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

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NIST
National Institute of Standards and Technology
U.S. Department of Commerce

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

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

(Official White House Photo by Pete Souza)

"*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*."

The Future - Advanced Manufacturing

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:

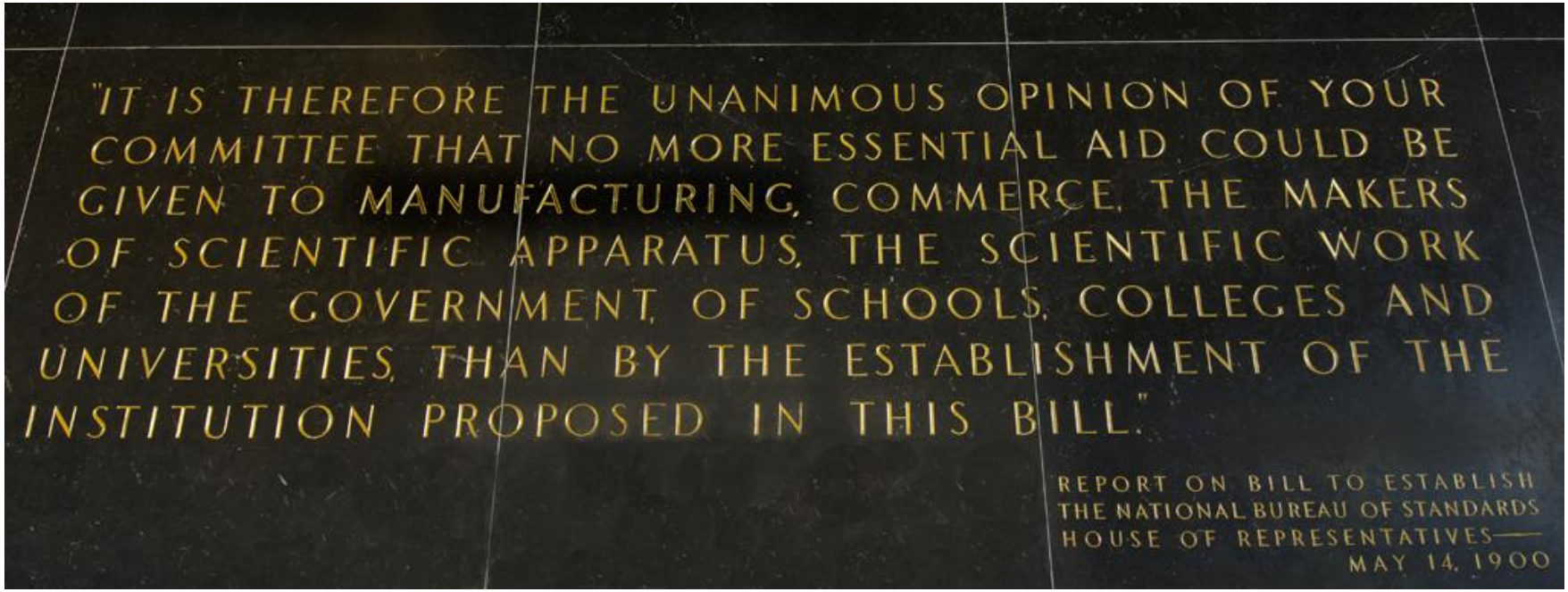
- ✓ Innovative Approaches
- ✓ Multidiscipline Expertise
- ✓ Technology Adoption
- ✓ Partnerships and Collaboration

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.



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

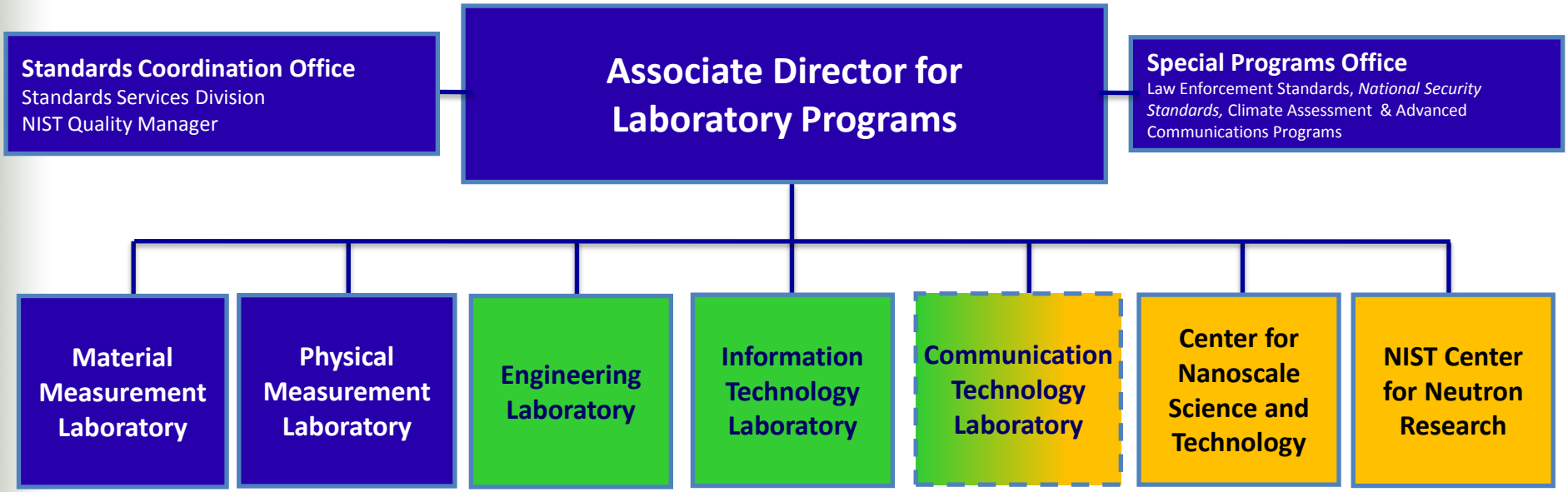
NNMI

Applied Research, Development,
& Demonstration; Scale-Up

MEP

Technology Deployment and
Adoption

NIST Laboratory Program



Metrology Laboratories	Technology Laboratories	National User Facilities
Driving innovation through Measurement Science and Standards	Accelerating the adoption and deployment of advanced technology solutions	Providing world class, unique, cutting-edge research facilities

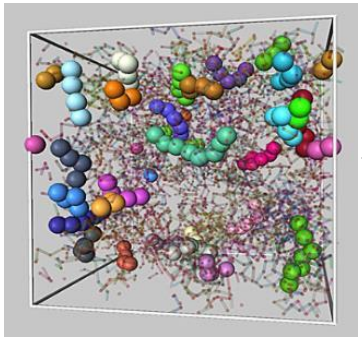
http://www.nist.gov

New Lab Initiative Funding for Advanced Manufacturing:

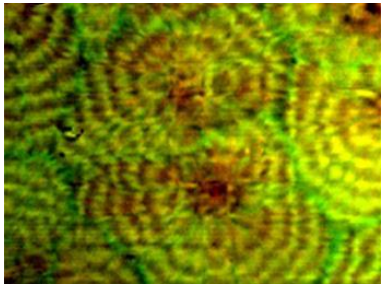
- FY2012 – $19M
- FY2013 – $15M
- FY2014 – $30M

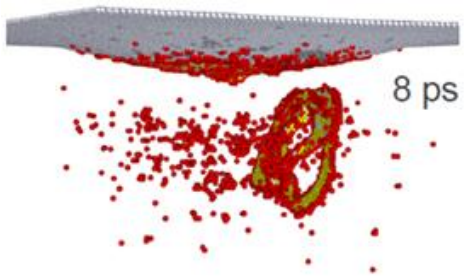
Advanced Materials Center of Excellence

- 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.



Credit: Douglas/NIST





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)

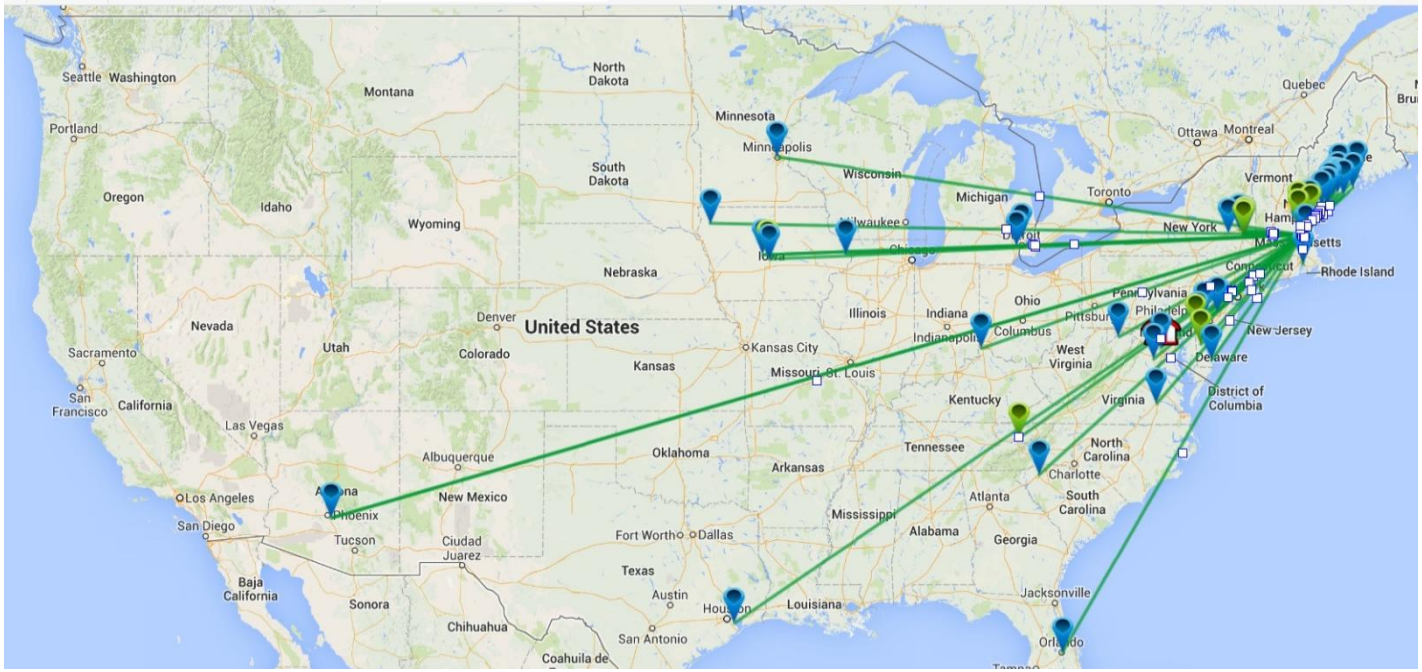
For competition results and awardee information –

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

BACKGROUND

President's Council of Advisors on Science and Technology

Advanced Manufacturing Partnership

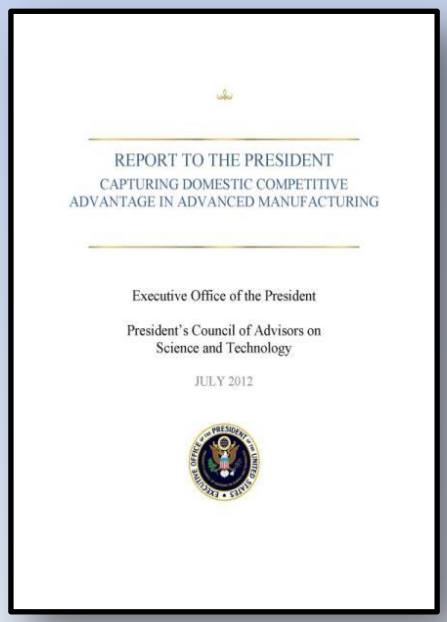
AMP Co-chairs

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


REPORT TO THE PRESIDENT
CAPTURING DOMESTIC COMPETITIVE ADVANTAGE IN ADVANCED MANUFACTURING

Executive Office of the President

President's Council of Advisors on Science and Technology

JULY 2012

Two early actions announced by Administration:

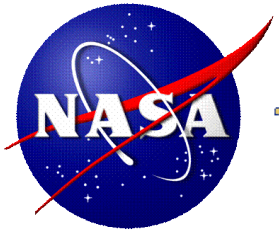
1) Coordinated "whole of government" effort via **Advanced Manufacturing National Program Office**

2) Pursue the "missing middle" via **manufacturing innovation hubs**

BACKGROUND

Advanced Manufacturing National Program Office (AMNPO)

Executive Office of the President



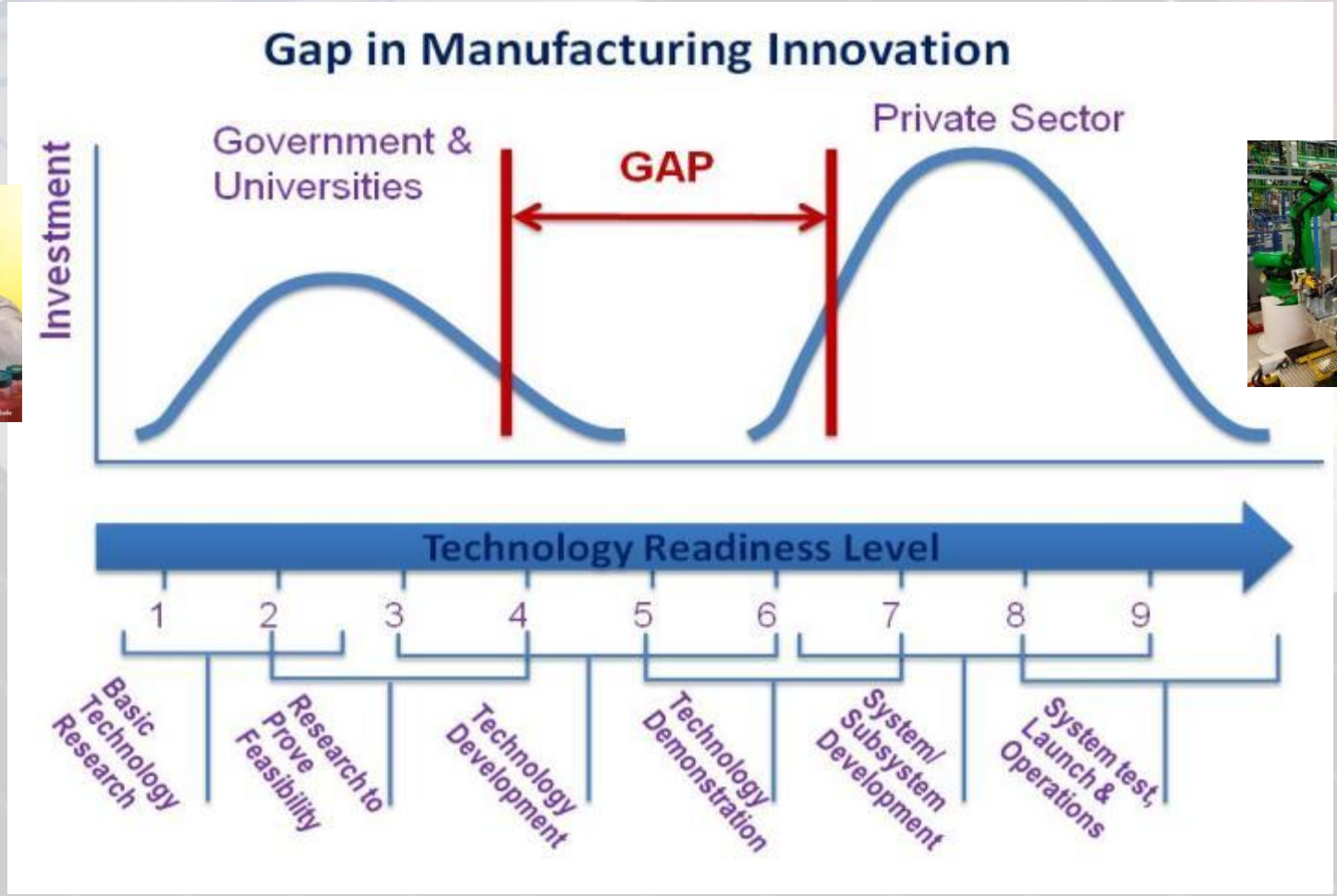
Advanced Manufacturing National Program Office
(housed at DOC - NIST)

The Scale-up Gap or Missing Middle

BACKGROUND

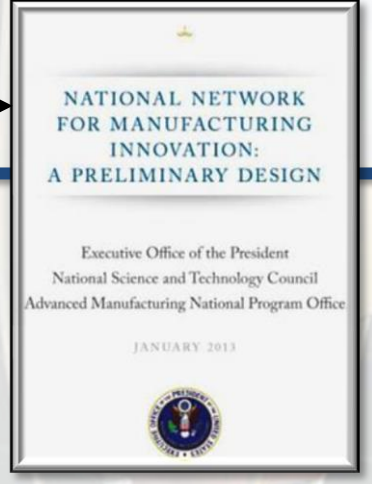
Common terms

valley of death, missing Bell Labs, industrial commons



Institute Design

White House Report
NNMI Framework Design
January 2013



National Network of IMIs

Academia
- Universities
- Academia
- Community Colleges

Institute For Manufacturing Innovation

Prototype lab/shops
Research facility
Computer lab

Shared Use Facility
Mfg. Demonstrations
Workforce Development

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

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

Institute Activities

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

Credit: anyaivanova /Shutterstock

Applied Research & Demo projects for

- reducing cost/risk on commercializing new tech.
- Solving pre-competitive industrial problems

Credit: Dmitry Kalinovsky /Shutterstock

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

Credit: with God/Shutterstock

Small/Medium Enterprises

- Engagement with small and medium-sized manufacturing enterprises (SMEs).

Institute

Source: istockphoto

Credit: Lisa Young/Shutterstock

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…"

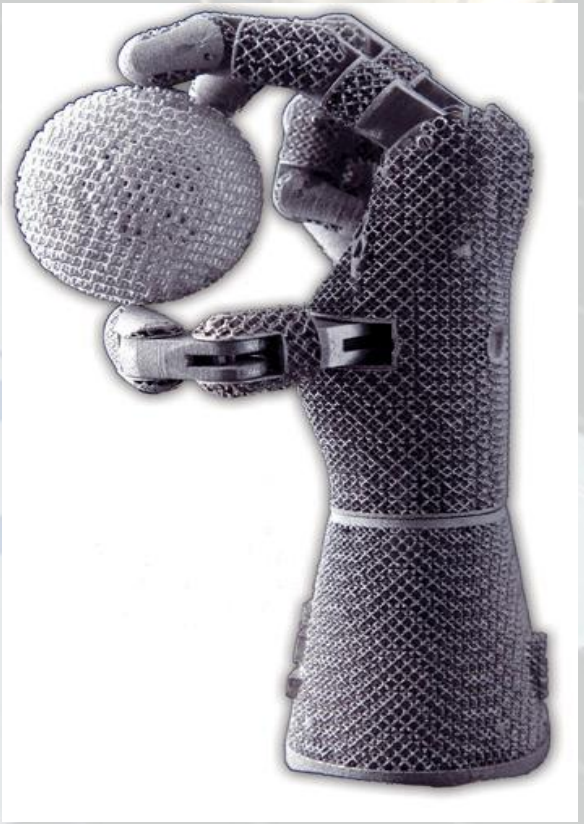
President Obama, March 9, 2012

- 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

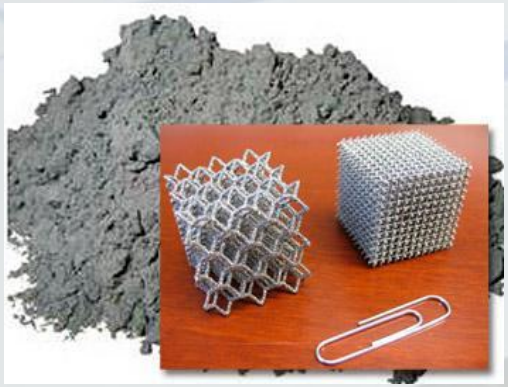
Prime Awardee: National Center for Defense Manufacturing and Machining

- 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



America Makes
National Additive Manufacturing Innovation Institute

The pilot institute, in Youngstown, OH



NNMI Vision – 45 institutes

"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

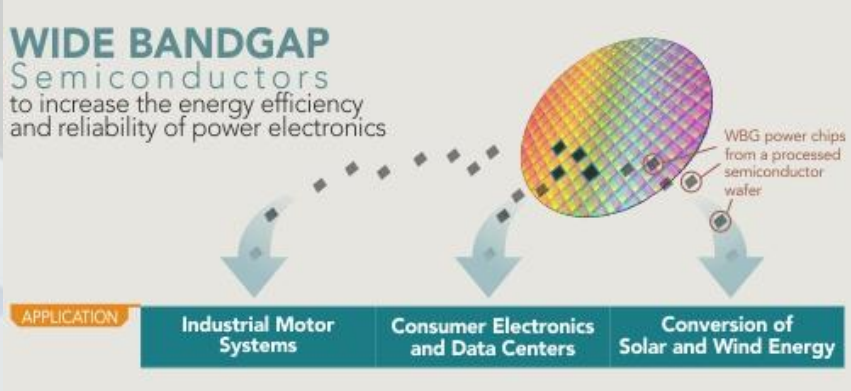
Next Generation Power Electronics Manufacturing Innovation Institute

$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

President Obama
North Carolina State University, January 15, 2014

State of the Union Announcement
2014 Institutes

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.

Six full-scale manufacturing innovation institutes to be awarded in 2014

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

NNMI Institute Status – the start of a network

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.

2014 Solicitations

Adv. Composites Mfg.

2014 Solicitation TBA

2014 Solicitation TBA

2014 Solicitation TBA

CHICAGO, IL

Digital Manufacturing and Design Innovation Institute (Digital Lab)
Digital Manufacturing

CANTON, MI

Lightweight and Modern Metals Manufacturing Innovation (LM3I) Institute
Materials Manufacturing

RALEIGH, NC

Next Generation Power Electronics Innovation Institute
Semiconductor Technology

YOUNGSTOWN, OH

"America Makes"*
Additive Manufacturing

* Formerly known as the National Additive Manufacturing Innovation Institute

Lightweight and Modern Metals Manufacturing Innovation Institute

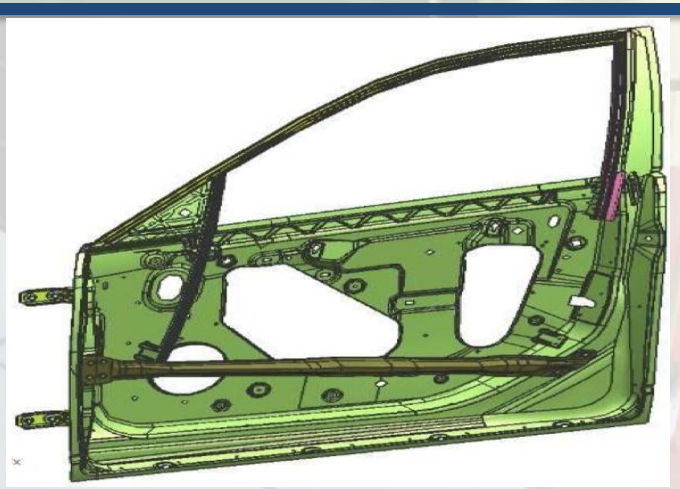
$70M public investment, $70M match

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

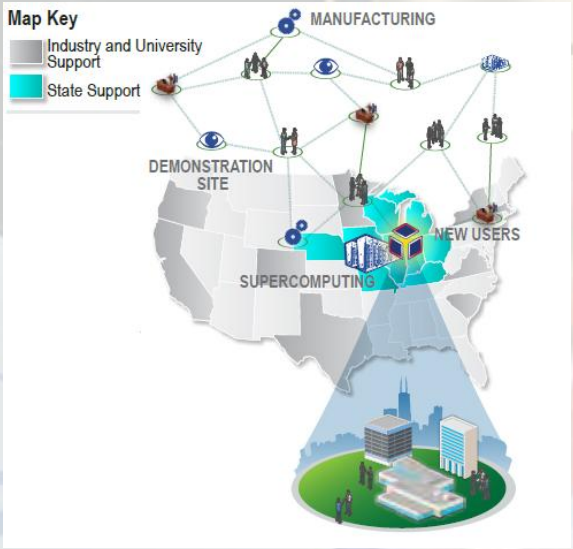
Digital Manufacturing and Design Innovation Institute

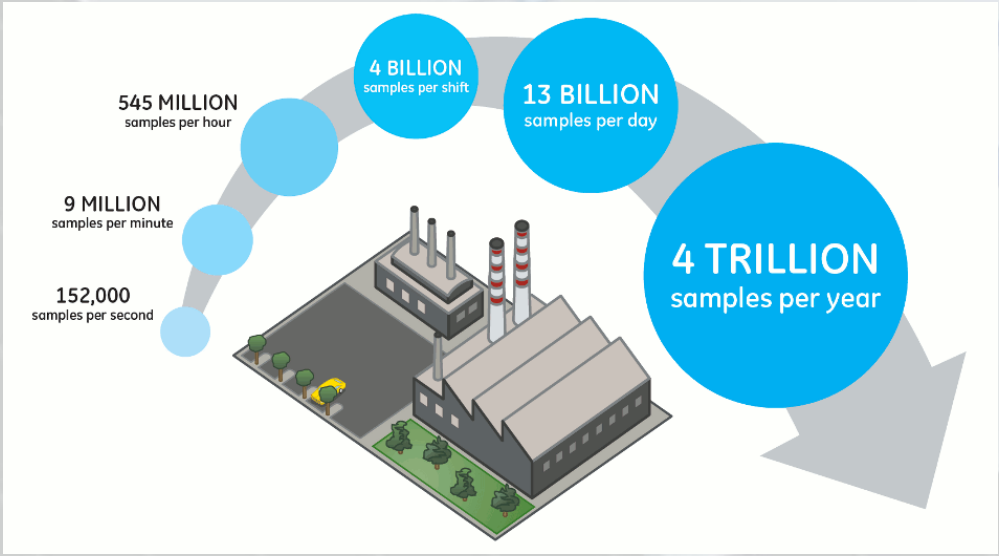
$70M public investment, ~$240M match

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…

50% Lower Cost

Using 75% Less Energy

And reuse or recycle >95% of the material

Application	Estimated Current CFC Cost	Institute CFC Cost Reduction Target (2018)[88]	CFC Ultimate Cost Target (2024)	CFC Tensile Strength	CFC Stiffness	Production Volume Cycle Time
Vehicles (Body Structures)	$26-33/kg	>35%	<$11/kg by 2025 ~60%	0.85GPa (123ksi)	96GPa (14Msi)	100,000 units/yr <3min cycle time (carbon) <5min cycle time (glass)
Wind (Blades)	$26/kg	>25%	$17/kg ~35%	1.903 GPA (276ksi)	134GPa (19.4Msi)	10,000 units/yr (at >60m length blades)
Compressed Gas Storage (700 bar – Type IV)	$20-25/kg	>30%	$10-15/kg ~50%	2.55 GPa (370ksi)	135 GPa (20Msi)	500,000 units/yr (carbon fiber)

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

President's Council of Advisors on Science and Technology

Advanced Manufacturing Partnership 2.0

AMP Mission: ***Encourage approaches that sustain and grow U.S. leadership in advanced manufacturing***

19 Senior Leaders -industry, academia & labor

Steering Committee Co-Chairs

Rafael Reif — Massachusetts Institute of Technology

Andrew Liveris — Dow

ALCOA · Applied Materials · Caterpillar · GlobalFoundries · South Central College · MacArthur Corporation · Honeywell · Harper College · United Steelworkers USW Métallos · The University of Akron · Northrop Grumman · Georgia Tech · Overland Storage · Berkeley University of California · Michigan · Siemens · Rensselaer

AMP Coordinating Group
DOW, MIT, WH, AMNPO

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)

EXPORTECH™
An Export Acceleration System for Achieving Profitable Growth

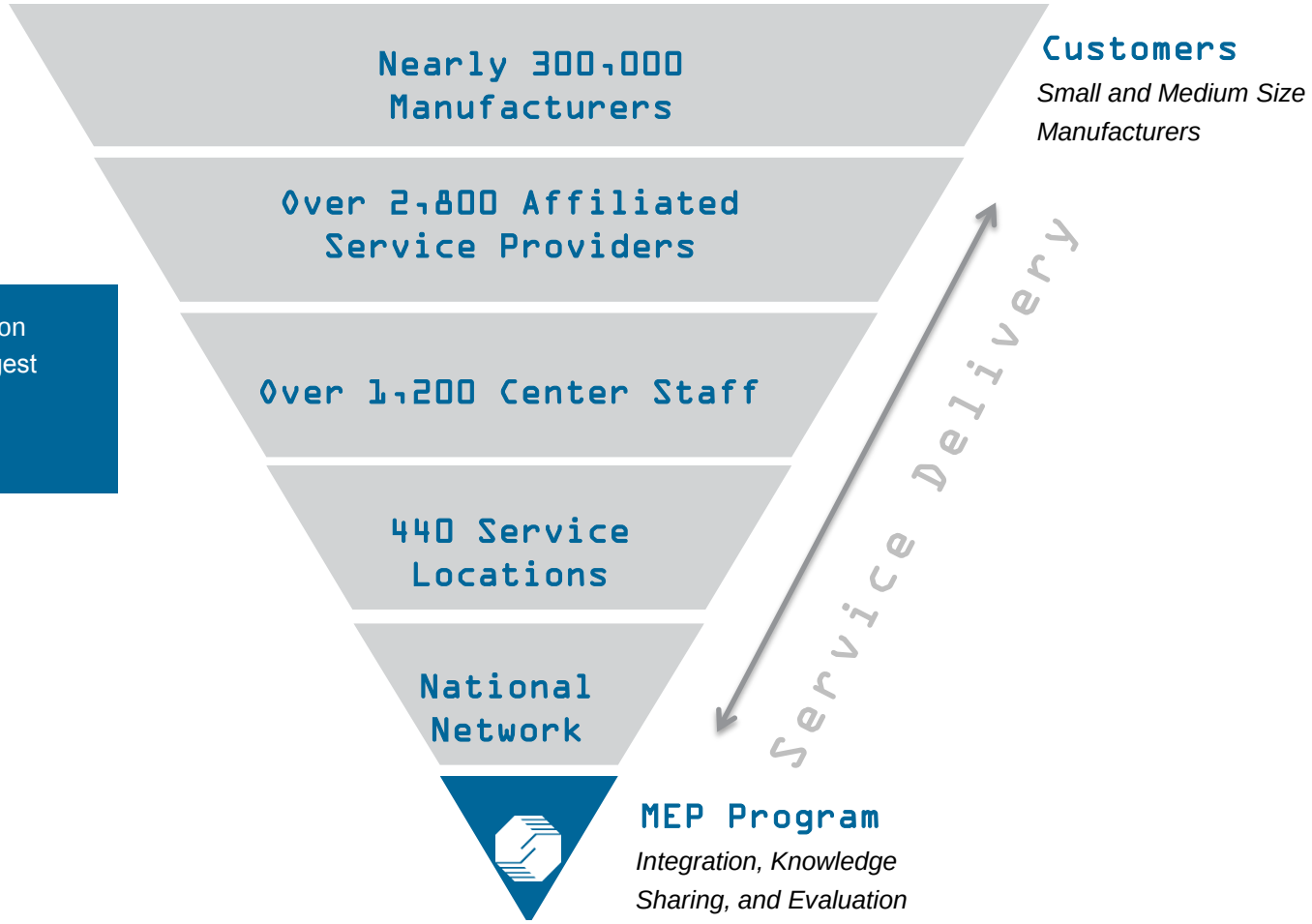
MAKE IT IN AMERICA
MANUFACTURING EXTENSION PARTNERSHIP

E3: ECONOMY - ENERGY - ENVIRONMENT
A SUSTAINABLE GROWTH STRATEGY

http://www.nist.gov/mep/

Partnering to Drive a National Program

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



How Centers work with Manufacturers

Initial Contact

Group sessions, referral

Assessment

Informal walk-through, detailed company analysis

Identify

Find potential issues, define proposed project and approach for solving it

Negotiate

Consult with company and sign project contract with fee paid to center

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 Program Initiatives

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.

Technology Scouting

Technology Driven 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

Supplier Scouting

Supply Chain Optimization

M-TACs

Client Impacts

30,131
Manufacturers
served in FY2013

JOBS SAVED	JOBS CREATED	RETAINED SALES	NEW SALES	COST SAVINGS	CLIENT INVESTMENTS
43, 914	18, 789	$6.2 Billion	$2.2 Billion	$1.2 Billion	$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?