ACCELERATING U.S. ADVANCED MANUFACTURING

THROUGH PUBLIC-PRIVATE PARTNERSHIPS



DEPARTMENT OF DEFENSE MANUFACTURING INNOVATION INSTITUTES December 2024

About the Department of Defense Manufacturing Innovation Institutes

Industry-driven, public-private partnerships serving the Warfighter and Nation

WHO? The Office of the Secretary of Defense Manufacturing Technology Office (OSD ManTech) sponsors a network of Department of Defense (DoD) Manufacturing Innovation Institutes (MIIs). These institutes are an integral part of the wider DoD Manufacturing Technology Program.

WHAT? The DoD MIIs are public-private partnerships that increase economic and national security by maturing manufacturing processes, building sustainable supporting ecosystems, and providing manufacturing education and workforce development.

WHEN? OSD ManTech launched the first institute in 2012. Other institutes followed with the latest launched in 2020.

WHERE? Institute headquarters and hubs are located across the United States with member organizations from 49 states, Puerto Rico, and Washington, D.C.

WHY? To facilitate DoD access to advanced manufacturing technologies, address DoD modernization priority needs, and further the national imperative to ensure future products are made in the United States.

HOW? Effectively operate and integrate a network of industry-led public-private partnerships that connect and develop people, ideas, and technology in ways that accelerate the transition of new capabilities into defense and commercial products and systems.

DoD MII Business Tenets

While each institute operates in its own unique ecosystem, they all share common business model tenets			
Regional hubs with national impact to U.S. ecosystem	Led by non-profit acting as "honest broker," accountable for viability	Industry-led, DoD-informed technical road-mapping	
Industrially relevant, DoD-oriented research and development (R&D) to "bridge the gap" (Technology Readiness Level / Manufacturing Readiness Level 4-7)	Access to shared assets for U.S. companies including intellectual property and infrastructure	Education and training for sufficient, skilled manufacturing workforce	
Significant initial federal investment (\$70-\$120M per institute) over 5-7 years	Leverage minimum of 1:1 cost share from non-federal sources	Formal evaluation prior to continued DoD engagement and funding	



DoD MIIs' Value Proposition

Federal Agencies



The DoD MIIs offer the Federal government, including the military services and DoD agencies, access to road-mapping activities with industry, pilot manufacturing facilities, and responsive project contracting. The federal government utilizes the institutes' precompetitive federal assistance agreements to perform technology projects, provide access to cost share, and ensure competition. From an operations and sustainment perspective, the DoD MIIs are a source for low-cost research and development.

State & Local Governments

The DoD MIIs are innovation clusters each with a diversity of members working to build a convergence of expertise. Because these clusters contain the elements necessary for product realization – research, design, prototyping, and production – members feed each other's success and become deeply entrenched locally and regionally. Inherently, clusters formed around advanced manufacturing facilities persist due to the ability to accelerate product to market using a co-located supply chain. This growth provides the region's students and workforce with phenomenal education and job opportunities.



Industry



The DoD MIIs foster collaboration between companies, customers, and the government to conduct pre-competitive applied research and development necessary for profitable commercialization. Advanced manufacturing facilities and key manufacturing findings are made available to U.S. companies of all sizes, allowing them to affordably develop products for commercial or defense needs. The institutes also host networking events and project calls for materials and manufacturing research and development to promote non-traditional partnerships between companies. Manufacturing workforce training and education programs offered by the DoD MIIs ensure the innovation industrial base is prepared for the United States' advanced manufacturing needs.

Academia & Educators

The DoD MIIs provide universities, community colleges, and other educational institutions with opportunities to understand industry and government needs so that targeted manufacturing research can be undertaken for the benefit of the institution, individual, and students. Cutting-edge sponsored research enhances the reputation of the institution. For students, the DoD MIIs provide opportunities for handson training, access to internships and apprenticeships, and increased connections to industry and job opportunities.





Department of Defense Manufacturing Innovation Institutes

Public-private partnership designed to overcome the challenges faced by American manufacturing innovators across targeted technology sectors.



1,800+ completed and ongoing projects advancing manufacturing technologies and **700+** completed and ongoing education and workforce development projects.



2,200+ members participate from across the defense industry, commercial manufacturers of all sizes, start-ups, universities, community colleges, and state and local economic developers in active partnership with the United States federal government.





DoD MIIs In Action Organic Industrial Base Modernization Challenge

In 2024, OSD ManTech and the DoD MIIs conducted the first-ever Organic Industrial Base (OIB) Modernization Challenge – an initiative to leverage the MIIs to advance manufacturing technologies across the Department's depots, arsenals, and shipyards.

Initially, representatives from five DoD MIIs and senior sustainment leaders from across the services and department attended a workshop, hosted at MxD in Chicago, IL, to identify crucial OIB technological needs. With those requirements identified, 104 proposals were submitted from member companies and the top nine were selected to present their pitches to earn up to \$2.5 million in OSD-sponsored government funding. Ultimately, five winning projects were selected by a panel of OIB experts, industry leadership, and the OSD ManTech director based on their projected positive impact across the 47 DoD-owned OIB sites.

The winning projects are:

- ARM Institute, Aris Technology: Robotic Non-Contact 3D Inspection Replacing Hard Gaging
- ARM Institute, Grid Raster Inc.: Extended Reality and AI-Assisted Paint Masking
- ARM Institute, Figure Engineering, Siemens, Lockheed Martin: Maskless Robotic Painting with Realtime Control
- MxD, Anark: A Closed-loop Technical Data Exchange that Meets the OIB Where They Work
- NextFlex, Aptima Inc.: Cybersecure Data Compliance for Integrated Sensors and Shop Floor Digitization

OSD ManTech is confident that these companies will effectively apply their technologies, leading to substantial and lasting improvements in the production, efficiency, and quality of life at various OIB sites and among their valued team members.

Thanks to public-private partnership with the DoD MIIs, the pitch event and subsequent initiatives are crucial steps toward improving the U.S. supply chain and enhancing national security readiness through cutting-edge technological advancements in manufacturing.





Additive Manufacturing

AMERICA MAKES

America Makes

Established 2012 Youngstown, OH www.americamakes.us

National Additive Manufacturing Innovation Institute

Accelerating the adoption of additive manufacturing (AM) by convening, coordinating, and catalyzing the AM industry to help advance U.S. manufacturing competitiveness and security

326 projects executed advancing additive manufacturing technology	23,216 learners educated in EWD activities in last 3 years	294 institute members (+52 in last 12 months)
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Additive Manufacturing Technology Roadmap for Casting & Forging

America Makes convened the U.S. additive manufacturing ecosystem to develop a roadmap that defines a multi-year technology pathway to develop and deploy AM capabilities at scale to augment existing castings and forgings operations. Cast and forged components lie at the heart of critical weapons platforms across DoD, providing a vital contribution to warfighter readiness for the U.S. With a 67% reduction in the number of US foundries since 2000, the U.S. castings and forgings ecosystem supply chain is dwindling. This roadmap provides a strategic assessment of the necessary investments for AM to make a meaningful impact in the short-term and production facilities across the country.





Additive Manufacturing Standards Roadmap, Version 3.0

America Makes and the American National Standards Institute (ANSI) Additive Manufacturing Standardization Collaborative (AMSC) developed and released Version 3.0 of the Standardization Roadmap for Additive Manufacturing. The roadmap describes the current and desired future standardization landscape for AM and focuses on industrial market sectors using AM technologies. The roadmap describes the current and desired future standardization landscape for AM and focuses on industrial market sectors using AM technologies.

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Digital Manufacturing & Cybersecurity

MxD

Digital Manufacturing & Cybersecurity Institute



Established 2014 Chicago, IL www.mxdusa.org

Strengthening U.S. economic prosperity and national security by driving digital adoption in manufacturing

\$400M public-private investments in 180 projects generated 540 intellectual property assets

250,000 enrollments in EWD programming since 2016

Cyber Supplier Program reaches over **20,000 suppliers** per month

Delivering Career Pathways to DoD Education Service Officers

In 2024, MxD partnered with the DoD Voluntary Education program to launch six featured career pathways on careerpathdecide.org, a tool utilized by 750 Education Service Officers that advise military service members how to find careers that match their experience, education, and military occupation. The MxD career pathways in digital manufacturing and cybersecurity have been viewed more than 20,000 times and are expected to reach tens of thousands of service members making decisions about which sector to launch their civilian careers.





Industry-led Sustainability Event

In collaboration with Dow and EY, MxD hosted their first event on Sustainability "The Win-Win of Sustainability: Simultaneously Improving Environmental and Manufacturing Performance." The event brought together sustainability leaders from manufacturing companies including Honeywell, BASF, Dow, and P&G to discuss solutions to sustainability implementation within their operations. Katheryn Scott, Office of Technology Transitions, Department of Energy (DoE), presented a keynote address on the DoE's "Pathway to Liftoff Reports" and provided resources to manufacturers to support their efforts in sustainability and sustainability reporting.

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Advanced Materials

LIFT

National Advanced Materials Manufacturing Innovation Institute



Established 2014 Detroit, MI www.lift.technology

Driving American advanced manufacturing into the future through technology and talent development by connecting advanced materials, manufacturing processes, systems engineering, and people.

5 million square feet of Active Technology Development Space Nationally **250,000+ students** engaged in Talent Development Programs since 2014

7,500 visitors annually to LIFT's Detroit Headquarters

LIFT, DoD, and State of Michigan Launch Planning Phase for Hypersonics & Extreme Environment Test Facility

LIFT launched a project exploring the potential for a new Hypersonic and Extreme Environment Test (HEET) facility at Selfridge Air National Guard Base in Michigan. Operating at speeds of Mach 5 or higher, hypersonics and counterhypersonic vehicles are among the Department of Defense's top priorities, and understanding the materials required to survive these speeds is critical to further developing those vehicles and maximizing their effectiveness. Vital to this research is the ability to test such materials under extreme conditions; thus, the need for a new test facility, ideally, located in near proximity to LIFT's Detroit applied research and development headquarters.





LIFT To Open Advanced Metallics Production and Processing (AMPP) Center at Its Detroit Headquarters

LIFT is set to open a new Advanced Metallics Production and Processing Center at its Detroit headquarters in Q12025. The AMPP Center will allow LIFT, the DoD, and the Defense Industrial Base to make bespoke alloys & feedstocks in powder, rod, and wire form, filling a critical materials need in the Defense industrial base and advanced manufacturing supply chain. This pilot-scale facility will join LIFT's Integrated Computational Materials Engineering capability with pilot-scale manufacturing to de-risk materials development and scale-up, hastening new materials for use in DoD systems.

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Integrated Photonics

AIM PHOTONICS

American Institute for Manufacturing Integrated Photonics

> Advancing integrated photonic circuit manufacturing technology development while simultaneously providing access to state-of-the-art fabrication, packaging, and testing capabilities for small-to-medium enterprises, academia, and the government

197 prototypes delivered to industry and researchers 783 individuals participating in EWD projects and activities during FY2024 Q1-Q2

249 engaged organizations

Established 2015 Albany & Rochester, NY

www.aimphotonics.com

Hands-On Photonic Education (HOPE) Kits

AIM Photonics is addressing the demand for skilled workers in integrated photonics by manufacturing and distributing 35 HOPE kits to 28 partner institutions, including two- and fouryear colleges and universities, across 10 states. The HOPE kits include fully packaged photonic integrated circuits (PICs) providing educators with the tools to deliver practical, handson training. The kits will be distributed along with manuals covering their usage and providing educators with additional resources to help in developing course curricula around the HOPE kits.





Drug Development Tools

AIM Photonics' PIC Sensors Platform will be used to develop tissue-on-chip devices for FDA-qualified drug development tools. The National Institutes of Health (NIH) center at the University of Rochester will use tissue-on-chip technology to develop drugs more rapidly and reduce the need for animal trials. The systems will feature photonic biosensors that utilize AIM Photonics' photonic integrated circuit (PIC) sensors platform. OUSD(R&E)'s support of chem/bio sensing development explored by AIM Photonics provided the core investment in the technology now being used. These new tools seek to provide "clinical trials on chip" with tissue-on-chip technologies that mimic human tissue. This new capability will improve the likelihood of a candidate drug being successful when it transitions to clinical trials using human subjects. This will increase the speed and decrease the costs associated with advanced treatments while also providing researchers with new insights on how to tailor drugs to make them more successful in the future.

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Hybrid Electronics

NFXTFIFX

NEXTFLEX

America's Hybrid Electronics Manufacturing Institute

> Expanding U.S. manufacturing of Hybrid Electronics (HE) through commercialization, advanced manufacturing workforce development, and promotion of a sustainable ecosystem to the benefit of our nation's warfighters and the U.S. economy

47 technologies transitioned

28,019 learners educated

86% of companies accelerated by NextFlex *

Established 2015

www.nextflex.us

San Jose, CA

Hybrid Electronics for Radomes and Nose Cones

Leveraging previous NextFlex Project Call results, General Dynamics Mission Systems (GDMS) and the University of Massachusetts Lowell recently developed processes to print metallic patterns onto the composite parts and attach electronic components. The results demonstrate manufacturing techniques for integrating conformal electronics into doubly curved, non-planar composite structures. GDMS aims to productize this manufacturing technology to integrate circuits, sensors, and antennas into multilayer composite structures such as radomes and nose cones for critical defense applications.





FlexFactor Education and Workforce Development

In collaboration with AccelerateMS and through funding from the DoD, NextFlex expanded the FlexFactor® program to five additional community colleges in Mississippi. These new adopters, along with previous adopter East Mississippi Community College, are focused on connecting students to careers in shipbuilding and advanced manufacturing. Since launching in Fall 2023, more than 1,000 Mississippi students have been engaged. These students self-report as 51% female, 14% military connected, and 54% from an under-represented minority in STEM. Further, 65% of students reported being more likely to attend the host college after the FlexFactor program with 37% expressing an increased interest in a career in advanced manufacturing.

CONNECT | Karen Savala, Director of Marketing, Membership, and Events: ksavala@nextflex.us

*2022 Study: Industry contacts were asked if they were further along in hybrid electronics development and adoption because of NextFlex.



Advanced Fabrics & Textiles

AFFOA

Advanced Functional Fabrics of America

aff@a°

Established 2016 Cambridge, MA www.affoa.org

Rekindling the domestic textiles industry by leading a nationwide enterprise for advanced fiber and fabric technology development and manufacturing, enabling revolutionary system capabilities for national security and commercial markets

253 technology projects completed to date

4,700+ learners exposed to advanced fabrics

150+ engaged members (59% small businesses)

Critical Aerospace Grade Preshrunk Silica Fabrics

AFFOA partnered with member Auburn Manufacturing Inc. (AMI), a women-owned small business in Maine, to support the establishment of a new manufacturing process for lowshrinkage, high temperature aerospace grade silica textiles used in aircrafts, missiles, and other defense equipment. Until recently this material was only available from overseas makers and a single domestic company.



Preshrunk silica fabric entering a 980C furnace



New BSL-4 prototypes used to collect feedback from users via on-site user evaluations

New Supply Chain for BioSafety Level 4 Suits

The US Food and Drug Administration (USDA) approached AFFOA for assistance when the sole US manufacturer of BioSafety Level 4 (BSL-4) suits, as well as the material manufacturer, stopped production, leaving the organization and many others with limited inventories that they expect will be exhausted by January 2025. Initially, AFFOA was charged with building a robust supply chain to keep production of critical suits in the US on an abridged timeline. AFFOA leveraged internal technical expertise as well capabilities across its Fabric Innovation Network to identify new suit materials and landscape manufacturers to create a robust domestic supply chain. The team partnered with various organizations, including member Kappler, to design, model and prototype new suits, collect feedback through user evaluations and iterate to develop a U.S. made, lighter, more comfortable suite with enhanced durability.

CONNECT | Natasha Spackey, VP of New Business Development & Partnerships: natasha@affoa.org



Regenerative Manufacturing

BIOFABUSA

Advanced Regenerative Manufacturing Institute



Established 2016 Manchester, NH www.armiusa.org

Making practical the scalable, consistent, and cost-effective manufacturing of engineered cells, tissues, and organs – and developing the trained and ready workforce for a new American industry.

200+ novel products advanced 50,000+ learners and workforce stakeholders engaged **10 Federal agencies** joining DoD in building a new American industry

Registered Apprenticeship Programs

BioFabUSA launched two U.S. Department of Labor-approved Registered Apprenticeship Programs this year – one for Biofabrication Technicians training to manufacture lifesaving, cell-based products, and a complementary program for Advanced Manufacturing Technicians training to manufacture the platform technologies essential for the industry. Through focused coursework and on-the-job training with BioFabUSA and its members, apprentices gain the skills to succeed in the industry and contribute to the development of regenerative technologies. BioFabUSA was honored to see the White House lift up the apprenticeships as part of a nationwide Advanced Manufacturing Workforce Sprint.



Biofabrication Technician and Advanced Manufacturing Registered Apprenticeship Programs Grow Talent & Opportunity for the Biofabrication Industry



Dr. Ramille Shah, Dimension Inx, delivers remarks at BioFabUSA's 2024 Meeting in the Millyard

First-Ever 3D Printed Regenerative Bone Graft

Dimension Inx, a longstanding Member of BioFabUSA, achieved a breakthrough 510(k) FDA clearance for the firstever 3D printed regenerative bone graft. The Institute provided regulatory services in direct support of this achievement. Following clearance, the company successfully introduced the product, CMFlex[™], into commercial distribution and clinical use. Resultant revenue and non-federal investments are fueling the growth of the company's regenerative therapeutics pipeline. Additionally, Dimension Inx recently announced multiple new biomaterials patents, growing a portfolio and future product pipeline.

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Robotics for Manufacturing

THE ARM INSTITUTE

Advanced Robotics for Manufacturing



Established 2017 Pittsburgh, PA www.arminstitute.org

Accelerating the development and adoption of robotics technologies that are the foundation of every advanced manufacturing activity today and in the future

174,000+ individuals have leveraged RoboticsCareer.org

450+ member organizations **120+ projects** in robotics and workforce development

Robotics Arms at the Point of Need

Through OSD's Point of Need Manufacturing Challenge, the ARM Institute worked with ARM member Corsha on the "Securing the Digital Backbone with Corsha's Zero-Trust Platform for Machine" project. This project centered on deploying the Corsha platform to protect access to a robotic arm at the point of need and demonstrating regulated access to a tabletop FANUC Robotic Arm with controlled, Zero Trust access to a shared artifact repository. The team successfully demonstrated their capability in frostbite-level temperatures at the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL).





Robotics Manufacturing Hub

The ARM Institute's Robotics Manufacturing Hub program provides free services to small- and medium-sized manufacturers in the Southwestern Pennsylvania region. The program worked with a family-owned and operated manufacturer that provides flame and induction hardening services to develop a robotic system to prep and package their awkward and heavy cast parts. The solution included an end effector that can both optimally pick up the part and withstand the oil, modeling and simulation for the pick-and-place software, and engineering expertise to adjust the process from a manual spray to an automated oil bath. The manufacturer is now working to implement the system on their manufacturing floor.

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Bioindustrial Manufacturing

BIOMADE

Bioindustrial Manufacturing And Design Ecosystem BioMADE

Established 2020 Twin Cities, MN Emeryville, CA www.biomade.org

Enabling domestic bioindustrial manufacturing at all scales, develop technologies to enhance U.S. bioindustrial competitiveness, de-risk investment in relevant infrastructure, and expand the biomanufacturing workforce to realize the economic promise of industrial biotechnology

75+ projects

\$166M+ in project value

290+ member organizations

Chemical Production through Fermentation

BioMADE members Amyris and Sudhin BioPharma have worked together on successive projects to advance technology for the removal of hydrophobic products during fermentation. They have recently demonstrated the viability of this process at pilot scale. This technology allows some toxic products to be removed during production leading to higher process yields and lower costs. Lowering the cost of production will lead to bringing a greater number of valuable chemicals to market.





New Warfighter-to-Scientist Workshop

BioMADE is launching a first-of-its-kind Warfighter-to-Scientist program to support members of the Travis Air Force Base community in entering the burgeoning bioindustrial manufacturing industry. The workshop will cover topics relevant for technician-level roles in the bioindustrial manufacturing sector, such as foundational biological principles; scale-up of biomass fermentation; collecting, preparing, and analyzing samples; following safety guidelines; and more. The bioeconomy is projected to see one million additional jobs added by 2030. This program will help meet that need, while setting up former military personnel and their families for success.

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Department of Defense Manufacturing Innovation Institutes



www.americamakes.us



www.mxdusa.org





PHOTONICS

www.aimphotonics.com



www.nextflex.us



https://affoa.org/



www.armiusa.org





www.biomade.org

AMERICA MAKES: NATIONAL ADDITIVE MANUFACTURING INNOVATION INSTITUTE

America Makes is the nation's leading public-private partnership for additive manufacturing (AM) technology and education through accelerating AM adoption and the nation's global manufacturing competitiveness.

MxD: DIGITAL MANUFACTURING AND CYBERSECURITY INSTITUTE

MxD advances economic prosperity and national security by strengthening U.S. manufacturing competitiveness through technology innovation, workforce development, and cybersecurity preparedness. In partnership with the Department of Defense, MxD convenes an ecosystem to solve critical manufacturing challenges by accelerating digital adoption, empowering a skilled workforce, and modernizing supply chains. MxD is the DoD designated National Center for Cybersecurity in Manufacturing.

LIFT: NATIONAL ADVANCED MATERIALS MANUFACTURING INNOVATION INSTITUTE

LIFT is driving American advanced manufacturing into the future through technology and talent development by connecting advanced materials, manufacturing processes, systems engineering, and talent development in support of our national security and economy.

AIM PHOTONICS: AMERICAN INSTITUTE FOR MANUFACTURING INTEGRATED PHOTONICS

AIM Photonics enables a complete photonic integrated chip manufacturing ecosystem. The system provides the photonic community and DoD access to advanced technology, capabilities, and resources throughout the entire product development cycle.

NEXTFLEX: AMERICA'S HYBRID ELECTRONICS MANUFACTURING INSTITUTE

NextFlex designs, prototypes, and pilot-scale manufactures hybrid and additively manufactured electronics aligned with multiple DoD priorities through its nationwide membership and its International Traffic in Arms Regulations and Food and Drug Administration compliant end-to-end manufacturing facility.

AFFOA: ADVANCED FUNCTIONAL FABRICS OF AMERICA

AFFOA enables a manufacturing-based revolution through the transformation of traditional fibers, yarns, and textiles into sophisticated, integrated, and networked devices and systems.

BIOFABUSA: ADVANCED REGENERATIVE MANUFACTURING INSTITUTE

BioFabUSA integrates life science, engineering, automation, robotics, and analytical technologies to advance the scalable, consistent, cost-effective manufacture of cell-based products – transforming healthcare for injured warfighters and propelling the United States to preeminent global leadership in biofabrication.

THE ARM INSTITUTE: ADVANCED ROBOTICS FOR MANUFACTURING

The ARM Institute strengthens and stabilizes the DoD manufacturing supply chain by advancing robotic and artificial intelligence technologies and supporting workforce needed to efficiently supply the U.S. warfighter from domestic sources.

BIOMADE: BIOINDUSTRIAL MANUFACTURING AND DESIGN ECOSYSTEM

BioMADE's mission is to enable domestic bioindustrial manufacturing at all scales, develop technologies to enhance U.S. bioindustrial competitiveness, de-risk investment in relevant infrastructure, and expand the biomanufacturing workforce to realize the economic promise of industrial biotechnology.

Don't know where to start?

Contact MicKenzie Frith, DoD MII Executive Secretary: mickenzie.r.frith.ctr@mail.mil

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