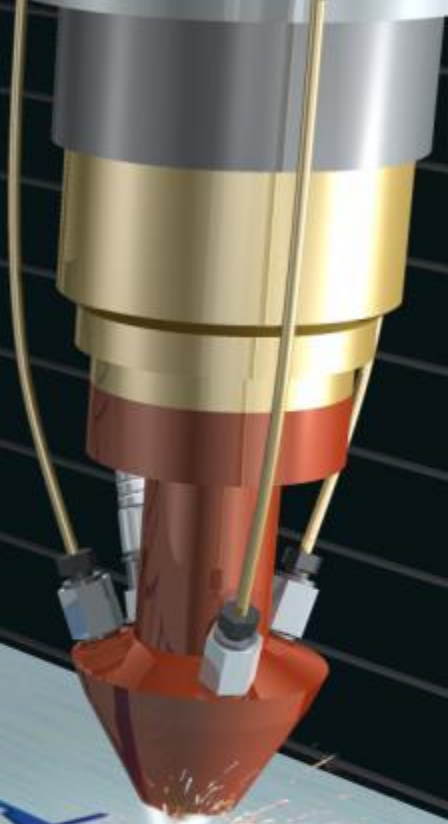
BLUEPRINT FOR ACTION

NSF ENG Advisory Committee Meeting
National Science Foundation
October 22, 2014



PCAST AMP AMNPO and NNMI

Fun Federal Acronyms and the critical role of Academia

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

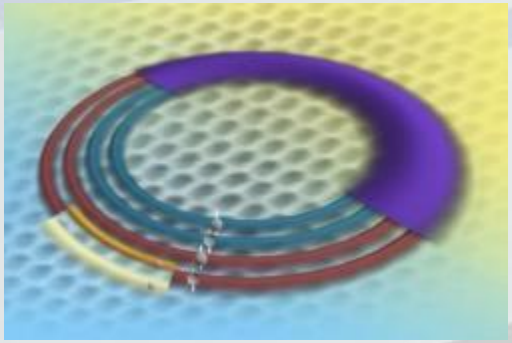
NIST's Unique Mission

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

Vector.lib/shutterstock.com

Cybersecurity: Improved response to cyber threats

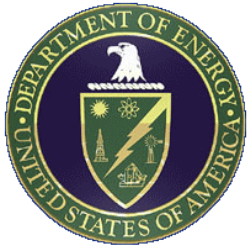


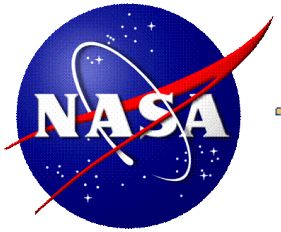
Nanomanufacturing: New measurement tools for advanced materials manufacturing

Energy: Measurements and standards for energy security

Interagency Advanced Manufacturing National Program Office (AMNPO)

Executive Office of the President





Advanced Manufacturing Partnership
(AMP/PCAST)

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

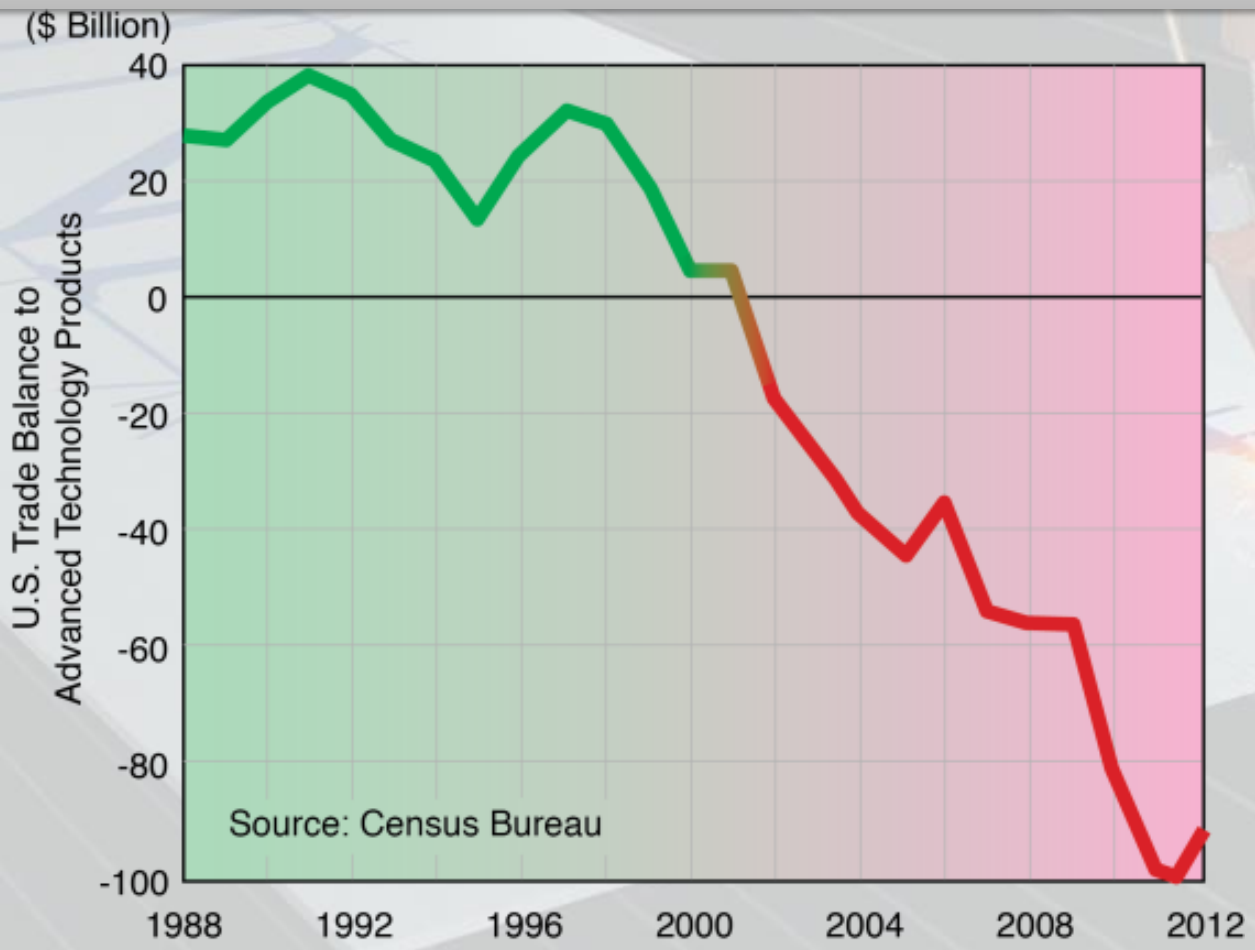
U.S. Trade Balance of Advanced Technology

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

BACKGROUND

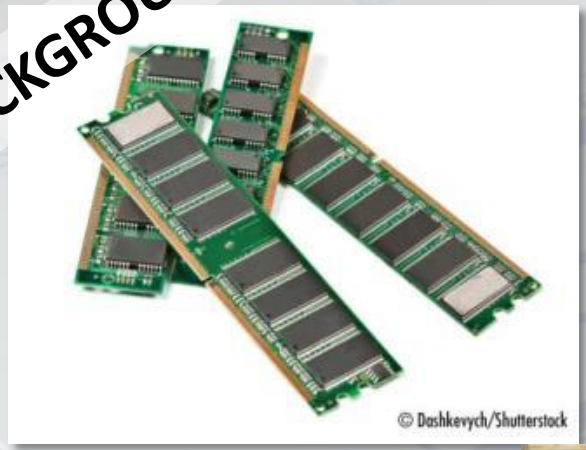
- **11%** of U.S. GDP, **12** million U.S. jobs
- ~ half of U.S. Exports
- Nearly 20% of the world's manufactured value added

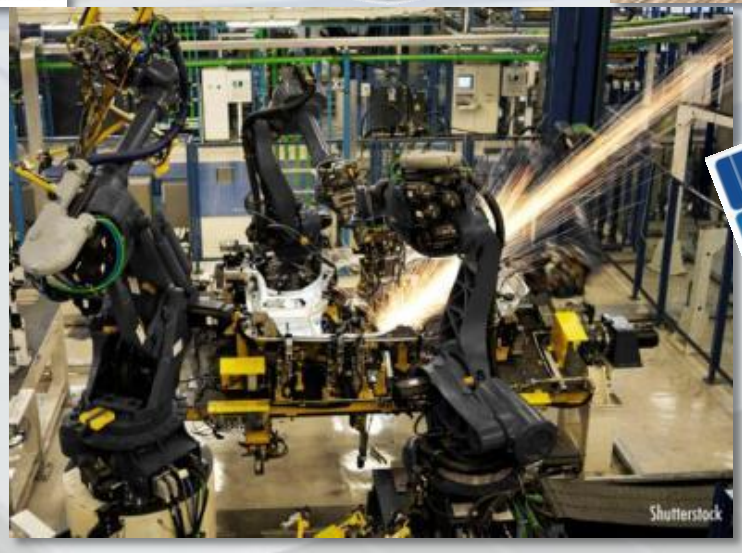
U.S. Trade Balance for Advanced Technology Manufacturing Products ($ Billions)



Products invented here, now made elsewhere - not driven by labor cost

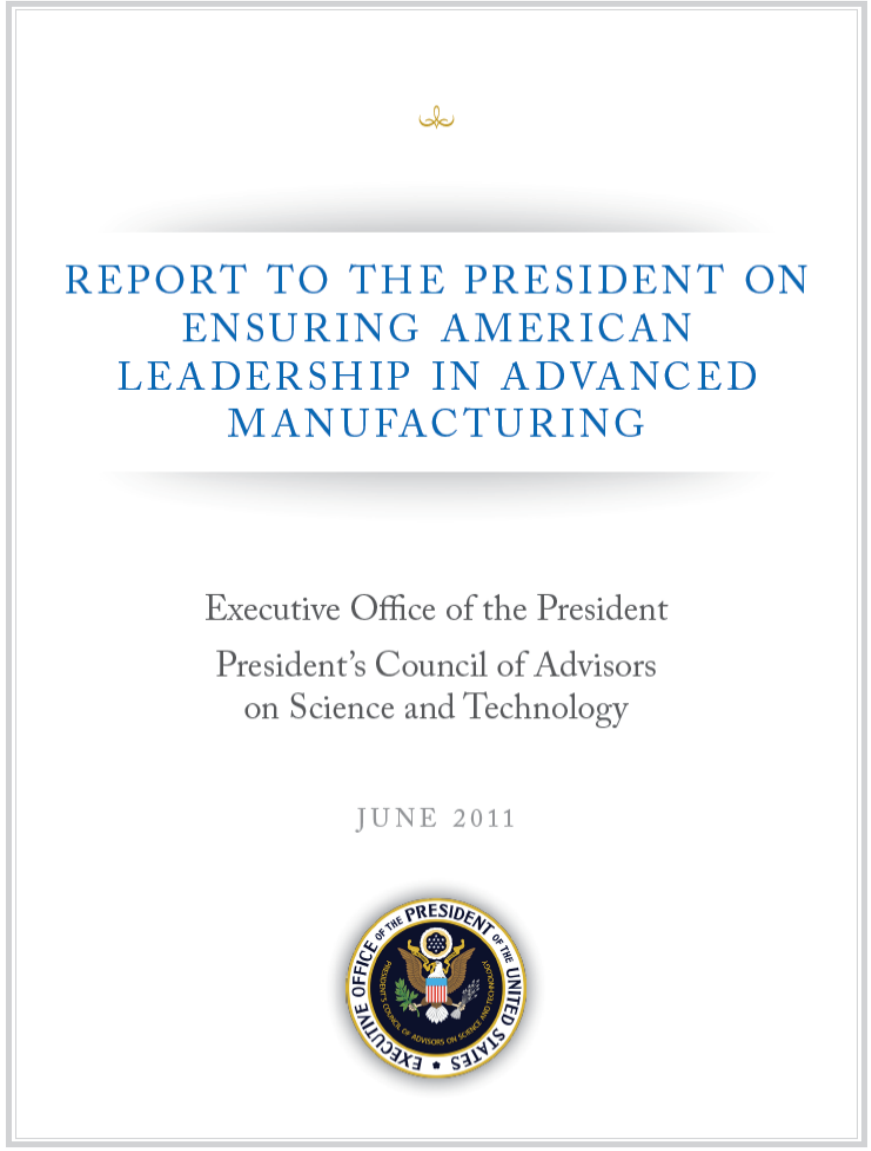
BACKGROUND





2011 PCAST Manufacturing Report to the President

Making the case for a Manufacturing Initiative



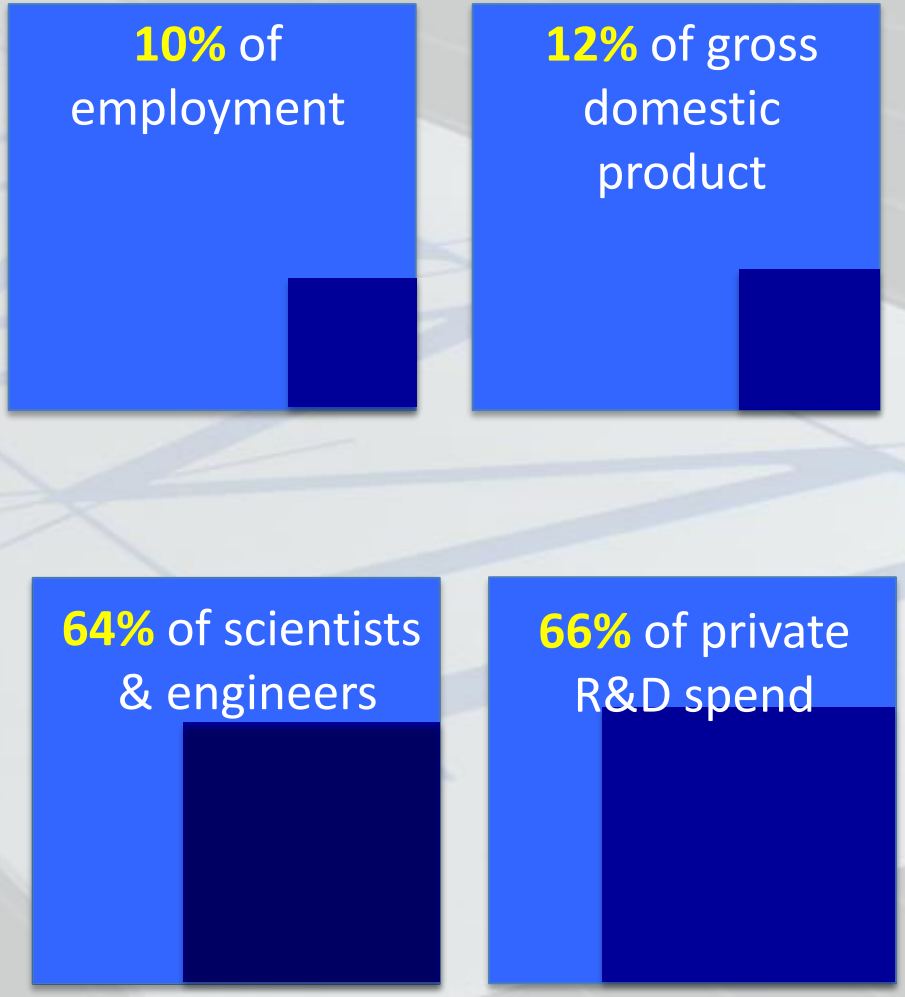
U.S. should strive to revitalize advanced manufacturing because:

- **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.

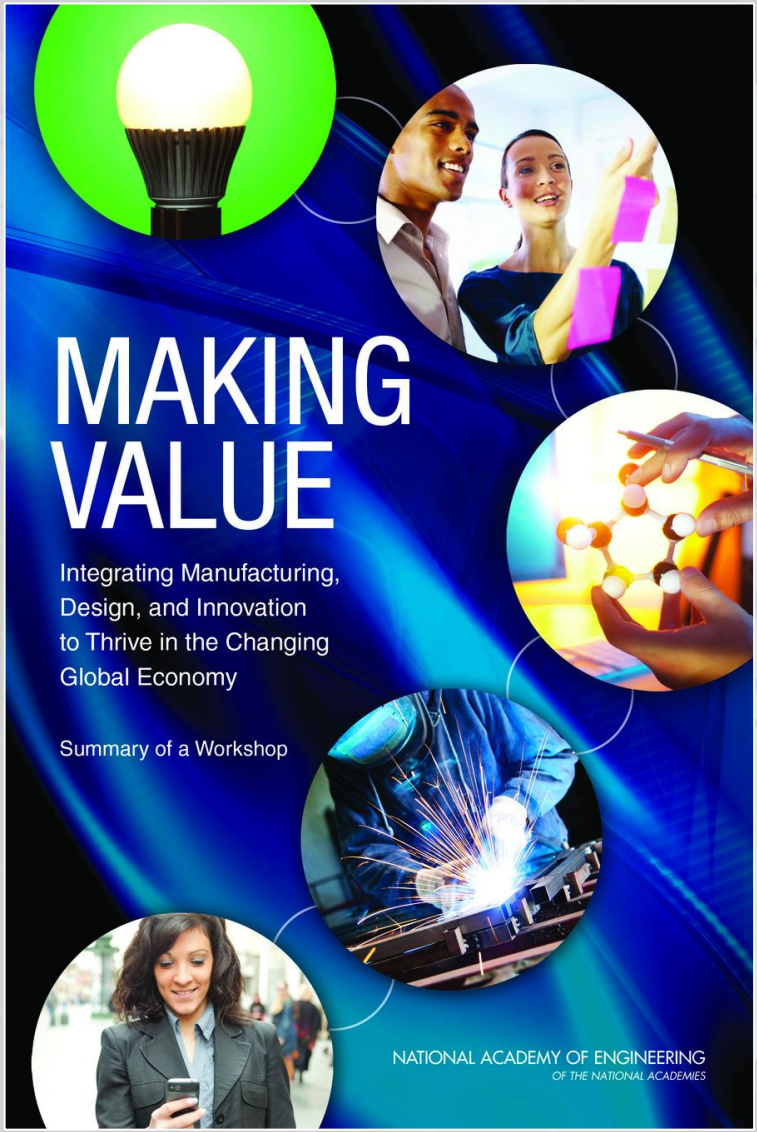
NEED: Coordinated Federal Focus on a National Manufacturing Initiative

Why should we care about US Manufacturing?

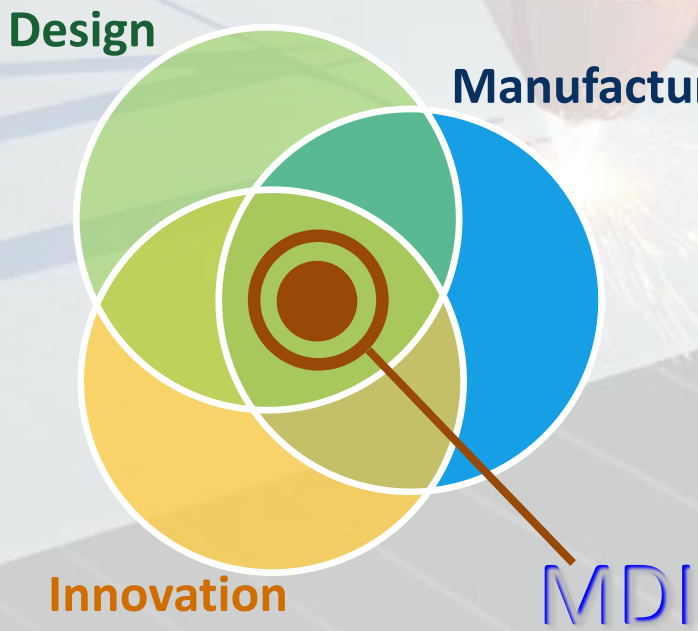
Critical role in U.S. Innovation Ecosystem



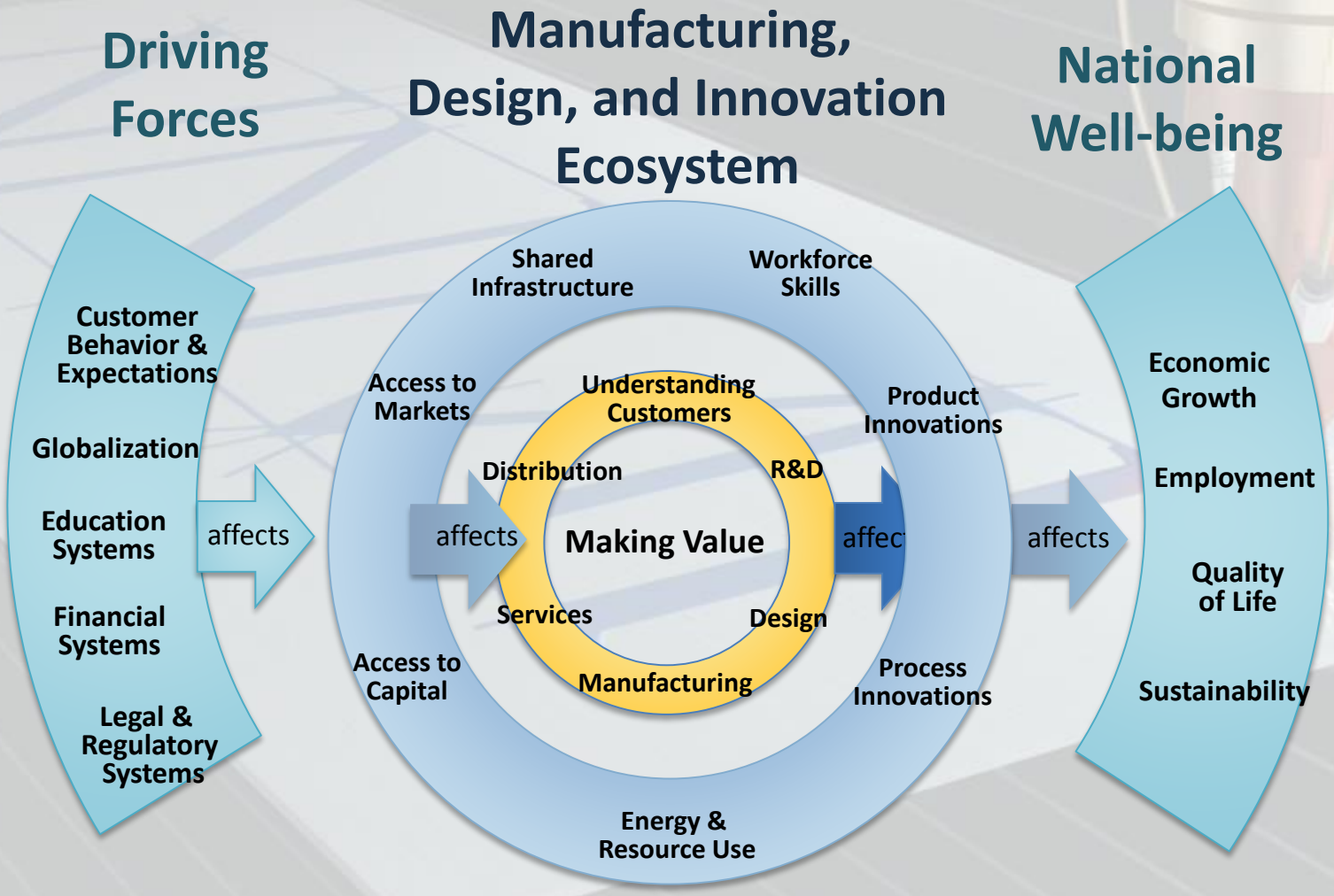
Changing technology *and* business models are transforming *manufacturing, design, innovation*



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



President's Council of Advisors on Science and Technology

Advanced Manufacturing Partnership

BACKGROUND

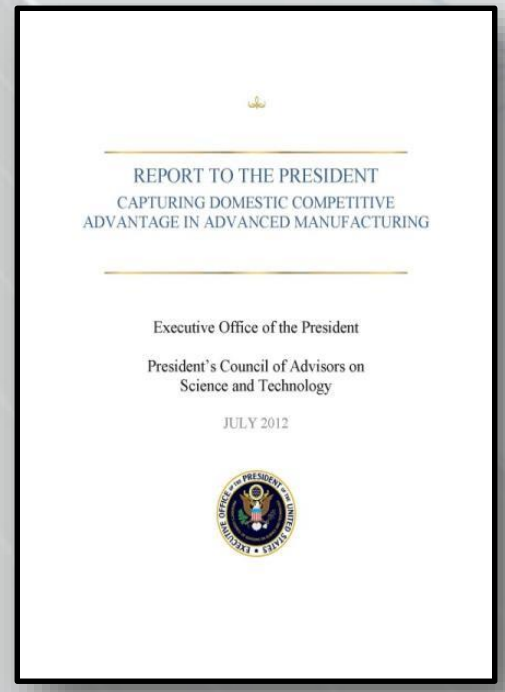
AMP Co-chairs

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 of these recommendations:

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

2) Pursue the "missing middle" via manufacturing innovation hubs ➔ NNMI

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

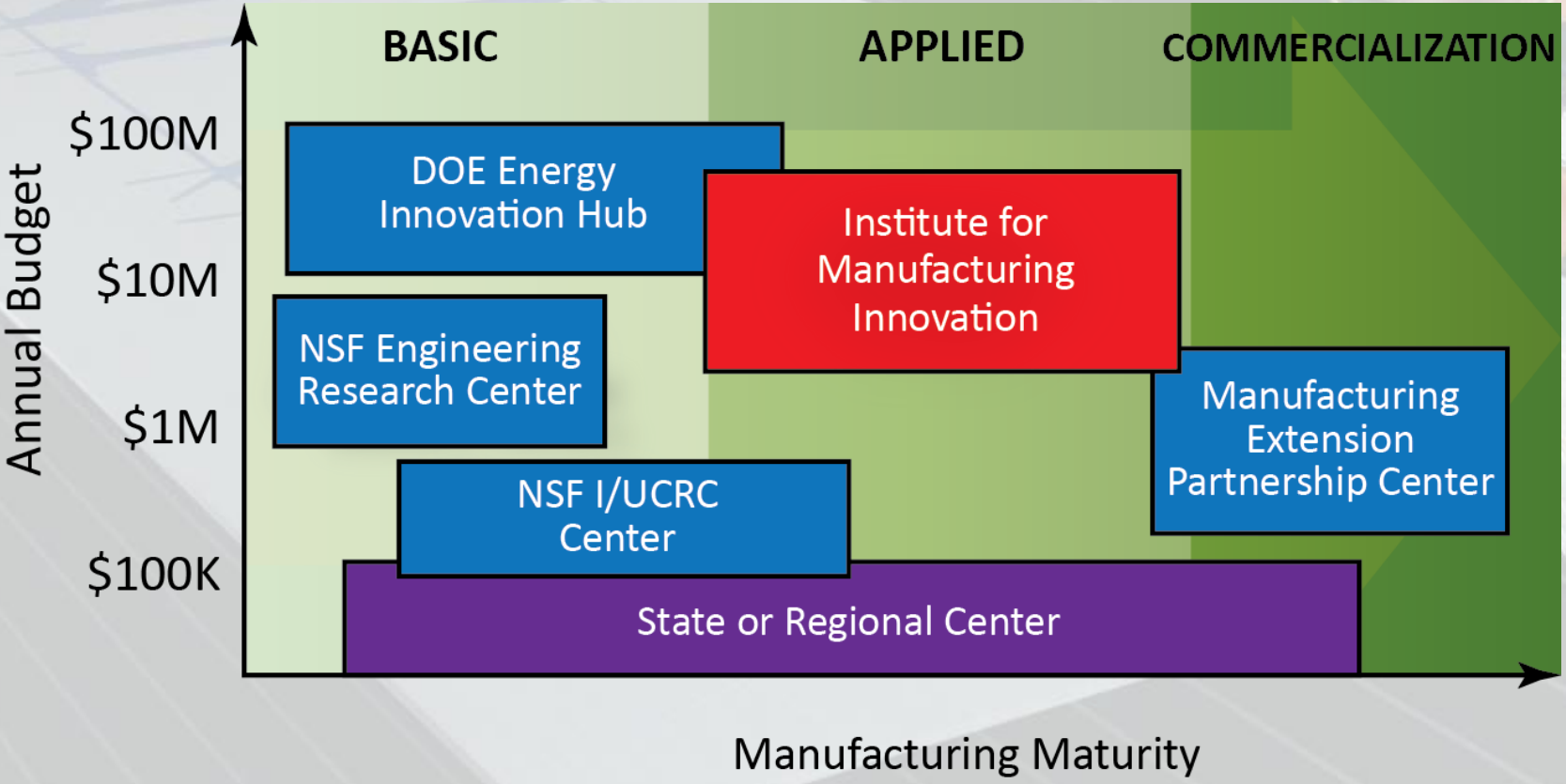
We can't wait to restore US Manufacturing Leadership

Forming the National Network for Manufacturing Innovation (NNMI)

Focus on Scale Up – The Missing Middle

Basic science
Largely government funded

Commercialization
private sector owned/funded

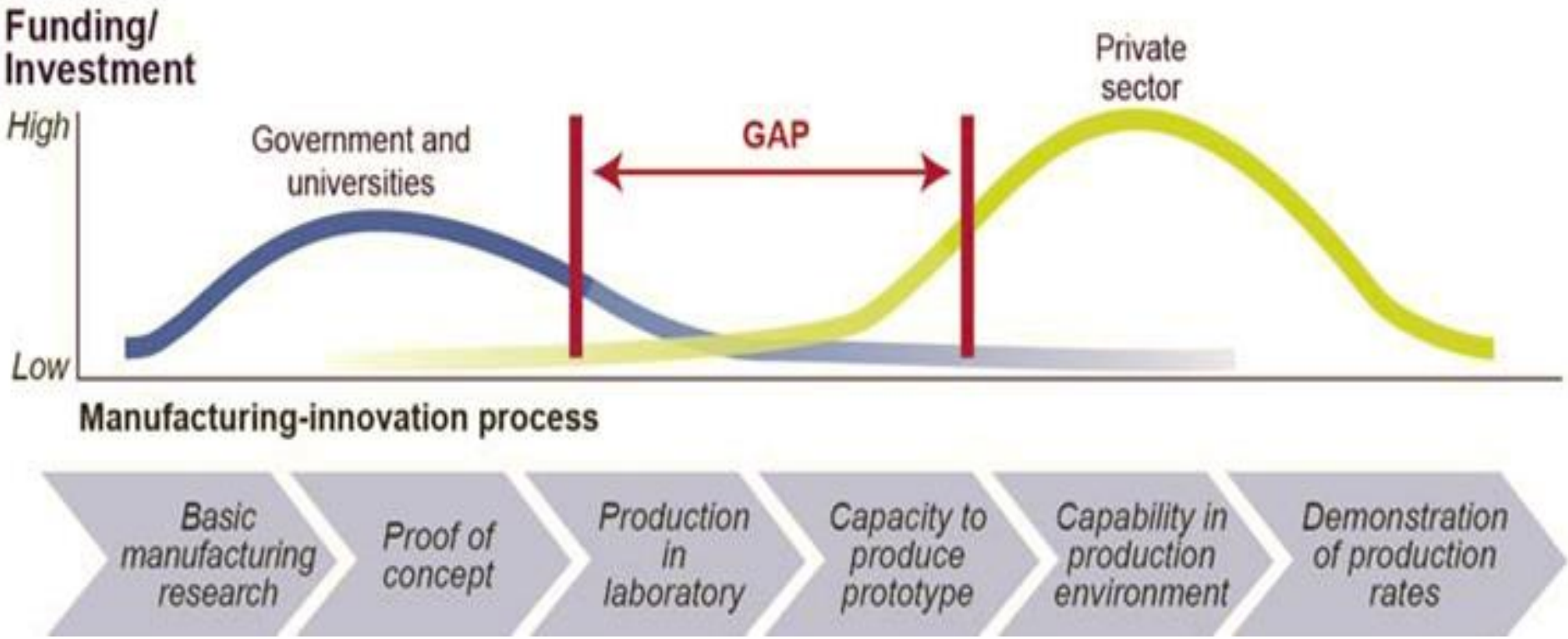


The “Scale-up” Gap or Missing Middle

Common terms
The “valley of death”
The “missing Bell Labs”
The “industrial commons”

Basic R&D

Commercialization



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

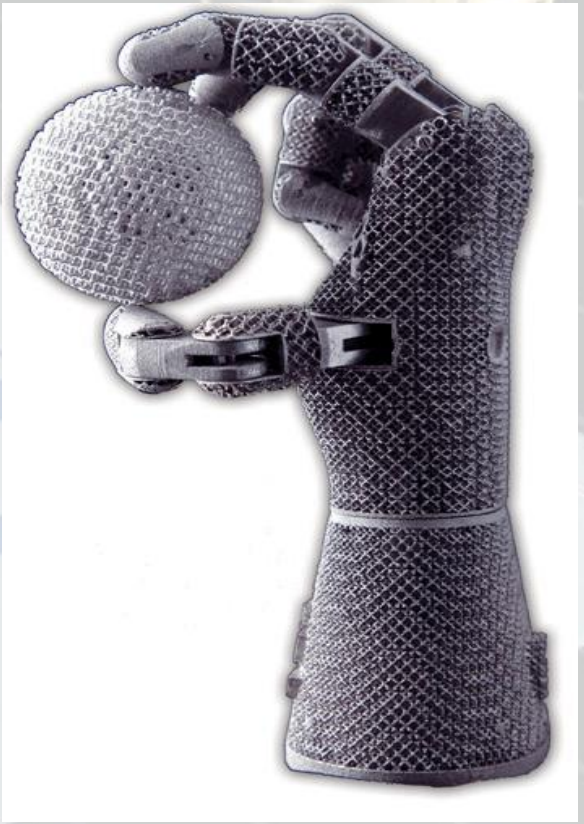
- President asks Congress to authorize initial network of up to 15 Manufacturing Innovation Institutes
- President directs Agencies to work together on Pilot Institute, while designing Institutes with input from Industry and Academia

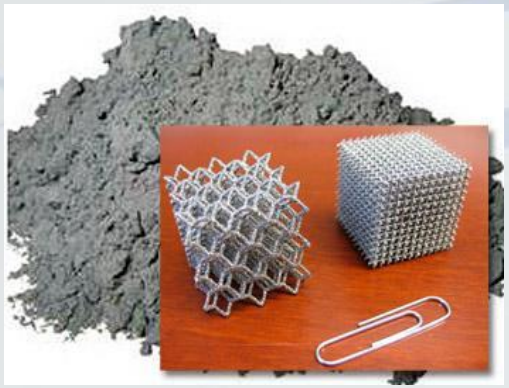
The First Pilot Manufacturing Innovation Institute

Additive Manufacturing/3D Printing – Youngstown OH

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

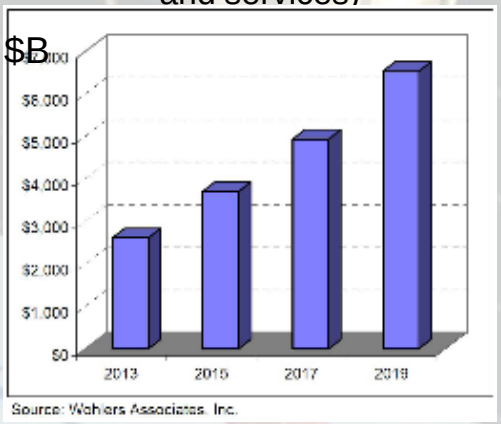




- **Now at $50M federal, $60M co-invested**
- **OVER 100 Participating partners!**

Why Additive Manufacturing?
High Potential for Transformative Impact

Projected AM Sales (products and services)

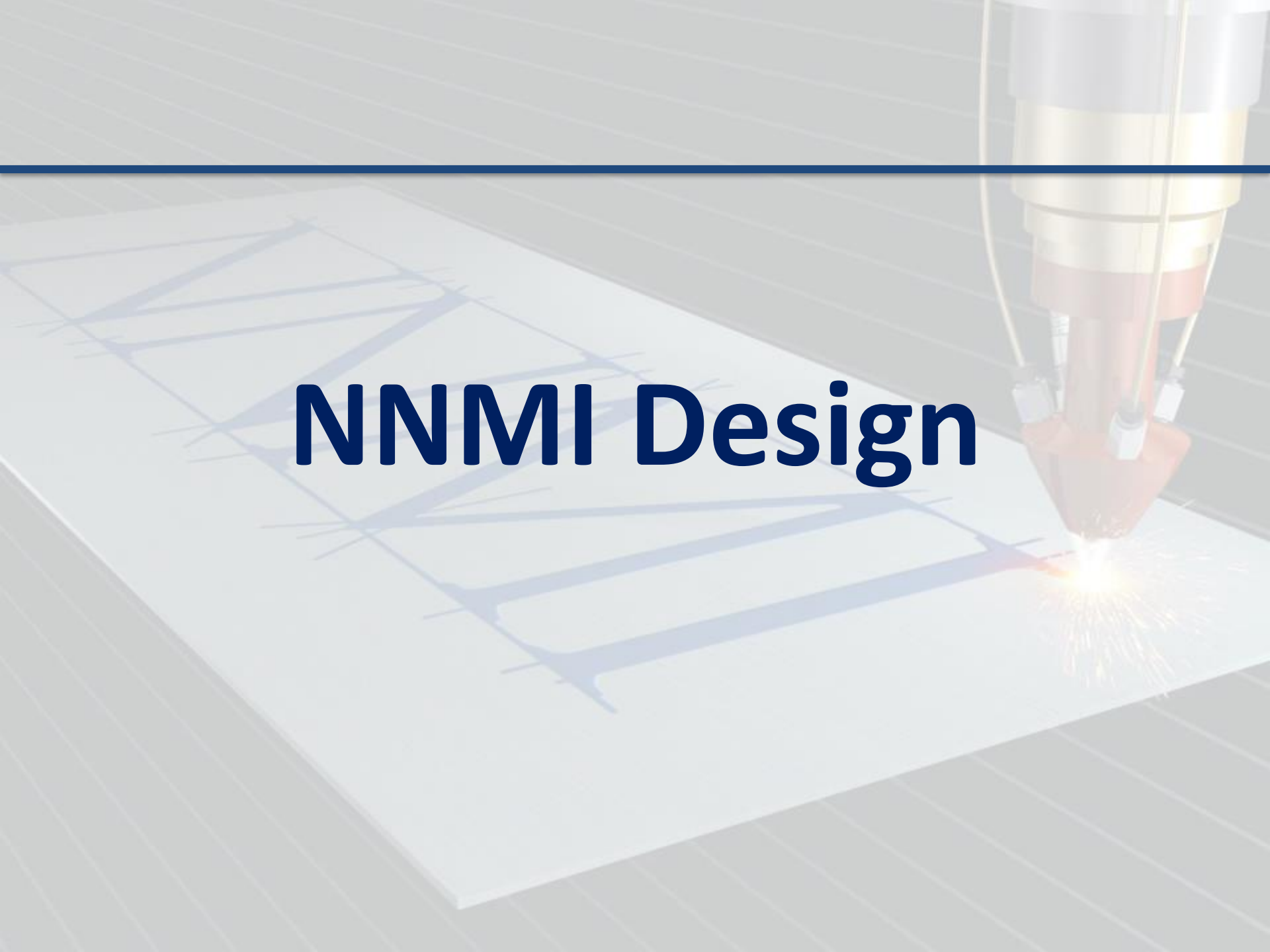


"20% of output of 3D printers is now final products, rather than prototypes. By 2020 it may be 50%." – *The Economist (2011)*

Government agency investments and interest

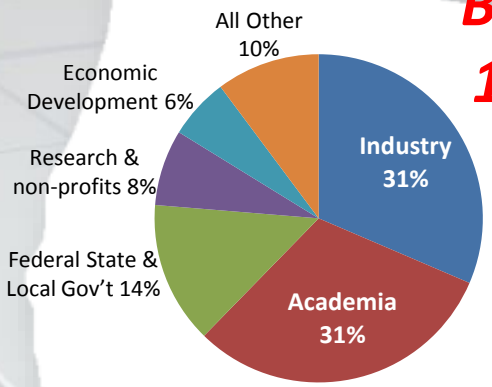
Consumer Product Market

NNMI Design



Public Engagement on Design

Workshops & Request for Information



Broad & Diverse Stakeholder Input

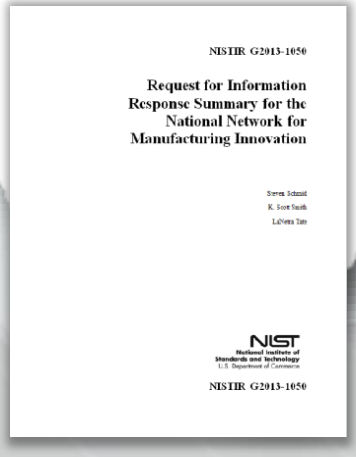
1,200 voices on the NNMI Design!

University of Colorado
Boulder, Colorado

Cuyahoga Community College
Cleveland Ohio

Rensselaer Polytechnic Institute
Troy New York

National Academies Beckman Center
Irvine California


NISTIR G2013-1050

Request for Information Response Summary for the National Network for Manufacturing Innovation

Steven Schmid
K. Scott Smith
LaVera Tate

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

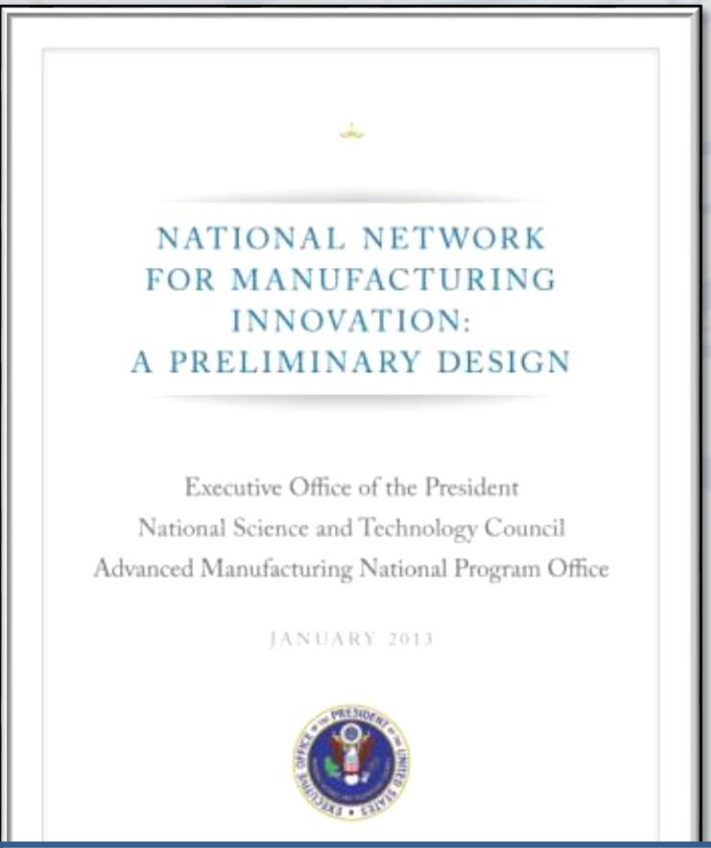
NISTIR G2013-1050

U.S. Space and Rocket Center
Huntsville, Alabama

The Institute Design

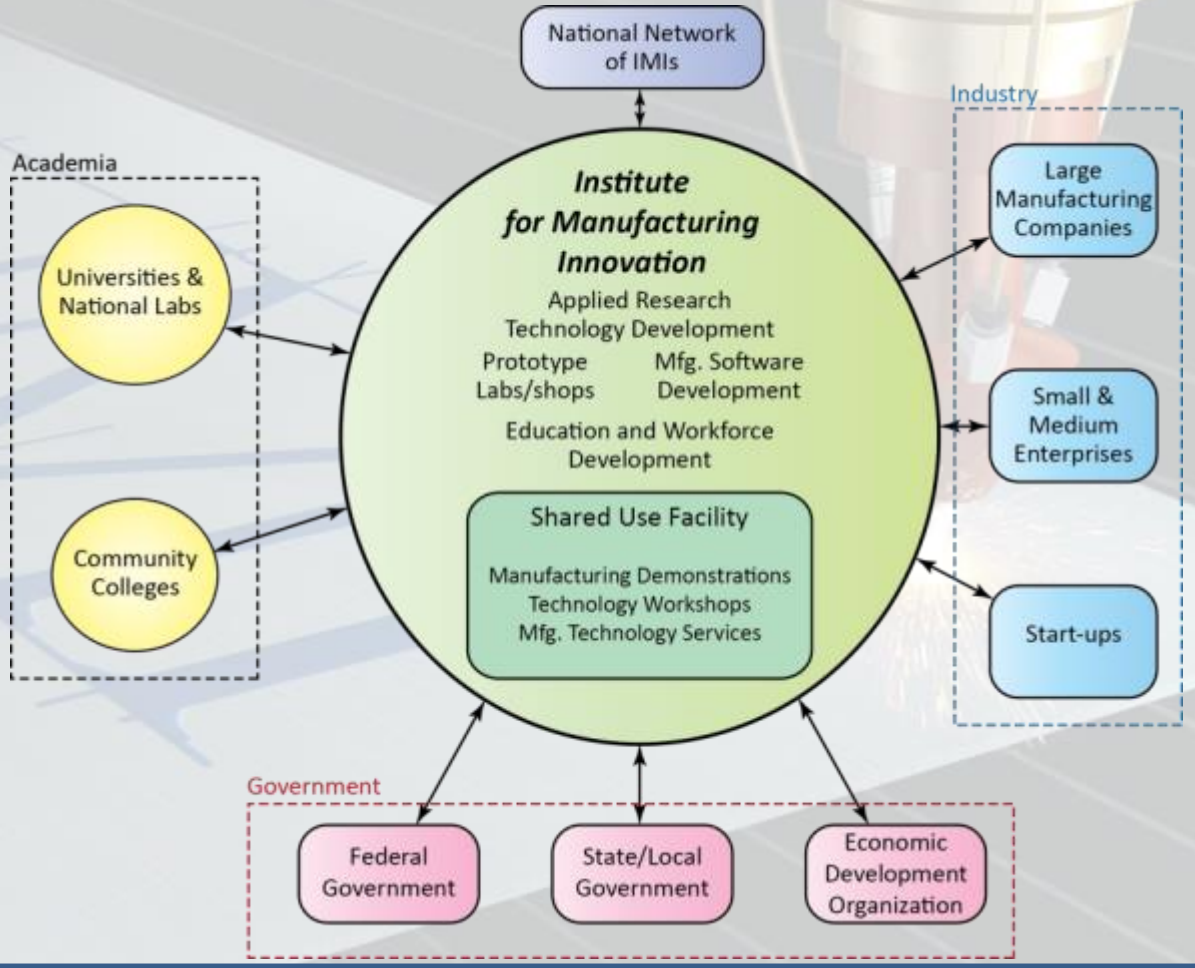
Creating the space for Industry & Academia to collaborate

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



Partnership: *Industry – Academia – Government*

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

Institute Major Activities

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

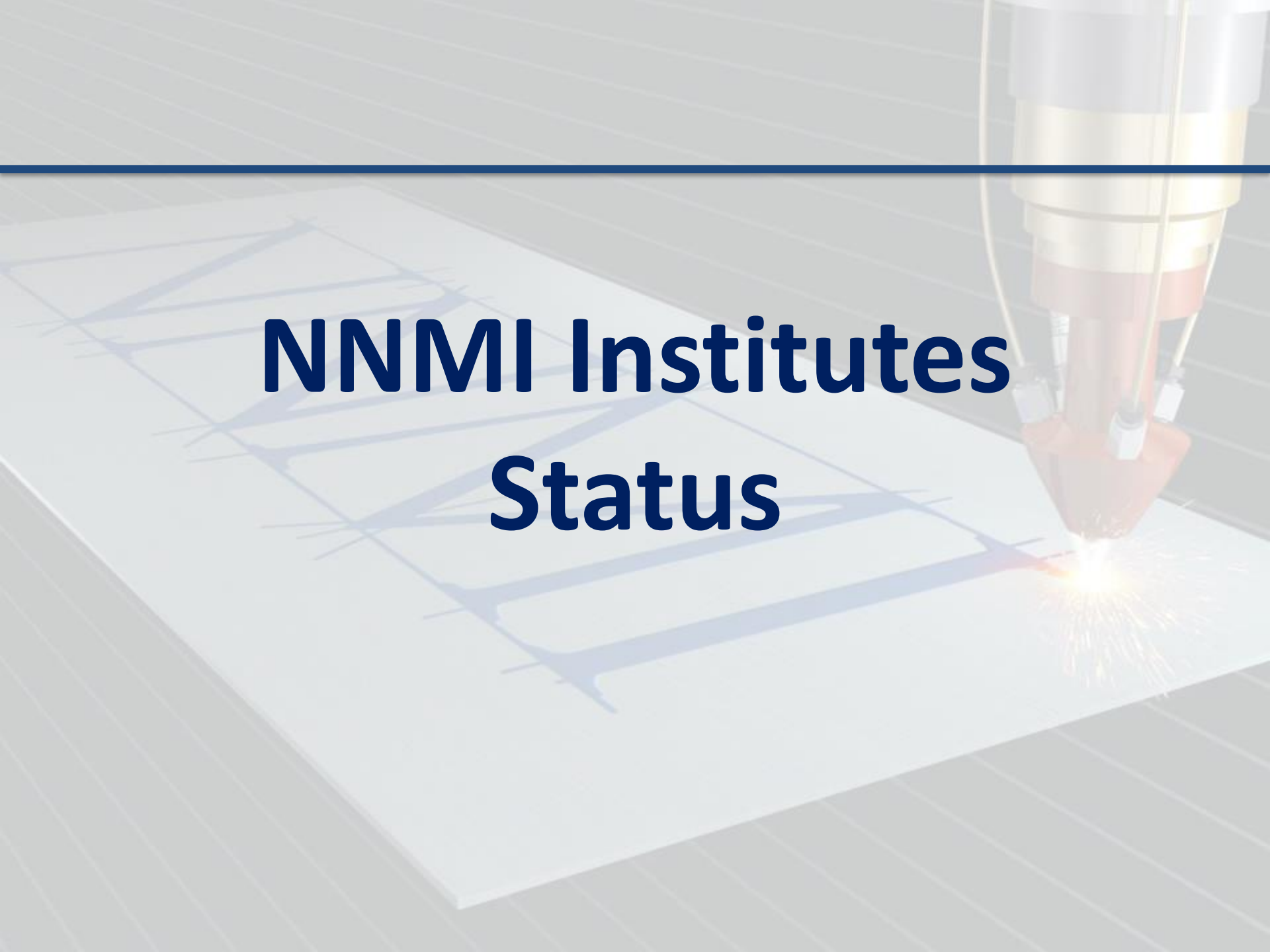
- Engagement with small and medium-sized manufacturing enterprises (SMEs).

Institute

Education, technical skills and Workforce development

Education and training at all levels for workforce development

NNMI Institutes Status



NNMI Vision – 45 institutes

AP Photo/Susan Walsh

"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." July 30, 2013

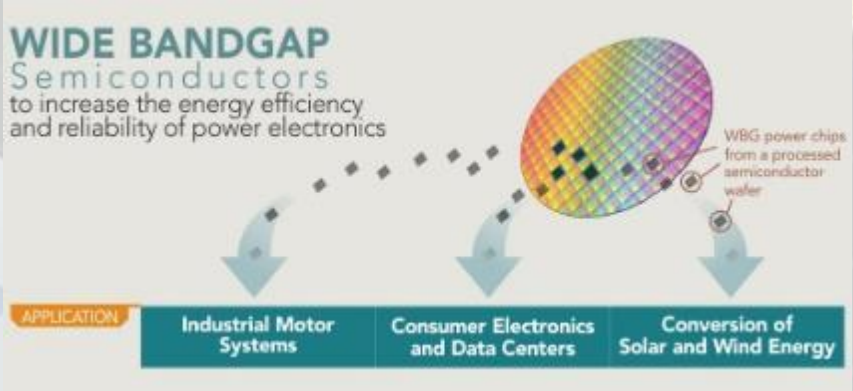
2nd Pilot Institute:
Next Generation Power Electronics

$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

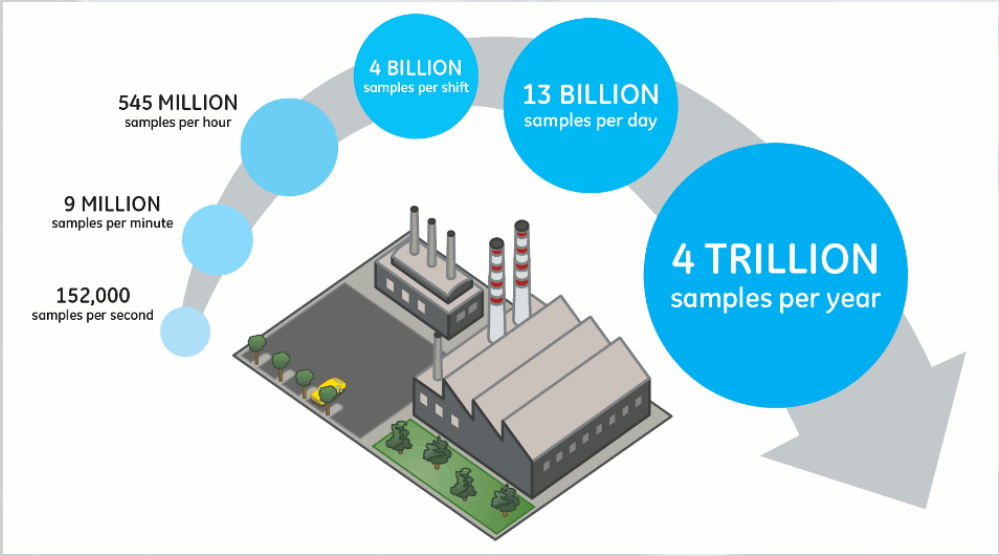
3rd Pilot Institute:
Digital Manufacturing & Design Innovation

$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

4th Pilot Institute:
Lightweight and Modern Metals

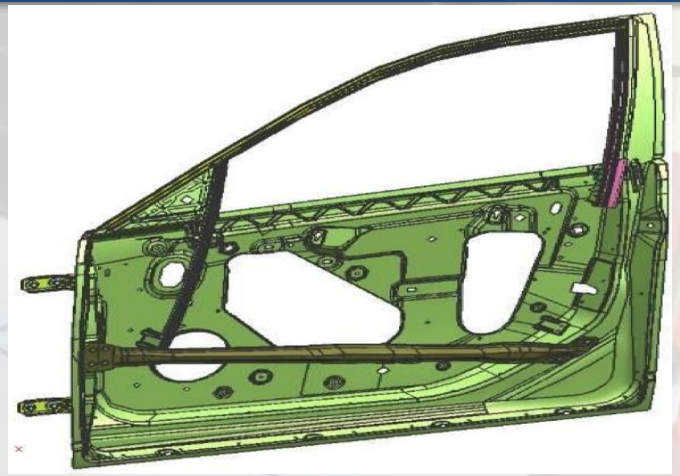
$70M public investment, $70M match

Lead: EWI

Hub location: Detroit, Michigan

Regional location: I-75 Corridor

- **34 Industry Partners**
- **9 Universities and Labs**
- **17 Other Organizations**



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

5th Pilot Institute: *Proposals under evaluation*

Advanced Composites Manufacturing

$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)

6th Pilot Institute Funding Opportunity BAA in 2014
Integrated Photonics Manufacturing Innovation Institute

More than $100M federal investment over five years

Objective

Develop and demonstrate innovative 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.

Revitalize American Manufacturing & Innovation Act of 2014
Status – just passed the House of Representatives

- House (H.R. 2996)
  - Legislation **approved** by the House of Representatives (Sept. 15)
    - 100 cosponsors (49R/51D)

Rep. Tom Reed
R NY-23

Rep. Joe Kennedy
D MA-4

Sen. Sherrod Brown
D Ohio

Sen. Roy Blunt
R Missouri

Senate (S. 1468)

- Passed Sen. Commerce Committee (Apr 9th)
  - 15 cosponsors (7R/7D/1Ind.)

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 Start of a Network…

Additive Manufacturing

Power Electronics

Digital Manufacturing

Lightweight Metals

Adv. Composites Manufacturing

Integrated Photonics Manufacturing

Solicitation TBA

Solicitation TBA

AMP 2.0

Advanced Manufacturing Partnership

President's Council of Advisors on Science and Technology

Advanced Manufacturing Partnership 2.0

Mission: ***Encourage approaches that sustain/grow U.S. leadership in Advanced Mfg.***

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, Northrop Grumman, United Steelworkers USW Métallos, The University of Akron, Georgia Tech, Berkeley University of California, Overland Storage, Michigan, Siemens, Rensselaer

AMP Coordinating Group
DOW, MIT, WH, AMNPO

AMP 2.0 focused on Implementation

kickoff Sept 30, 2013

- Regional engagement and outreach
- Implementation on national initiatives
- Five active Working Teams

AMP 2.0 Regional Meetings [*Hosts*]

- Atlanta, GA – February 3, 2014 [*Georgia Institute of Technology*]
- Akron, OH – April 2, 2014 [*University of Akron / United Steelworkers*]
- Troy, NY – April 24, 2014 [*Rensselaer Polytechnic Institute / Global Foundries*]
- Cambridge, MA – May 16, 2014 [*Massachusetts Institute of Technology*]
- Detroit, MI – June 9, 2014 [*University of Michigan / Northrop Grumman Corporation*]

Final Report October 27, 2014

- 12 key actions
- White House Event
- Public briefing at National Academies

AMP2.0 Recommendations

Pillar 1: ENABLING INNOVATION

- **Recommendation #1**: Establish a **national strategy** for securing U.S. advantage in emerging manufacturing technologies with a specific national vision and set of coordinated initiatives across the public and private sectors and all stages of technology development. This should include **prioritized manufacturing technology areas** of national interest, leveraging the technology prioritization and analysis process developed by the Advanced Manufacturing Partnership, and should facilitate management of the portfolio of advanced manufacturing technology investments.

- **Recommendation #2:** Create an **Advanced Manufacturing Advisory Consortium** to provide coordinated private-sector input on national advanced manufacturing technology research and development priorities.

AMP2.0 Recommendations

Pillar 1: ENABLING INNOVATION

- **Recommendation #3:** Establish a new public-private manufacturing research and development infrastructure to support the innovation pipeline, which complements Manufacturing Innovation Institutes at earlier and later technology maturation stages, through the creation of **manufacturing centers of excellence** (MCEs) and **manufacturing technology testbeds** (MTTs) to provide a framework that supports manufacturing innovation at different stages of maturity and allows small and medium-sized enterprises to benefit from these investments.

- **Recommendation #4:** Develop processes and standards enabling **interoperability** of manufacturing technologies; **exchange** of materials and manufacturing process information; and **certification** of cybersecurity processes for developers of systems.

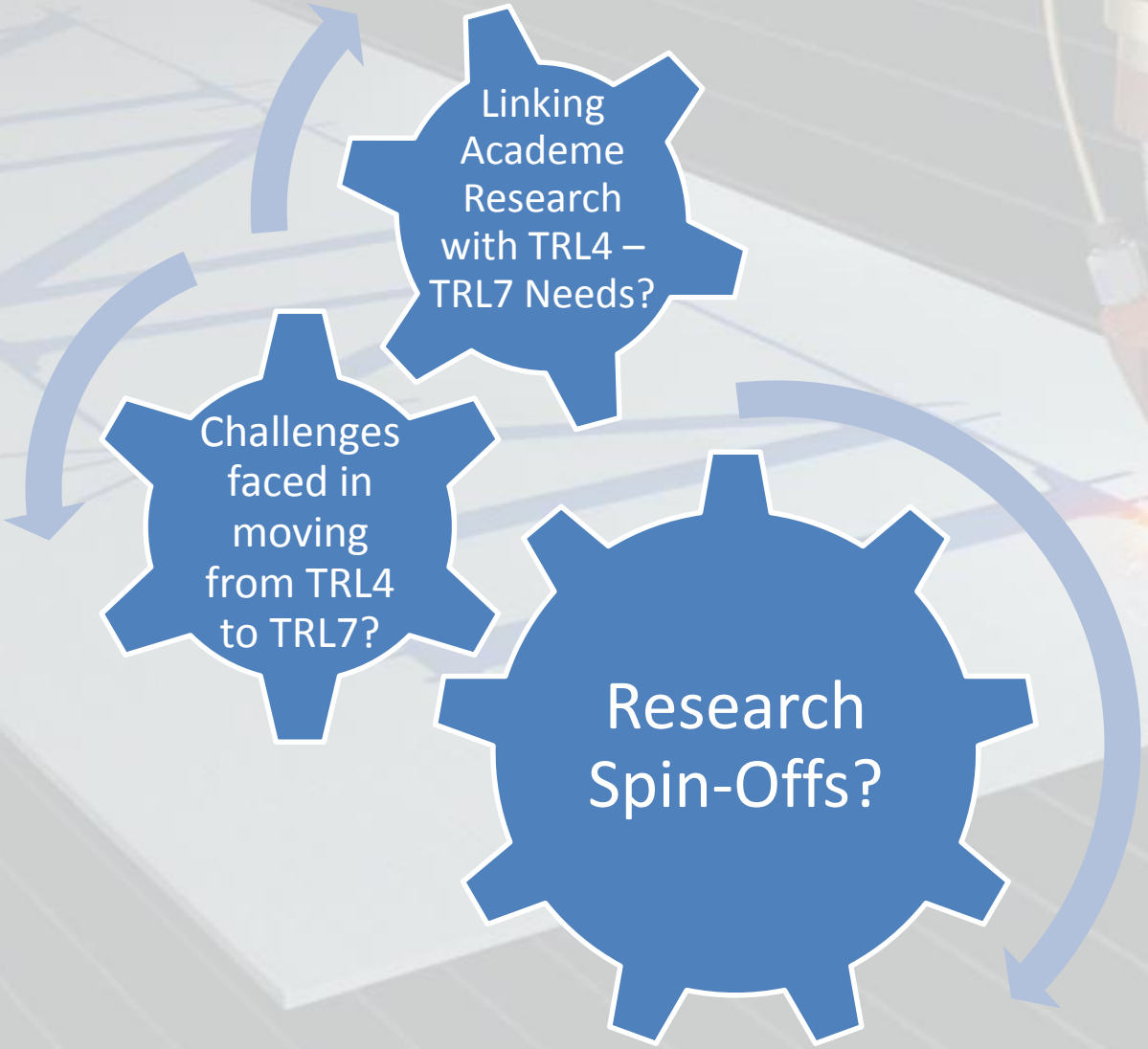
AMP2.0 Recommendations

Pillar 1: ENABLING INNOVATION

- **Recommendation #5:** Create – through the National Economic Council, the Office of Science and Technology Policy, and the implementing agencies and departments – a shared National Network for Manufacturing Innovation **(NNMI) governance structure** that can ensure a return on investment for the NNMI's many stakeholders by including input from various agencies as well as private sector experts, organized labor and academia.

Addressing the Nation's Advanced Manufacturing Needs

– Academe Research versus R&D –



Addressing the Nation's Advanced Manufacturing Needs

– Leveraging Resources –

Leveraging Funding & Resources

Gov., VC funding?

University IP Commercialization Funds?

State Innovation & Capitalization funds?

Scale-up?

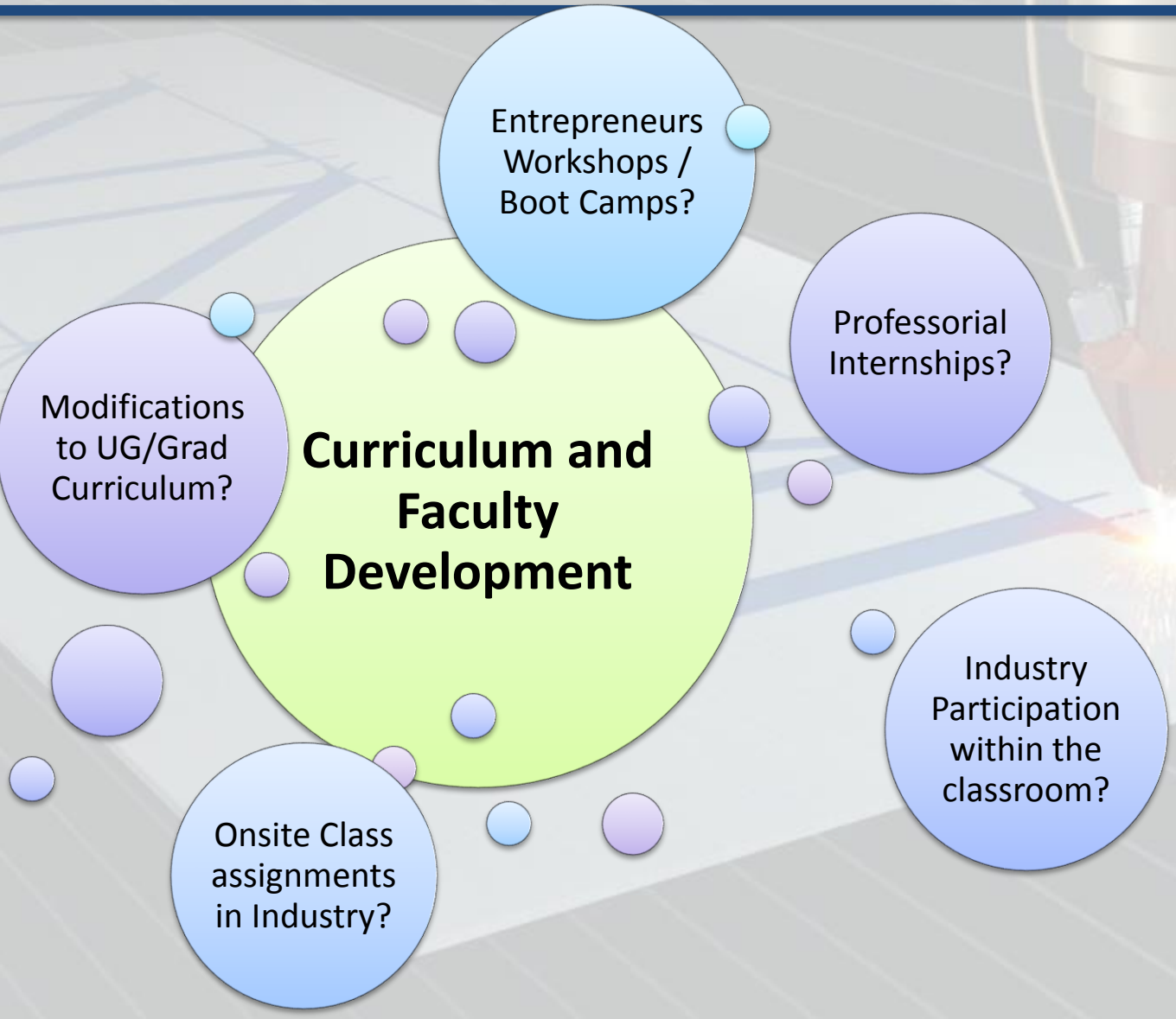
Incubators,

Innovation Hubs,

Thematic Accelerator Sites

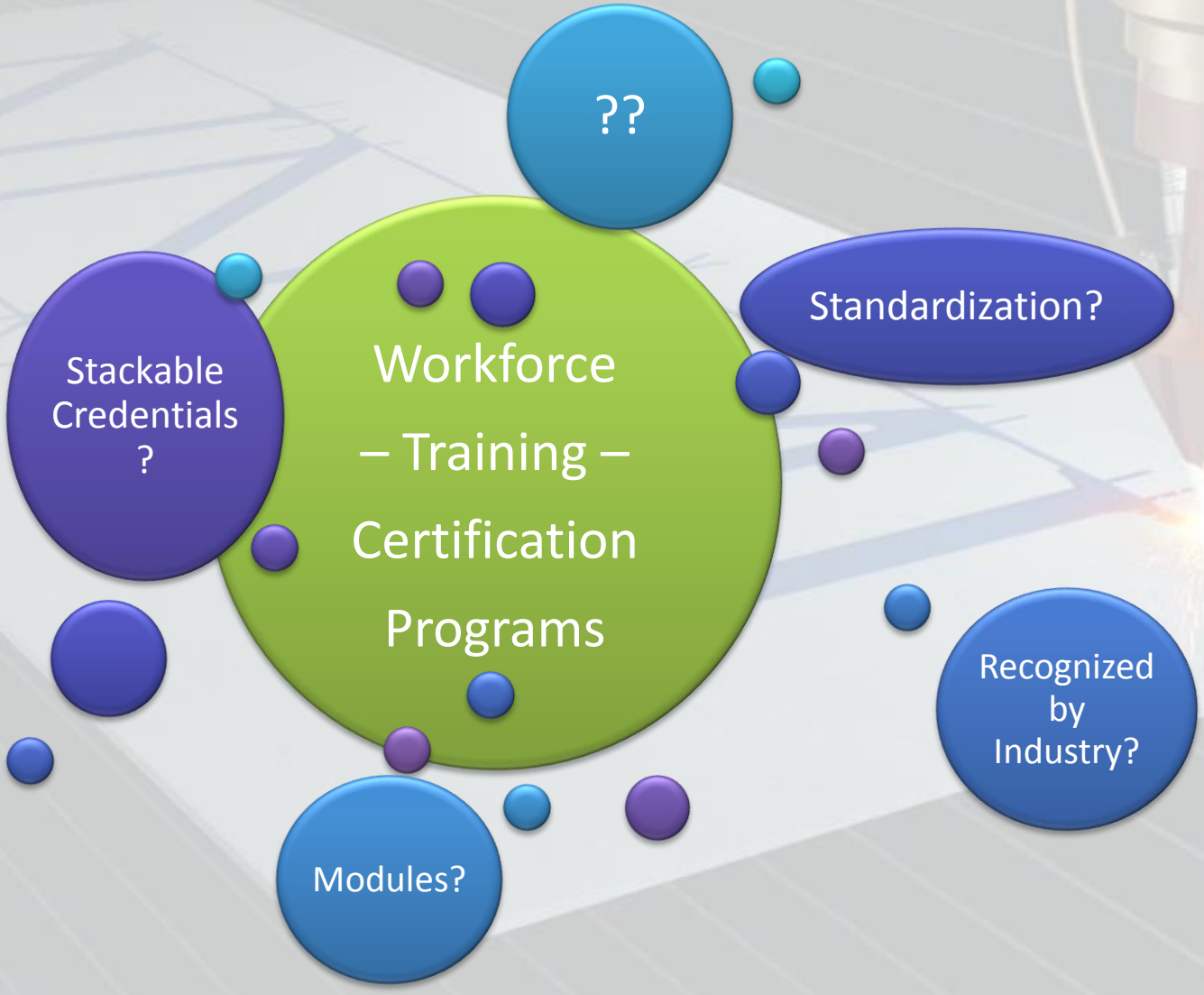
Addressing the Nation's Advanced Manufacturing Needs

Industry Needs to Future Curriculum and Faculty



Addressing the Nation's Advanced Manufacturing Needs

Workforce Skills Standards to new Programs & Modules



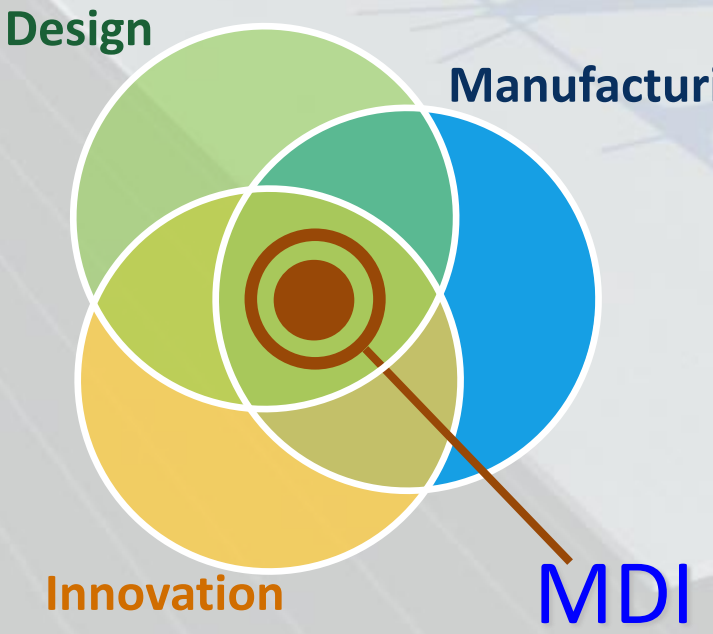
Addressing the Nation's Advanced Manufacturing Needs

– Academe Engagement –

Outreach & Service Activities

- Via NNMI's, MEP, Etc.
- AMP Initiatives
- Manufacturing Image

Benefits – Visibility & Networking



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

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