DoD Manufacturing USA Institutes

Presentation to International Economic Development Council

Manufacturing Matters Breakout Session

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Manufacturing and Industrial Base Policy, ODASD(MIBP)

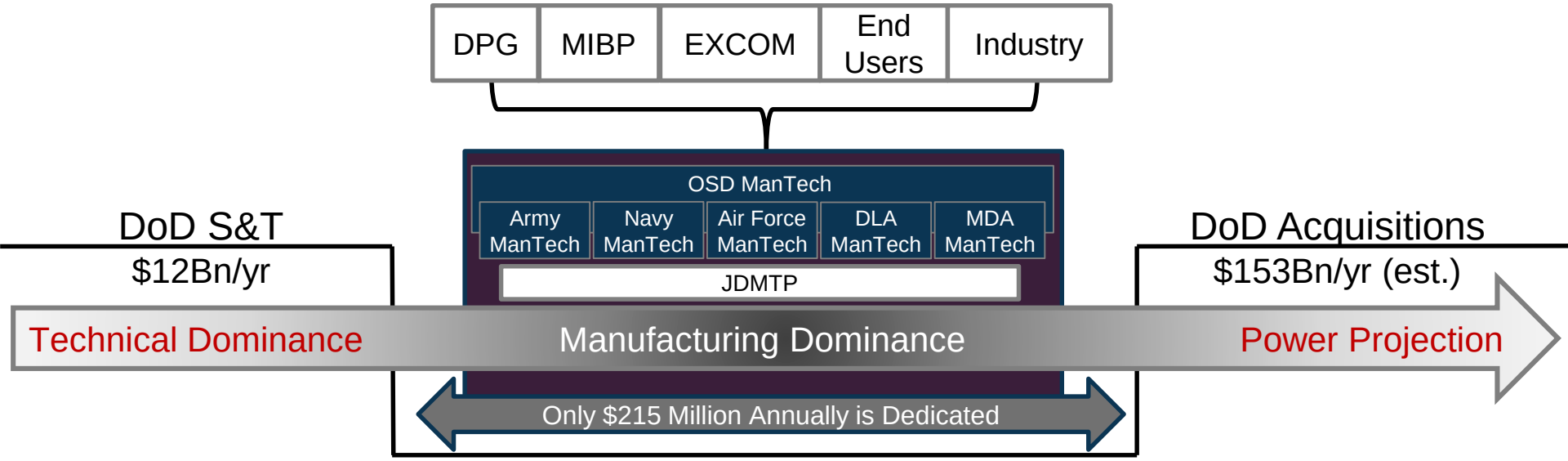
MIBP Capabilities and Programs that support the defense industrial base across the DoD acquisition lifecycle

Strengthen the industrial base that supports the Warfighter

OSD ManTech:

The Power to Connect and Drive Transition

- **Convenes the Services and Agencies for DoD ManTech strategic plan.**
- **Positioned to operate across and coordinate the manufacturing enterprise.**
- **Focuses S&T priorities and responds to operational shortfalls to create Warfighter capabilities**
- **Highly leveraged to maximize resources to improve capability and reduce cost.**



DoD Institutes Introduction

Overview

WHY

The U.S. is not doing well in the Global Economy, and needs a reinvigorated Manufacturing Sector that includes a strong Defense Industrial Base.

HOW

Transform manufacturing in the U.S. through innovative, coordinated:

- ***Technology Development***
- ***Technology Transition and Dissemination***
- ***Workforce & Educational Outreach***

WHAT

Increase the yield of innovative products and increased domestic manufacturing competitiveness.

Collaborate ~ Innovate

International Manufacturing Innovation Programs

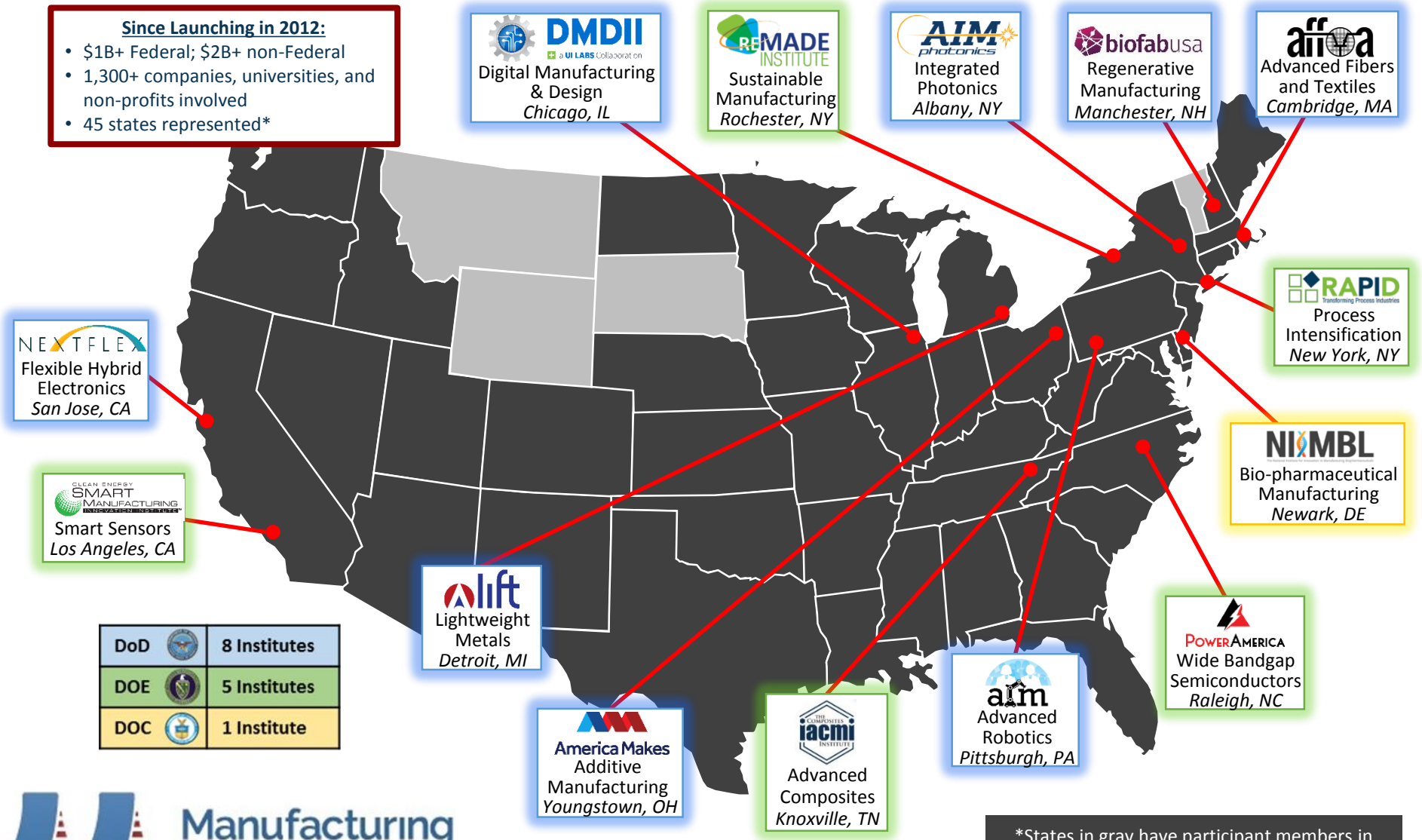
Attribute	MfgUSA	Fraunhofer	Catapult* HVM	IMEC	A*Star	ITRI	MIC
Owner	Government Agencies	Fraunhofer Society	Innovate UK	Non Profit	Govt. of Singapore	Non Profit	Government of China
Type of governing organization	Non Profit	Non Profit	Non Profit	Non Profit	Autonomous Government	Non Profit	Government
Country	USA	Germany	UK	Belgium	Singapore	Taiwan	China
Est 2017 GDP (US$ Billions)	19,417	3,423	2,496	426	292	566	11,795
Percent GDP From Mfg	12%	23%	10%	14%	20%	29%	23%
# of Institutes	14	69	7	9	18	6	2
Yr. started	2012	1949	2011	1984	1991	1973	2016
Est. Total Budget/year (USD millions)	$330	$2,482	$ 287	$426	$163	$570	NA
Research done by institute and partners**	Partners only	Yes	Yes	Yes	Yes	Yes	NA
Index/Mfg GDP	1.0	22.3	8.1	50.4	19.8	24.5	NA
Government direct support after 5 Y	0%	33%	33%	15%	15% - 100%	25%	NA
Government Indirect support (Competitive Projects)	NA	33%	33%	NA	NA	0%	NA

DoD Institutes Introduction

All Current Manufacturing USA Institutes

Since Launching in 2012:

- $1B+ Federal; $2B+ non-Federal
- 1,300+ companies, universities, and non-profits involved
- 45 states represented*



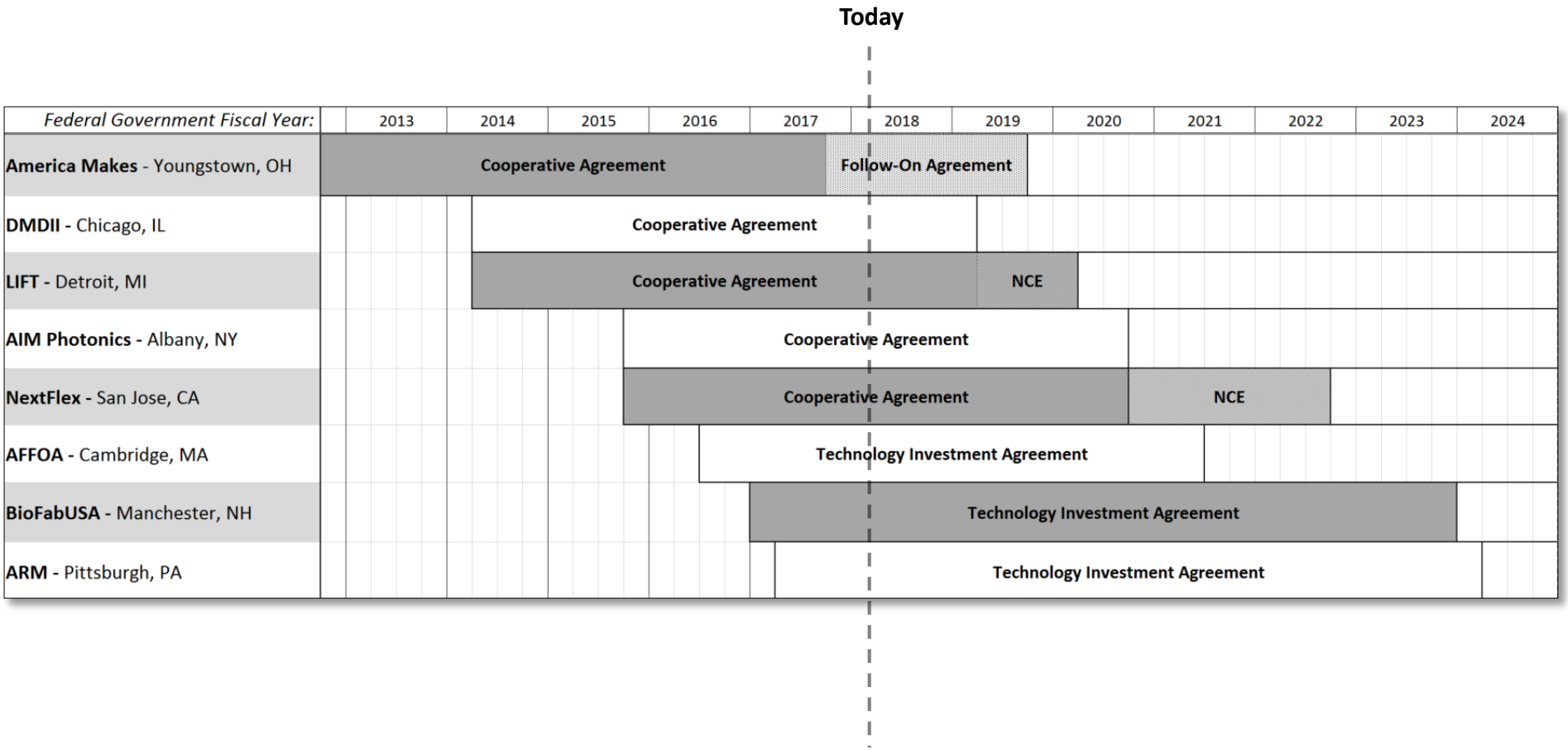
DoD	8 Institutes
DOE	5 Institutes
DOC	1 Institute

Manufacturing USA®

https://www.manufacturingusa.com/institutes

*States in gray have participant members in *Manufacturing USA* Institutes

Initial Assistance Agreements



DoD Institutes Introduction

DoD Institutes Design Tenets

- Industry driven, public-private partnerships
- Regional hubs of manufacturing excellence
- Investments in applied research and industrially-relevant manufacturing technologies
- Required focus on education and workforce development needs

Tenets meet key DoD ManTech requirements and are aligned with Manufacturing USA

Manufacturing USA Institute Success

Technology Innovations & Ecosystem Growth

Fast Facts*

1291	Total number of institute members from industry (large, midsize, and small manufacturers), academia, non-profits, and other entities
273	Total number of technology R&D projects ongoing
$298.5M	Total institute expenditures in the fiscal year

***As of FY17**

Manufacturing USA Institute Success

Education and Workforce Development

2018 SCIENCE + INNOVATION AWARDS

Fast Facts*

OPERATION NEXT POWERED BY lift

185,425	Number of students participating in institute projects or institute internship programs/training
4,302	Number of individuals in the workforce completing a certificate, apprenticeship or training program led by the institutes
1,299	Number of teachers or trainers participating in institute-led training

America Makes ACADEMI

*As of FY17

Manufacturing USA Success

Organizational Relationships

Deloitte Report Extract:

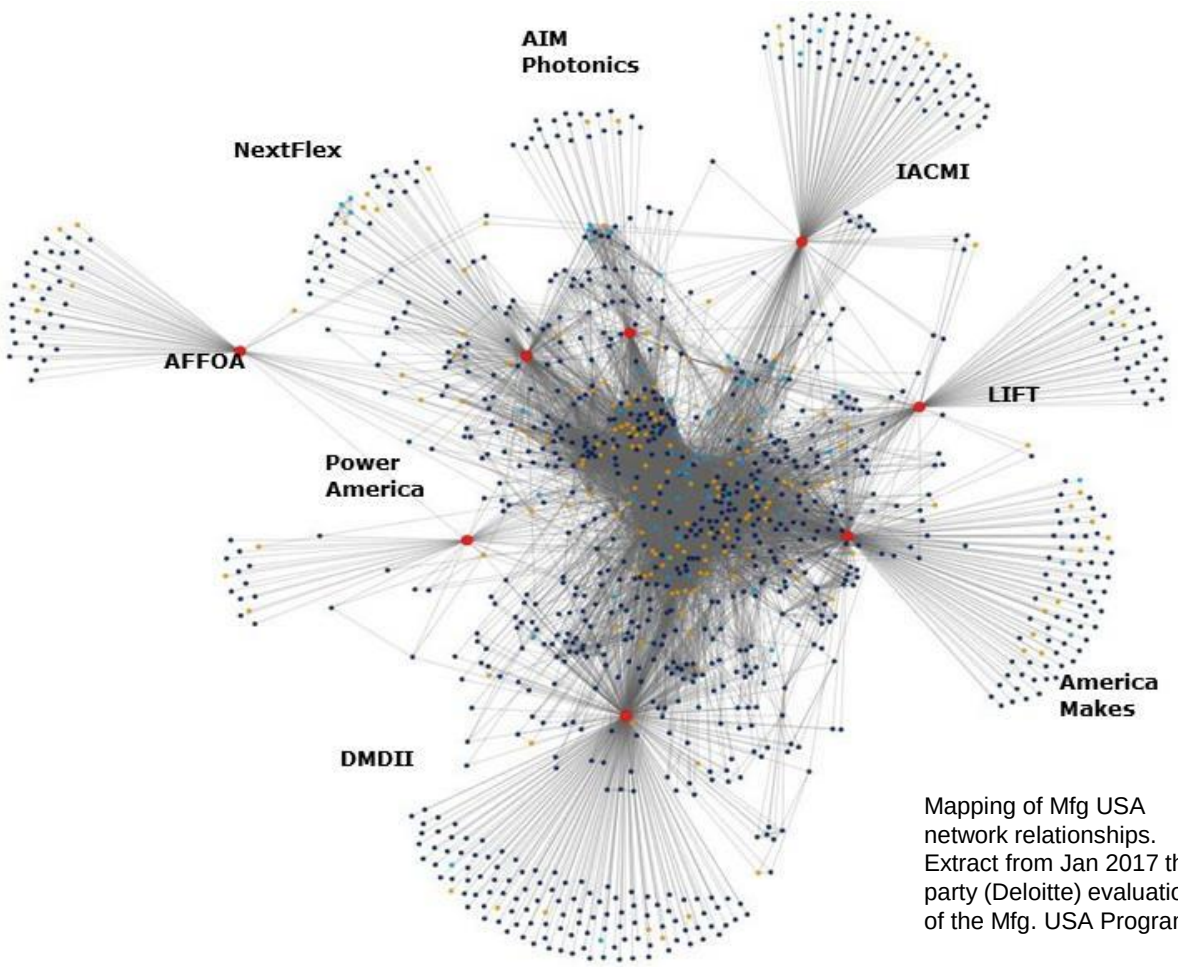
9,424
Relationships between organizations

1,174
Organizations involved with the program

753
Organizations with formal membership

203
Organizations have relationships with multiple institutes

120
Organizations are members of more than one institute



Mapping of Mfg USA network relationships. Extract from Jan 2017 third party (Deloitte) evaluation of the Mfg. USA Program.

Together, the Institutes' convene **nearly 1,200 organizations** in an inter-industry network comprised of **9,000+ organization relationships**

Manufacturing USA Success

Summary

- ✓ Helping to bridge the gap between basic research and product development/fielding
- ✓ Providing DoD with access to key, domestic enabling technologies
- ✓ Advancing manufacturing innovation for specific, focused technology areas
- ✓ Ensuring a strong ecosystem of companies and organizations
- ✓ Maintaining close manufacturing partnering relationships
- ✓ Providing shared assets among MII member organizations; key benefit for small and medium enterprises
- ✓ Creating an environment to develop the skills and educate/train the workforce

Collaborate ~ Innovate

Manufacturing USA Engagement

Opportunities

- ✓ Project Funding
- ✓ Vast Networks
- ✓ Workforce Readiness
- ✓ Technology Transition

DoD's Manufacturing USA Institutes spur innovation, performance, and competitiveness for businesses across the U.S. industrial base.

Manufacturing USA Engagement

Membership Value for Small Businesses

Each institute offers exclusive membership benefits including:

- Participation in project reviews
- Access to institute technical information and reports
- Access to education and workforce development programs
- Access to a Technical Help Desk
- Invitations to institute networking events
- Access to “Member’s Only” website and shared space
- Access to manufacturing equipment

DoD Manufacturing USA Institutes
"Quick Start" Engagement Guides

Four tailored "quick-start" guides, each focused on a major user or stakeholder group:

1. Federal Agencies
2. U.S. Manufacturers
3. Academic Institutions
4. State & Local Governments

Technology Transition and Commercialization Community of Practice (TTAC CoP)

CURRENT LANDSCAPE AND NEED

- Basic Research
- SBIR Phase I
- ManTech
- MD5
- Darpa

Basic Research/Proof of Concept TRL/MRL 1-3

- Manufacturing USA
- SBIR Phase II
- ManTech
- Mentor Protégé
- Emerging Capabilities & Prototyping
- Defense Production Act Title III
- IBAS

Technology Development/Prototype TRL/MRL 4-6

- Rapid Innovation Fund
- Mentor Protégé
- Defense Production Act Title I/III
- Acquisition Programs
- IBAS

Completed System/Commercialization TRL/MRL 7-9

TRL 1	TRL 2	TRL 3	TRL 4	TRL 5	TRL6	TRL 7		TRL 8	TRL 9
MRL 1	MRL 2	MRL 3	MRL 4	MRL 5	MRL6	MRL 7	MRL 8	MRL 9	MRL 10
Pre-Concept	Concept Refinement	Technology Development	Engineering & Manufacturing Development					Production & Deployment	Operations & Support

Program Maturity

Technology Transition and Commercialization Community of Practice (TTAC CoP)

Institutionalizes increased collaboration and rigor in technology transition and commercialization activity across the Department of Defense to best utilize taxpayer dollars, achieve the greatest return on investment, and provide the best capability for the warfighter.

GOALS AND OBJECTIVES

Guide Transition of Technology	• Understand best practices • Capture lessons learned
Shared Technology Transition Tools	• Create access to shared tech transition tools • Jointly develop transition tools
Develop Standards and Metrics for Transition Outputs	• Jointly develop a common architecture for measuring tech transition outputs
Technology Transition Strategic Planning	• Shared templates for transition planning • Coordinated closing of gaps • Data repositories

Questions?

For more information on the DoD Manufacturing USA Institutes:

http://www.businessdefense.gov/Programs/Manufacturing-USA-Institutes/

For more information on the Manufacturing USA Program:

https://www.manufacturingusa.com/

Back Up Slides

America Makes

FOUO

The National Additive Manufacturing Innovation Institute – Youngstown, OH

America Makes

Established: August 2012
Hub Location: Youngstown, Ohio
Lead: National Center for Defense Manufacturing and Machining (NCDMM)
Regional Location: "TechBelt" Cleveland to Pittsburgh Corridor & El Paso, Texas Region

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

- $55M federal investment and 1:1 cost share pledged to support development and management of the institute plus applied research projects over 5 years
- Strong tech transition, workforce education & STEM focus

https://www.americamakes.us/

Manufacturing USA®

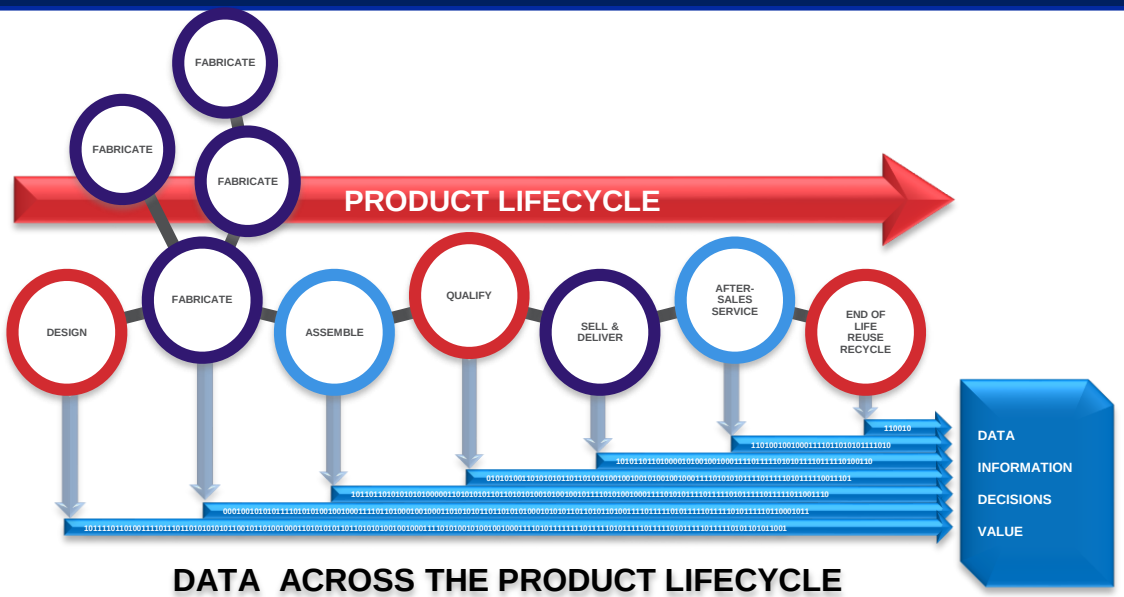
DMDII

Digital Manufacturing & Design Innovation Institute – Chicago, IL

FOUO

DMDII
a UI LABS Collaboration

Established: February 2014
Hub Location: Chicago, Illinois
Lead: UI LABS
Federal Funding: $70M
Cost Share (UI Labs): $106M



DATA ACROSS THE PRODUCT LIFECYCLE

Mission: Digitize American Manufacturing

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**

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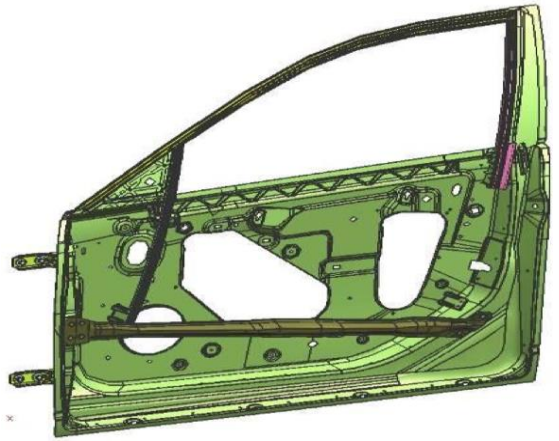
LIFT

Lightweight Innovations for Tomorrow – Detroit, MI

Established: February 2014
Hub Location: Detroit Metro, Michigan
Lead: ALMMII (American Lightweight Materials Manufacturing Innovation Institute)
Regional location: I-75 Corridor
Federal Funding: $70M
Cost-Share: $78M

Positioned to expand the US Industrial base for new products and technologies for commercial and USG demands that utilize new, lightweight high-performing metals



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.

AIM Photonics

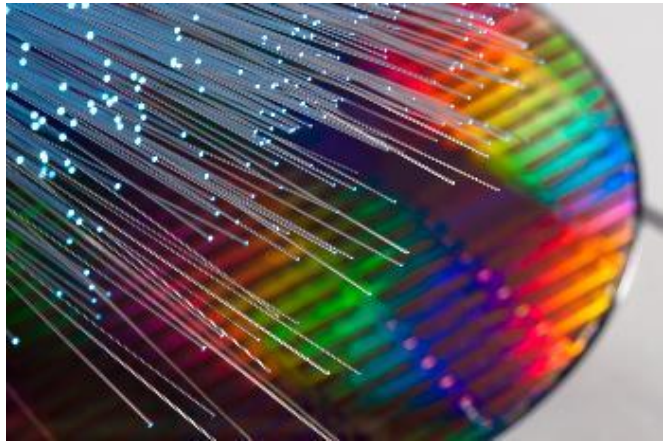
American Institute for Manufacturing Integrated Photonics - Rochester, NY

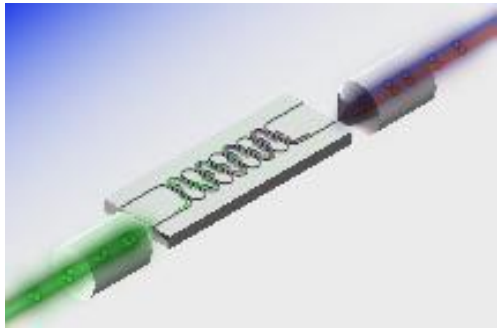
Established: July 2015
Hub Location: Albany & Rochester, NY
Lead: RF SUNY
Federal Funding: $110 M
Industry Cost Share: $502 M

Objective: Develop & 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 focuses 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.

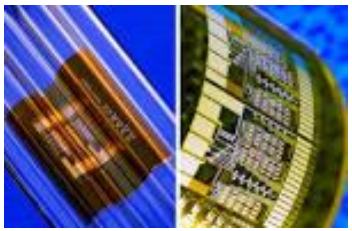


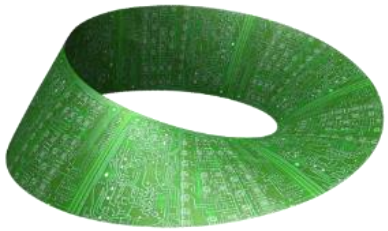


All these developments will require cross-cutting disciplines of design, manufacturing, packaging, reliability and testing.

NextFlex

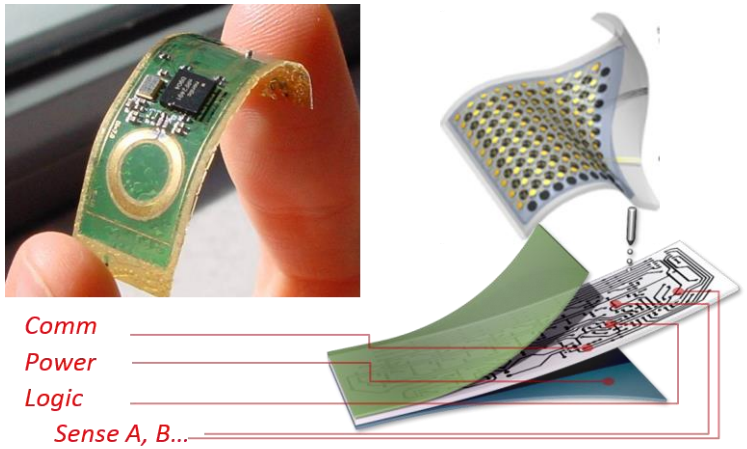
Flexible Hybrid Electronics Manufacturing Innovation Institute – San Jose, CA





Established: August 2015
Hub Location: San Jose, California
Lead: FlexTech Alliance
Federal Funding: $75 M
Industry Cost Share: $96 M

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
Wearable Technologies	Warfighter information devices and sensors
Internet of Things	Unattended sensors, vehicle borne sensors
Medical (prosthetics, medical sensing)	Warfighter Training and performance monitoring. Soldier medical care

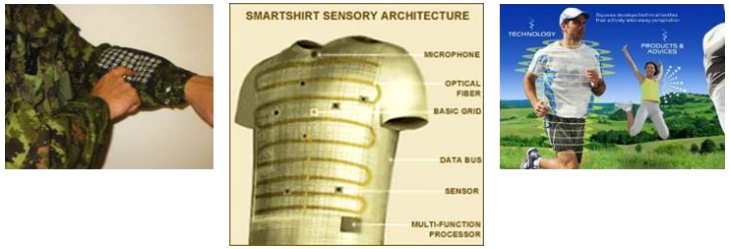
AFFOA

Advanced Functional Fabrics of America – Cambridge, MA

Established: April 1, 2016
Hub Location: Cambridge, Massachusetts
Lead: Advanced Functional Fabrics of America.
Federal Funding: $75 Million
Industry cost share: $240 million

Military and Commercial Shelters

Military and Commercial Smart Clothing



Transportation – Covers and Airbags

Geosynthetics – Construction

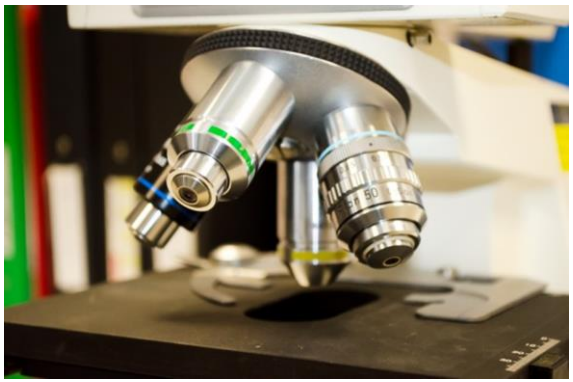
Objectives:

- Serve as a public-private partnership[illegible]ernment, aca[illegible] address manufacturing challenges fr[illegible]end products
- Support an end-to-end innovation 'ec[illegible]e 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

BioFabUSA

Advanced Regenerative Manufacturing Institute – Manchester, NH

Established: December 2016
Hub Location: Manchester, New Hampshire
Lead: ARMI
Federal Funding: $80 Million
Industry cost share: $214 Million



Focus Areas:

- Cell & Material Selection & Sourcing: The ATB-MII will use industrial manufacturing practices to reliably and reproducibly generate cells and biomaterials.
- Biofabrication Platforms: Integrated biofabrication platforms will be developed to transform these standardized starting materials into novel and evolving tissue and tissue-related end-products.
- Process Design and Automation: Additionally, process design and automation will need to be used to improve the rate and reproducibility of multi-step manufacturing processes.
- Tissue Finishing and Testing Technologies: The ATB-MII will assist in developing the successful commercialization of tissue-based products and non-destructive validation tools.

Biofabrication: An innovative manufacturing industry segment is *creating state-of-the-art manufacturing innovations in* ***biomaterial and cell processing***, ***bioprinting***, ***automation and non-destructive testing technologies*** *for critical Department of Defense and novel commercial use.*

ARM

Advanced Robotics for Manufacturing – Pittsburgh, PA

Established: January 2017
Hub Location: Pittsburg, PA
Lead: American Robotics
Federal Funding: $80 Million
Industry cost share: $173 Million

Problem: The use of robotics is becoming widespread in manufacturing environments but the robots are typically **expensive**, **singularly purposed**, **challenging to reprogram**, and require **isolation from humans for safety**.

Need: Robotics are increasingly necessary to achieve **the level of precision necessary for defense and other industrial manufacturing requirements** which limits the participation of mid-size to small manufacturers due to capital cost and complexity of use.

Technologies ripe for significant evolution within the RIME institute include, but are not limited to:

- Robot control (learning, adaptation, & repurposing)
- Collaborative robotics
- Dexterous manipulation
- Autonomous navigation and mobility
- Perception and sensing
- Testing, verification, and validation (TV&V)

Solution: ARM will integrate industry practices and institutional knowledge across many disciplines to **realize the promises of a robust manufacturing innovation ecosystem**.

DOC and DOE Institutes

PowerAmerica

Established: January 2014
Hub Location: Raleigh, NC
Lead: North Carolina State University
Current Number of Members: 70
Federal Funding: $70 Million
Industry cost share: $70 Million

The Institute for iacmi Advanced Composites Manufacturing Innovation — The Composites Institute

Established: January 2015
Hub Location: Knoxville, TN
Lead: University of Tennessee, Knoxville
Current Number of Members: 122
Federal Funding: $70 Million
Industry cost share: $180 Million

Clean Energy Smart Manufacturing Innovation Institute

Established: June 2016
Hub Location: Los Angeles, CA
Lead: Smart Manufacturing Leadership Coalition
Current Number of Members: 56
Federal Funding: $70 Million
Industry cost share: $70 Million

NIMBL

Established: December 2016
Hub Location: Newark, DE
Lead: University of Delaware
Federal Funding: $70 Million
Industry cost share: $129 Million

*The first Manufacturing USA institute to operate under the RAMI Legislation

RAPID Transforming Process Industries

Established: December 2016
Hub Location: New York, NY
Lead: American Institute of Chemical Engineers
Federal Funding: $70 Million
Industry cost share: $140 Million

REMADE Institute

Established: January 2017
Hub Location: Rochester, NY
Lead: Rochester Institute of Technology
Federal Funding: $70 Million
Industry cost share: $70 Million

Manufacturing USA®

DoD Institutes Introduction

Current DoD Institutes

America Makes: The National Additive Manufacturing Innovation Institute
Est. AUG 2012 (Youngstown, OH)

Digital Manufacturing and Design Innovation Institute (DMDII)
Est. FEB 2014 (Chicago, IL)

LIFT - Lightweight Innovations For Tomorrow
Est. FEB 2014 (Detroit, MI)

AIM Photonics (photonic integrated circuits)
Est. JUL 2015 (Albany, NY)

NextFlex (flexible hybrid electronics)
Est. AUG 2015 (San Jose, CA)

Advanced Functional Fabrics of America (AFFOA) – (revolutionary fibers and textiles)
Est. APR 2016 (Cambridge, MA)

Advanced Regenerative Manufacturing Institute (ARMI) (advanced tissue biofabrication)
Est. DEC 2016 (Manchester, NH)

Advanced Robotics for Manufacturing (ARM)
Est. JAN 2017 (Pittsburgh, PA)

- DoD MIIs part of Manufacturing USA: whole-of-government effort, in partnership with industry & academia
- Strategically aligning resources to address targeted technology spaces
- Creating 'industrial commons' for manufacturing R&D, workforce education and development
- Catalyzing defense and broader industrial 'innovation ecosystems' across the nation
- Accelerating trust in supply chain development with diversified risks

DMDII Facility in Chicago, Illinois