Department of Defense Manufacturing Technology Program 101

Tracy Frost

Director, DoD ManTech

OUSD(R&E)

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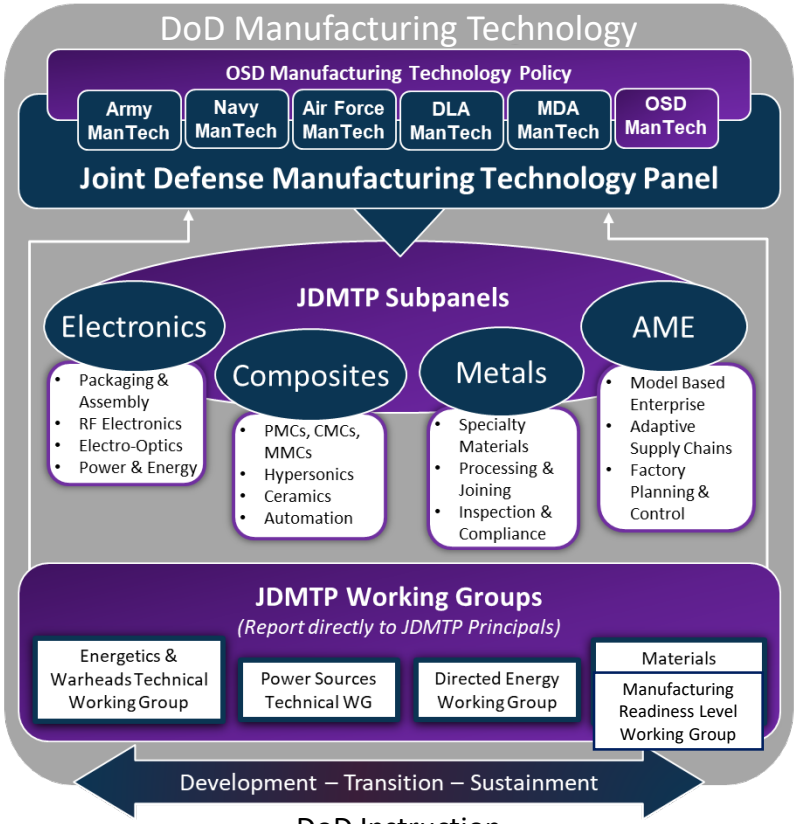
https://www.CTO.mil *@DoDCTO*

DoD ManTech
Joint Defense ManTech Panel (JDMTP)

- **Principals (06/NH-IV equivalent):** Conduct reviews across all ManTech portfolios & joint strategic planning
  - Identify & integrate common manufacturing needs through joint strategic planning
  - Chair of the panel selected on a rotating basis from Service/agency ManTech Principals
  - The Panel reports to & receives direction from OSD
- **Subpanels:** Conduct annual project reviews; identify trends, gaps, & opportunities as Joint Technology Pursuits Areas (JTPAs)
- **Working Groups:** Focused tiger teams developed for emerging technologies & business practices
- **JTPAs:** Provide opportunities for modernization priorities focus



DoD Instruction 4200.15

Acronyms

MDA – Missile Defense Agency	S&T – Science and Technology
DLA – Defense Logistics Agency	JTPA – Joint Technology Pursuit Areas
RF – Radio Frequency	WG – Working Group
CMC – Ceramic Matrix Composite	PMC – Polymer Matrix Composite
MMC – Metal Matrix Composite	AME – Advanced Manufacturing Enterprise

OSD ManTech Investment Portfolio

Investment programs under PE 0603680D8Z:

- P680 – Manufacturing Technology "Core"
  - Budget: FY19 - $22.3M
  - Congressional Adds: $30.0M (Advanced Manufacturing – Cold Spray)
- P350 – Manufacturing Innovation Institutes (MIIs)
  - Budget: FY19 - $91.9M
  - Congressional Adds: $10.3M (MIIs– Digital Engineering)
  - $ 5.0M (Manufacturing Engineering Program)

Other major ManTech activities include…

- Participation on the White House's Subcommittee on Advanced Manufacturing
- Chairing the Joint Additive Manufacturing Steering Group and Working Group
- Coordinating with the Department of Commerce hosted Manufacturing USA network

Current DoD MIIs

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

MxD: Manufacturing x Digital (Formerly DMDII)
Est. FEB 2014 (Chicago, IL)

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

AIM Photonics: American Institute for Manufacturing Integrated Photonics
Est. JUL 2015 (Albany & Rochester, NY)

NextFlex: America's Flexible Hybrid Electronics Institute
Est. AUG 2015 (San Jose, CA)

AFFOA: Advanced Functional Fabrics of America
Est. APR 2016 (Cambridge, MA)

BioFabUSA: Advanced Regenerative Manufacturing Institute
Est. DEC 2016 (Manchester, NH)

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

DoD ManTech Program

MISSION:

Anticipate and close gaps in manufacturing capabilities for affordable, timely, and low-risk development, production, and sustainment of defense systems.

ManTech carries out its mission through programs in the Military Departments, participating Defense Agencies, and OSD

DoD Manufacturing Innvoation Institutes are executed out of OSD with support from the Services.

Mission & Tenets

MISSION

The Office of Secretary of Defense (OSD) Manufacturing Technology (ManTech) program focuses on cross-cutting defense manufacturing needs – those that are beyond the ability of a single service to address – and stimulates the early development of manufacturing processes and enterprise business practices concurrent with S&T development to achieve the largest cost-effective impact and to facilitate the developments enabling capabilities to our warfighters.

TENETS

- Develop enabling technologies for advanced capabilities that ensure warfighter technical dominance
- Address cost-cutting, defense-critical manufacturing needs beyond the ability of a single service or agency to address
- Reduce cost to acquire and maintain critical technologies
- Enhances manufacturability/producibility of Defense-essential/defense-unique processes or components

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

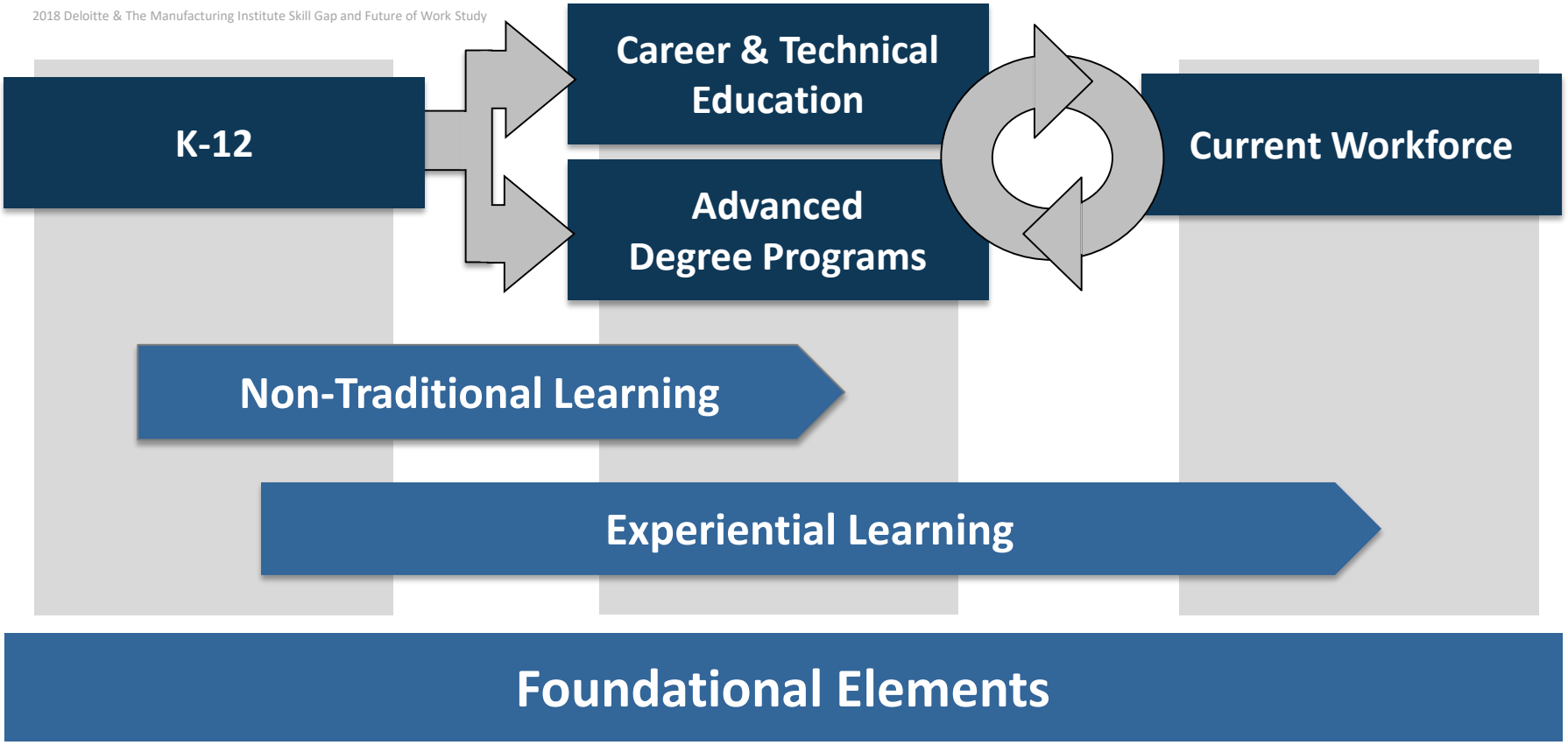
Guide Transition of Technology	• Understand best practices • Capture lessons learned
Shared Technology Transition Tools	• Create access to shared tech transition tools • Jointly develop transition tools
Develop Standards and Metrics for Transition Outputs	• Jointly develop a common architecture for measuring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

Manufacturing EWD Program Overview

- 2018: Half of open production positions went unfilled due to a **Talent Shortage**
- 2028: Skills gap projected to reach 2.4M

- Students/Teachers/Professionals Reached by Manufacturing USA EWD
  - **2018 → 196,570**
  - **2017 → 182,061**

2018 Deloitte & The Manufacturing Institute Skill Gap and Future of Work Study



DoD Manufacturing Innovation Institutes
Current Network

Since Launching in 2012*

- $870M+ Federal; $1.65B+ non-Federal
- 1,350+ companies, universities, & non-profits members or partners
- 48 states represented

*Information as of October 1, 2019

Establishment of DoD Innovation Institutes

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

MxD: Manufacturing x Digital (Formerly DMDII)
Est. FEB 2014 (Chicago, IL)

LIFT: Lightweight Innovations For Tomorrow
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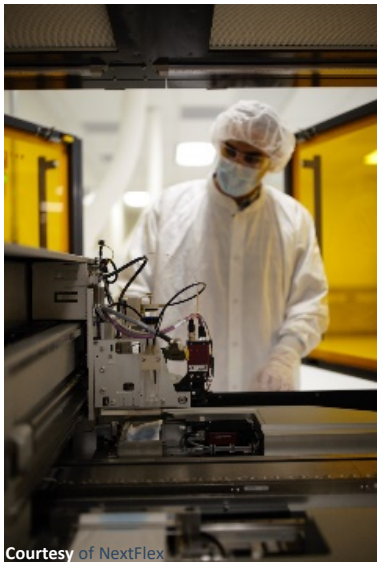
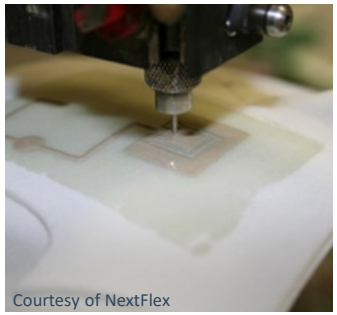
Advanced Robotics for Manufacturing (ARM)
Est. JAN 2017 (Pittsburgh, PA)

- DoD institutes are part of the Manufacturing USA network: a *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

AIM Photonics Institute in Rochester, NY

Factory to Warfighter


Courtesy of NextFlex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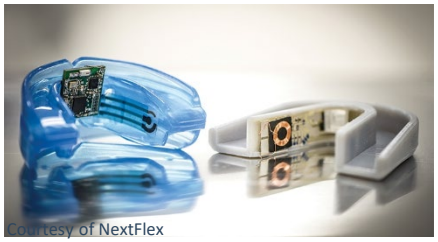

Courtesy of NextFlex

Our warfighters cannot use it if our U.S. manufacturers cannot make it!


Courtesy of NextFlex


Courtesy of NextFlex

SOURCE: Defense.gov

DoD Long-Term Partnership Model

DoD Strategic Influence

- **Federal Partnership/Membership**
  - Council representation (executive, technical, EWD, etc.)
- **Foundational Community Building**
  - DoD coordination/interface
  - DoD requirements coordination platform
  - Technical exchange symposiums
  - Standards coordination
  - Data coordination
  - Maintain or scale up EWD programs
- **Technology exploration**

Predictable level of annual support based on satisfactory performance

Partnering Investments

Projects aligned directly with OSD modernization priorities and joint priorities across technical community

- Technology projects
- Business practices
- Regional hubs with defense focus
- Technical training for
  - DoD organic IB
  - veterans
- Technical and EWD road mapping for DoD

*Cost share dependent on project type

Project funding competed among the established DoD Institutes

DoD Directed Technology/EWD Projects

DoD/USG executes R&D and EWD projects through Institutes

- Includes all Government-directed or competed for technical projects
- Provides higher ROI for industry members
- Allows DoD to reap benefit of the 1st 5 years investment
- Initiates or takes education and workforce programs to larger scale

Agency driven funding based on perceived value and unique manufacturing capabilities

EWD – education workforce development

DoD's Manufacturing Innovation Institutes:
Demonstrating Growing, Tangible Impact

- ✓ 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

DoD's Manufacturing Innovation Institutes are creating new, collaborative environments spurring innovation, performance, and competitiveness across the U.S. industrial base.

Defense Manufacturing for the Modernization Priorities

USD Research & Engineering (R&E) and Acquisition & Sustainment (A&S) are working together with the Services to align defense manufacturing with the Defense Modernization Priorities.

OSD ManTech
https://www.dodmantech.com/

Small Business Innovative Research
https://sbir.defensebusiness.org/

Small Business Technology Transfer
https://rt.cto.mil/rtl-small-business-resources/

Industrial Base Analysis & Sustainment (IBAS)
https://www.businessdefense.gov/IBAS/Overview/

Defense Production Act (DPA) Title III
https://www.businessdefense.gov/Programs/DPA-Title-III/

OSD is establishing a DoD Manufacturing Council to provide holistic governance across DoD budget authorities, and to improve our engagement strategy and process with our industry partners.

MII Example Success Stories

Army

Tactical Identity and Access Management (TIDAM)

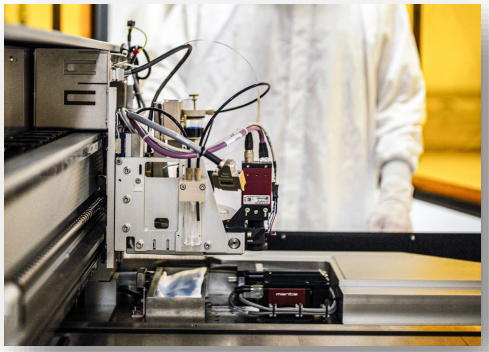


Photo courtesy of NextFlex

NextFlex: America's Flexible Hybrid Electronics Institute
https://www.nextflex.us/

Navy

Streamlined Shipbuilding

Photo courtesy of LIFT

LIFT: Lightweight Innovations For Tomorrow
https://lift.technology/

Air Force

Maturation of Advanced Manufacturing for Low Cost

USAF A-10 Thunderbolt II (Wikipedia)

America Makes: The National Additive Manufacturing Innovation Institute
https://www.americamakes.us/

DoD wide

National Center for Cybersecurity in Manufacturing (NCCM)

Photo courtesy of MxD

MxD: Manufacturing x Digital
https://mxdusa.org/

Education & Workforce Development Initiatives

Representative DoD Institute Initiatives

- LIFT's Operation Next: http://www.opnextjobs.com/
- LIFT's Maker Minded: http://makerminded.com
- NextFlex's Flex Factor: https://www.nextflex.us/news-events/news/flexfactor-changing-lives-one-high-school-student-time/
- America Makes' ACADEMI Program: https://www.americamakes.us/academi/
- AIM Photonics' Future Leaders Program: https://aimphotonics.academy/education/student-resources/future-leaders

Photo courtesy of NextFlex

DoD Application Success Stories

Flexible Write of Array Antenna & FSS on UAV Surface

LiFi

Printed Casting Molds Improve Aircraft Readiness

Light-Weighting to Reduce Fatal Rollovers

LOOks

Reducing Orthotic Out-Patient Visits from 3 to 1

America Makes

The National Additive Manufacturing Innovation Institute

America Makes

Established: August 2012

Hub Location: Youngstown, OH

Lead: National Center for Defense Manufacturing & Machining (NCDMM)

Program Managing Service: Air Force

Initial DoD Federal Funding: $56M

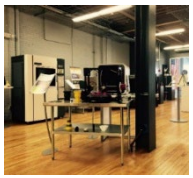
Initial Industry Cost Share: $67M

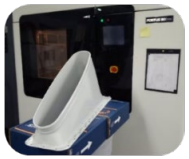
DoD-Directed Project Funding: $59.9M

On-going Projects: 40

Completed Projects: 149

**as of November 2019*





TOP LEVEL STRATEGY

Accelerate the adoption of Additive Manufacturing (AM) in the United States industrial base to reduce cost, reduce lead time, and increase capability of DoD warfighter products.

- **TECHNOLOGY DEVELOPMENT**: Since launching in 2012, America Makes has executed over 189 projects against a consortium developed AM technology roadmap. Projects range from those addressing design tools, materials, and processes to those supporting an integrated value chain.
- **DoD APPLICATIONS**: America Makes helped coordinate across the Department of Defense to create the first-ever open platform that simplifies sharing model data across the service while respecting existing systems. The platform was delivered to the Defense Logistics Agency in last 2019 and has been deployed for Warfighter use. While America Makes continues to refine the tool, this solution offers a way for 3D models to be shared across the DoD which previously did not exist.
- **WORKFORCE READINESS**: America Makes' education activities are rooted in a roadmap vetted through industry and defense engagement through the institutes' membership and education advisory committee. The institute engaged, introduced, and trained more than 3,000 individuals in 2019, including leading over 30 trainings impacting over 500 DoD members.
- **FACILITIES & CAPABILITIES**: America Makes is an impartial convener of AM stakeholders, a coordinator of technical and workforce information, and an activation catalyst through the execution high-impact projects. The institute has satellite centers at the University of Texas El Paso, Wichita State, and Texas A&M.

MxD
Manufacturing x Digital (formerly DMDII)

Established: February 2014

Hub Location: Chicago, IL

Lead: UI LABS

Program Managing Service: Army

Initial DoD Federal Funding: $70M

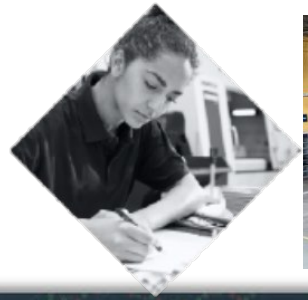
Initial Industry Cost Share: $106M

DoD-Directed Project Funding: $26M

On-going Projects: 7

Completed Projects: 54

**as of November 2019*



TOP LEVEL STRATEGY

Accelerate the development and transition of digital manufacturing technologies into the DoD. Provide the U.S. government and American manufacturers with the digital tools needed secure the manufacturing enterprise, reduce development & production cost, and accelerate product development.

- **TECHNOLOGY DEVELOPMENT**: Since launching in 2014, MxD has executed over 61 projects. Projects seek to solve technology challenges in digital manufacturing that are too big for any one organization.
- **DoD APPLICATIONS**: MxD, with the support of the DoD, has stood up the National Center for Cybersecurity in Manufacturing; because ensuring manufacturing security against cyber threats is critical to securing the warfighter, as well as driving manufacturing competitiveness. The Center for Cybersecurity will bridge and build a more resilient industrial base and defense supply chain by adapting the best in cyber tools and training to the unique needs of manufacturers of all sizes, including SMEs.
- **WORKFORCE READINESS**: MxD has engaged more than 1,493 individuals in workforce development and education efforts, including 80 high school students visiting as part of the Catapult entrepreneurship program, and 35 students taking part in a visit through a Chicago neighborhood summer program.
- **FACILITIES & CAPABILITIES**: MxD and its Future Factory Floor provide a neutral, pre-competitive environment and network unique amongst public and private organizations for DoD agencies to consider, assess, test, and demonstrate various technologies and solution architectures across the digital thread and regardless of where the agency, depot, or arsenal is on its digital modernization or transformation journey.

LIFT
Lightweight Innovations for Tomorrow

Established: February 2014

Hub Location: Detroit, MI

Lead: ALMMII

Program Managing Service: Navy

Initial DoD Federal Funding: $70M

Initial Industry Cost Share: $78M

DoD-Directed Project Funding: $7.8M

On-going Projects: 27

Completed Projects: 58

**as of November 2019*

TOP LEVEL STRATEGY

Develop advanced lightweight materials manufacturing technologies and implement educational programs to train a workforce confident in deploying new technologies in defense and commercial applications.

- **TECHNOLOGY DEVELOPMENT**: Since launching in 2014, LIFT has executed over 85 projects. Projects work to develop and deploy new lightweight manufacturing technologies and processes for products that can be applied to vehicles in the air, land, or sea.
- **DoD APPLICATIONS**: LIFT is supporting the development of the FeMnAl alloy for use as armor on military ground vehicles. The steel expected to reduce armor weight by >10% while matching or exceeding the ballistic performance of rolled homogeneous armor (RHA). LIFT is optimizing processing conditions to produce affordable, high quality plate in large volumes.
- **WORKFORCE READINESS**: MakerMinded, powered by LIFT, has trained more than 6,000 students and teachers from over 500 middle and high schools via an online competition platform design to expand students' and schools' access to world-class advanced manufacturing and science, technology, engineering, and math (STEM) learning experiences.
- **FACILITIES & CAPABILITIES**: LIFT, with its 100,000 square-foot Advanced Manufacturing Center in Detroit, along with its ecosystem of Fortune 500 companies, top academic research universities, small and medium-sized manufacturers, and national education and workforce development partners, rapidly contracts, designs, develops, prototypes and tests innovative technologies for the Department of Defense to speed technology transition to the warfighter while building the future workforce of America.

AIM Photonics

American Institute for Manufacturing Integrated Photonics

Established: July 2015

Hub Location: Albany & Rochester, NY

Lead: Research Foundation of the State University of New York (SUNY)

Program Managing Service: Air Force

Initial DoD Federal Funding: $110M

Initial Industry Cost Share: $502M

DoD-Directed Project Funding: $28.3M

On-going Projects: 42

Completed Projects: 66

**as of November 2019*

TOP LEVEL STRATEGY

Accelerate transition of Integrated Photonics into DoD weapon systems & commercial products by building a U.S.-based Integrated Photonics ecosystem that provides DoD and industry access to the world's best Integrated Photonics (IP) fabrication, packaging, and testing capabilities.

- **TECHNOLOGY DEVELOPMENT**: Development/release of Process Design Kits and rollout of Multi-Project Wafers (MPW) has enabled industry, academia & DoD to design, fab and test integrated photonics subsystems in over 64 projects, enabling innovation in capability tied to DoD's future needs. Cost savings of MPW has enabled fabrication services to DoD service labs, universities, and small businesses.
- **DoD APPLICATIONS**: AIM's capabilities directly result in the reduction of SWAP-C by replacement of bulk photonic systems across all services. DoD-relevant application areas include next-generation SIGINT, PNT, communications, sensors, and compact random access LIDAR.
- **WORKFORCE READINESS**: AIM created an online course to give designers the necessary skills and knowledge to be able to submit a design to the AIM foundry. 136 designs representing over 10,000 hours of design time were submitted for competition, with 52 winning designs fabricated using AIM's $1B foundry. Over 2,000 additional students audited the online course, which serves as an on-ramp for new AIM users. **FACILITIES & CAPABILITIES**: AIM has the world's only 300 mm integrated photonics prototyping foundry, with domestic industry now on-shoring previous overseas efforts. The associated Test, Assembly, & Packaging Facility (Rochester) is the only domestic facility of its kind, allowing export-controlled test, assembly and packaging.

NextFlex

America's Flexible Hybrid Electronics Manufacturing Institute

Established: August 2015

Hub Location: San Jose, California

Lead: FlexTech Alliance

Program Managing Service: Army

Initial DoD Federal Funding: $75M

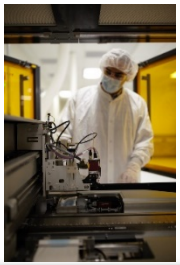
Initial Industry Cost Share: $96M

DoD-Directed Project Funding: $37.2M

On-going Projects: 85

Completed Projects: 73

**as of November 2019*



TOP LEVEL STRATEGY

Pioneer Flexible Hybrid Electronics (FHE) manufacturing to serve our nation's warfighters and the U.S. Electronics Assembly industrial base.

- **TECHNOLOGY DEVELOPMENT**: Since launching in 2015, NextFlex executed 150 projects. Projects integrate digital printing processes with thin semiconductors to achieve low-cost-low-volume stretchable, bendable, conformable, and flexible electronic devices and sensors for novel applications.
- **DoD APPLICATIONS**: The institute is leading DoD electronics technology transitions through FHE prototypes to include; warfighter health monitoring, platform monitors, soldier authentication, 3D antenna systems, and soft robotics. The Institute has projects sponsored by nine DoD Services or Agencies, including Army, Navy, Air Force, DTRA, DLA, DMEA, MDA, SOCOM, and NASA. At present, 14 FHE prototypes are under consideration for transition to DoD applications.
- **WORKFORCE READINESS**: NextFlex launched FlexFactor to expose K-12 students to opportunities in advanced manufacturing careers in concert with community colleges. The Institute also developed FlexPro, an advanced FHE curriculum focused on the current microelectronics design and engineering workforce.
- **FACILITIES & CAPABILITIES**: The NextFlex Technology Hub includes capabilities where FHE devices and manufacturing processes can be prototyped, materials can be tested, and pilot-scale manufacturing can be proven at the NextFlex Technology Hub. In 2019, the NextFlex pilot line began low rate production for two product lines and was granted FDA certification and ITAR compliance.

AFFOA
Advanced Functional Fabrics of America

Established: April 2016

Hub Location: Cambridge, MA

Lead: MIT

Program Managing Service: Army

Initial DoD Federal Funding: $75M

Initial Industry Cost Share: $240M

DoD-Directed Project Funding: $14.5M

On-going Projects: 57

Completed Projects: 110

**as of November 2019*

TOP LEVEL STRATEGY

Enable a domestic manufacturing-based revolution by transforming traditional fibers, yarns, and fabrics into highly sophisticated, integrated and networked devices and systems. IP-protected technology that is Made in USA.

- **TECHNOLOGY DEVELOPMENT**: Since launching in 2016, AFFOA has advanced the state-of-the-art in fiber technology, moving from fibers that are single devices to fibers that incorporate multiple devices and capabilities within a single fiber. AFFOA's projects are designed to produce fabrics that can see, hear, sense, communicate, store, convert energy, regulate temperature, monitor health, and change color.
- **DoD APPLICATIONS**: AFFOA launched a dedicated defense facility where classified work can be executed and where advanced fibers are developed. These fibers are being incorporated into prototype applications that provide authentication (Identify Friend or Foe), navigation and communication in GPS-denied environments—in air, land and undersea.
- **WORKFORCE READINESS**: In collaboration with MD5 and MIT, AFFOA hosted an Advanced Fabrics Hackathon to design functional fabric prototypes for military applications..
- **FACILITIES & CAPABILITIES**: AFFOA's headquarters recently completed renovations to accommodate a larger staff and additional prototyping equipment. The PA Fabric Discovery Center (FDC) also recently expanded its facility and added additional knitting and weaving machines (including warp knitting) as well as a specialized shoe-making capability. The four FDCs are regional prototyping and EWD centers established to work with AFFOA's local member base to enhance the DoD's effort to secure U.S. leadership in revolutionary fibers and textiles manufacturing.

BioFabUSA

Advanced Regenerative Manufacturing Institute

biofabusa

Established: December 2016

Hub Location: Manchester, NH

Lead: Advanced Regenerative Manufacturing Institute (ARMI)

Program Managing Service: Army

Initial DoD Federal Funding: $80M

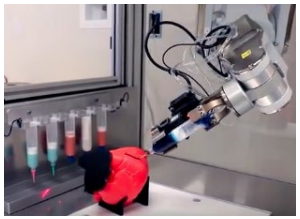
Initial Industry Cost Share: $214M

DoD-Directed Project Funding: $6.7M

On-going Projects: 33

Completed Projects: 7

**as of November 2019*



TOP LEVEL STRATEGY

Make the large scale manufacturing of engineered tissues and tissue-related technologies practical, and prepare the required workforce to meet the needs of the wounded warfighter and others in need of this technology across the U.S.

- TECHNOLOGY DEVELOPMENT: Since launching in 2016, BioFabUSA has initiated 25 projects and completed 6. Projects include developing real-time label-free viability and sterility assurance sensors, Tissue Engineered Medical Products (TEMP), centralized fluid management, tissue transport, online curriculum development, and enhanced veteran training.
- DoD APPLICATIONS: The development of tissue products on an industrial scale enables the DoD to accelerate numerous medical products through development for treating our wounded Warfighters. This contributes to force readiness and saves lives on the battlefield of today and the future.
- WORKFORCE READINESS: The focus of BioFabUSA's workforce program is to ensure that the U.S. has the trained workforce necessary for large-scale manufacture of engineered tissues. BioFabUSA has piloted three online courses that focus on areas identified by the biofabrication industry as important for their workforce needs.
- FACILITIES & CAPABILITIES: In 2019, the institute developed the Tissue Foundry manufacturing platform. The Tissue Foundry is composed of a series of subsystems, or modules, each representing a different stage of the TEMP manufacturing process, from culture of the cells that make up the tissue to packaging of the final product.

ARM
Advanced Robotics for Manufacturing Institute

ARM

Established: January 2017

Hub Location: Pittsburgh, PA

Lead: Advanced Robotics

Program Managing Service: Army

Initial DoD Federal Funding: $80M

Initial Industry Cost Share: $174M

DoD-Directed Project Funding: $25K

On-going Projects: 32

Completed Projects: 2

**as of November 2019*

TOP LEVEL STRATEGY

Accelerate innovation to drive U.S.-based growth in manufacturing while developing domestic robotics expertise to create high-value careers.

- TECHNOLOGY DEVELOPMENT: Since launching in 2017, ARM has kicked off 54 projects. With a focus on key industrial sectors such as aerospace, automotive, electronics, and textiles, projects target growth sectors that are ripe for rapid adoption of robotic technologies in manufacturing.
- DoD APPLICATIONS: ARM advances new robotic technologies to ensure that the U.S. retains its global leadership in manufacturing to help secure the supply chain and the warfighters who rely on these capabilities. ARM is also advancing robotics and AI technologies into the DoD sustainment and maintenance communities to ensure operational readiness.
- WORKFORCE READINESS: ARM is developing an educational partner network to develop messaging around robotics and automation careers, develop and promote broad participation in ARM certification and education programs, and encourage a robotics/automation industry-recognized stackable credential.
- FACILITIES & CAPABILITIES: In early 2019, ARM moved into a new facility considered as a one-of-a-kind advanced manufacturing hub in Pittsburgh, bringing together large-scale academic research and corporate development and transition opportunities under one roof.

For more information…

DoD ManTech Program & Sponsored Institutes

https://defenseinnovationmarketplace.dtic.mil/business-opportunities/mantech-program/

The Manufacturing USA Program

https://www.manufacturingusa.com/