participate in the NNMI, web portal.
- Institutes will share resources.
- Institutes will direct projects to other institutes as appropriate.
- Government (federal and state) will provide funding and disseminate research results through manufacturing.gov.

IMI Key Characteristics

- Institutes will be the anchor to a regional innovation ecosystem, with a vision for national and international preeminence.
- Institutes will be partnerships between all stakeholders: industry, academia, government, industry development organizations. Collaboration is critical.
- Each institute will have its own unique focus area, one of:
 - Manufacturing process
 - Advanced Materials
 - Enabling Technology
 - Industry Sector
- Institutes should be proposed by an industry-focused non-profit organization. Focus areas will be ideally be defined by proposing teams.
- Institutes will be self-sustaining after 7 years.





Flexible electronics, nano/micro, lightweight materials, personalized medicine, alternative energy, additive manufacturing, smart machining, pharmaceutical s, modeling and simulation, composite materials ,coatings, energy storage, sensors, metal casting, advanced forming, advanced joining, robotics, peening, machining, other surface finishing, coal compact internal burning, convert truck fleets to natural gas, thermoplastic recycling, sensors for harsh conditions, machining, forming, molding, casting, assembly, forgings, joining, surface engineering, electro-optics, nanomanufacturing, miniaturized electronics, design tools and informatics, nanoelectronics, autonomy, superalloys, precision machining, rapid prototyping, organic electronics, nanocomposites, sensors, embedded technologies, remote sensing, renewable energy, strategy development, printed electronics, sustainable manufacturing, bioprocessing, nanomedicine, nanomaterials, micromanufacturing, stoichiometry in thin films and bulk materials, photonic integrated circuits, electro-optic materials and devices, polymericbased web converting manufacturing platforms, sensors for diagnosis and control of manufacturing, renewable energy, biofuels, nano/bio manufacturing, digital model-based manufacturing, advanced materials, medical technology manufacturing, additive manufacturing, smart manufacturing, advanced/intelligent machining and fabrication, advanced metrology, digital manufacturing, advanced joining, near-net shape technologies, forging, extrusion, rolling, casting, powder, molding, hydroforming, composites manufacturing, advanced nanomaterials, next generation semiconductor technologies, MEMS/NEMS and embedded sensors, energy efficient technologies, dynamic machine tool management, Big Data, robotics, automation technologies, advanced magnets, joining technologies, in-situ metrology, powder metallurgy, electron beam, cryogenic techniques, coatings, repair welding, composites, maritime technologies, photovoltaics, biomimetic engineering (related to solar), materials characterization, laser-based processing, non-destructive evaluation, wafer fab and equipment, ceramics, sustainable manufacturing, digital manufacturing, mechatronics and cyberphysical manufacturing, optics and imaging, electronics assembly, IT systems, metamaterials, rapid prototyping via flexible manufacturing, wide bandgap manufacturing, advanced batteries...

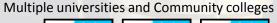
All ideas are viable! Make the technical and business case...

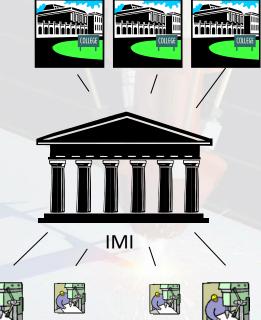


IMI Proposal

- Proposing teams should demonstrate their focus area is:
 - Has the potential to deliver regional and national improvements in advanced-manufacturing capabilities
 - Meets national needs
- IMIs should leverage existing regional or national innovation ecosystems or catalyze the formation and sustainability of new innovation clusters.
- IMIs will have a specific physical location and a clear lead organization; they will not be distributed or virtual.
- IMIs will have a regional focus with a plan for national and international preeminence.
- Activities will include
 - Applied research, development and demonstration projects
 - Education and training at all levels
 - Development of innovative methodologies and practices.









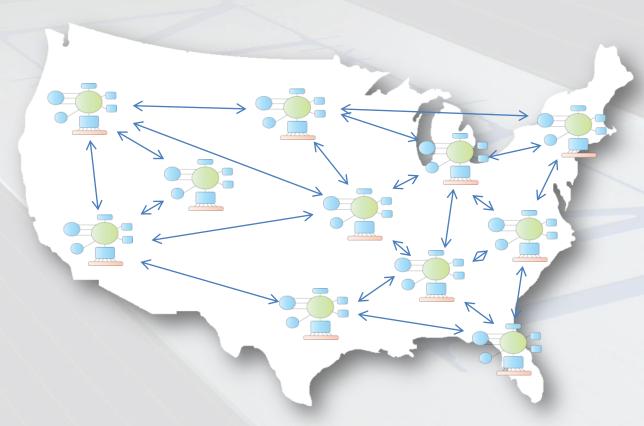
Large companies and SMEs

Today

- NNMI Milestones and Vision
- The Missing Middle Challenge NNMI Positioning
- NNMI Design Process
- Institute Design
- NNMI Characteristics
- Next Steps



NNMI Characteristics



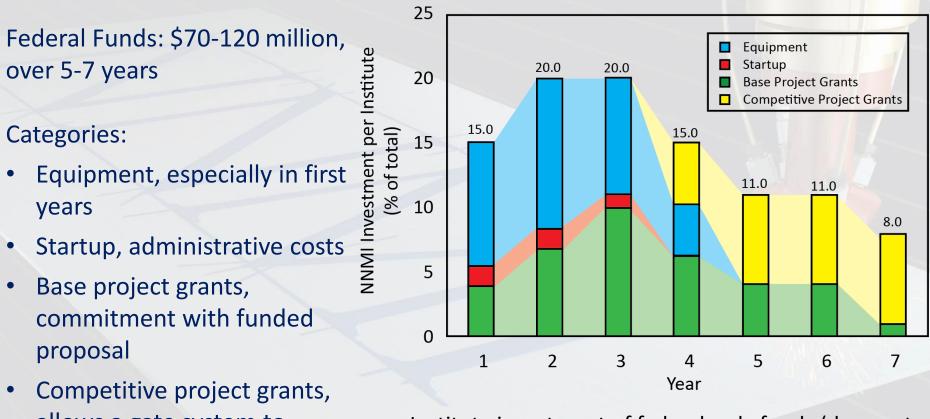
- Promote collaboration between institutes
- Provide a forum for sharing best practices
- Establish common IMI Policies when appropriate
- Link activities through the Manufacturing Portal

Workforce Development and Education

- Each Institute will interact with academia (research universities and community colleges) to positively affect manufacturing curricula.
- Applied research, development, and demonstration projects will consider the potential to collaborate with educators as part of the design.
- Institutes will provide shared facilities to local industry, especially SMEs and startups, with the goal of scaling up laboratory demonstrations and making technologies ready for manufacture.
- To support education and training objectives of each IMI, facility sharing must include planning for the uses of facilities for education and training—both for advancedknowledge workers and mid-level technicians.



Notional Spending Plan – Federal Funds



allows a gate system to reward performance.

Institute investment of federal-only funds (does not illustrate matching funds or other revenue streams)

Summary: Game Changing Characteristics

- Establish a presence, at scale, in the missing middle
- Partnering between all stakeholders
- An Industrial Commons
- Emphasizing/supporting longer-term investments by industry
- Combining R&D with workforce training
- A national network of Institutes
- Overarching mission: Create new U.S. manufacturing capabilities and industries - to grow high paying manufacturing jobs of the future



Today

- NNMI Milestones and Vision
- The Missing Middle Challenge NNMI Positioning
- NNMI Design Process
- Institute Design
- NNMI Characteristics
- Next Steps.... ... and a few words on NAMII



Workshop on the Design of the National Network for Manufacturing Innovation (NNMI) – Washington, DC, spring-summer 2013

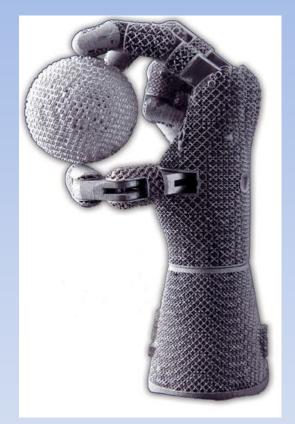
FY13 "Jumpstart" Institutes – 3 DOE and DOD institutes – FFO "soon"

For More Information on AMNPO, NNMI, and FY13 DOE and DOD institutes... www.manufacturing.gov



Pilot Institute on Additive Manufacturing

2012 Pilot Manufacturing Institute on Additive Manufacturing







National Additive Manufacturing Innovation Institute (NAMII), Youngstown OH

Prime Awardee: National Center for Defense Manufacturing and Machining

- \$30 M federal grant
- \$39 M cost share (\$20M from industry)
- 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



Credit: All photos courtesy National Additive Manufacturing Innovation Institute



Industry

AM Materials

Allegheny Technologies FMW Composite Systems Lubrizol Oxford Performance Materials Plextronix RTI Touchstone

AM Equipment ExOne

Laser Technology Associates MicroFab Technologies nScrypt 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 AST2 Autodesk

IBM

Government

Army ARDEC ECDC ManTech NETL NUWC

Manufacturing Support

Manufacturing Extension Partners PA MEP Network (IRCs) OH MEP Network

Industry Organizations/TBEDs BFTP OAI

EIO Nortech JumpStart Wohlers Associates

NAMII Initial Regional Partners

NAMII Hub Northeast Ohio Facility

National Center for Defense Manufacturing and Machining

> Manufacturing & Standards Organizations

> > AMT MTConnect Institute NDMEC NIST SME

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 RCBI @ Marshall Univ.

Research Universities*

Carnegie Mellon University (Automation)

Case Western Reserve University (Micro/Nano)

> Kent State University (Sensors)

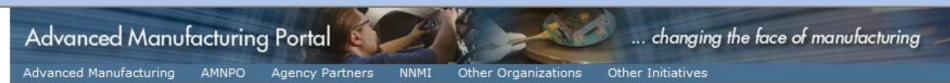
Lehigh University (Composites)

Penn State University, ARL (Metal SLS, E-beam)

University of Akron (Polymer/Ceramic LOM)

University of Pittsburgh (Medical)

For More Information on AMNPO, NNMI, NAMII, and the 3 new Institutes (DoD, DoE)... www.manufacturing.gov



Advanced Manufacturing Portal > Welcome to Manufacturing.gov!

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Publications & Resources
National Additive Manufacturing

National Additive Manufacturin Innovation Institute

Events

September 27, 2012 Designing for Impact III: Workshop on



A cardiovascular stent, currently manufactured using laser cutting, is a candidate for additive manufacturing.

Welcome to Manufacturing.gov!