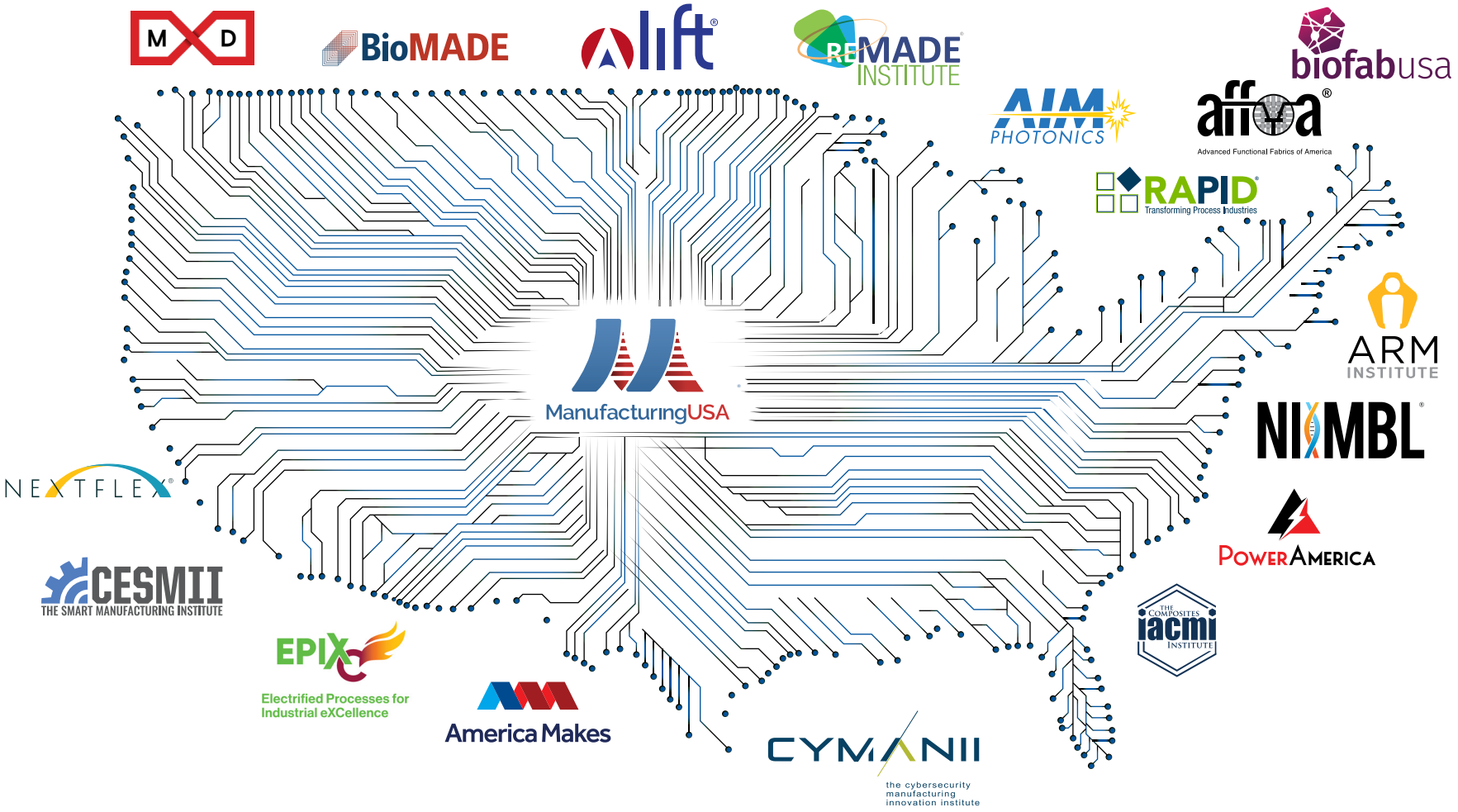
Manufacturing USA®

ANNUAL REPORT 2025



This publication is available free of charge
https://doi.org/10.6028/NIST.AMS.600-19

NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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This Annual Report covers Manufacturing USA activities and impact from October 1, 2022, to September 30, 2023.

TABLE OF CONTENTS

A MESSAGE FROM OUR **INTERAGENCY TEAM**

In 2023, Manufacturing USA® continued to strengthen U.S. global leadership in advanced manufacturing by supporting the development and transition of innovative technologies into scalable, cost-effective, and high-performing domestic manufacturing capabilities.[1] Collaboration across the network—including institutes, industry, academia, and government partners—has been key to harnessing technology to accelerate manufacturing and bolster economic and national security.

Throughout its existence, Manufacturing USA has demonstrated that the public-private partnership model is essential to accelerating technology development and advancing manufacturing. In 2023, the Manufacturing USA network convened 17 institutes focused on advancing key technology areas—including electronics, materials, digital controls, automation, and biomanufacturing—critical to securing U.S. global leadership in advanced manufacturing.

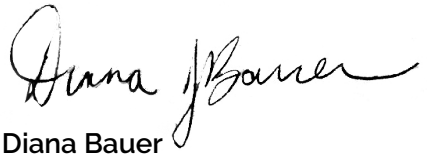
The Manufacturing USA network succeeds through its collaborative model, forging strong partnerships across institute networks to overcome challenges and drive industrial innovation. In FY 2023 alone, the network worked on more than 900 high-priority applied research and development technology projects, helped more than 150,000 workers, students, and educators through institute workforce development programs and training, engaged more than 2,900 institute member organizations (with 73% of industry member organizations comprising small and mid-size manufacturers), and invested $380 million from state, federal, and private funds in addition to $160 million in base federal funding.

Workforce development remains a cornerstone of the network's success, ensuring a future workforce that will support tomorrow's advancements and opportunities. In FY 2023, Manufacturing USA launched two significant network-wide workforce programs—Modern Makers and the Manufacturing USA Education and Workforce Development Roadmap—to ensure that technologies invented in the U.S. will be made here by a skilled and expert domestic workforce. Manufacturing USA is poised to support the Administration in implementing its newly developed "America's Talent Strategy: Building the Workforce for the Golden Age" and "White House Artificial Intelligence Action Plan" through continued industry-driven initiatives, including standards for occupations and training for skills needed in emerging technologies.

Manufacturing USA serves federal agencies and U.S. industry as a valuable resource for delivering technical leadership, empowering the current and next-generation manufacturing workforce, and building powerful innovation networks and supply chains. With ongoing collaboration and innovation, the program is well-positioned to drive the future of U.S. manufacturing.

Michael F. Molnar
Department of Commerce

Keith DeVries
Department of Defense



Diana Bauer
Department of Energy

[1] Consolidated and Further Continuing Appropriations Act, 2015, (Pub. L. 113-235, Title Vii – Revitalize American Manufacturing Innovation Act of 2014, codified at 15 USC. 278s) http://uscode.house.gov/view.xhtml?req=(title:15%20section:278s%20edition:prelim)

ABOUT **MANUFACTURING USA**

A strong manufacturing sector is the foundation of America's economic success and national security.

It fuels job creation, fosters innovation in critical industries, and enhances our quality of life. Manufacturing accounts for 54% of U.S. private sector research and development investment, driving the advancement of cutting-edge technologies[2]

Manufacturing USA was established to secure the future of manufacturing in the United States by connecting people, ideas, and technology to solve industry-relevant challenges.

As part of the government's unified strategy for global leadership in advanced manufacturing, Manufacturing USA aims to make the U.S. more competitive in the global manufacturing landscape, ensure economic growth, and secure manufacturing jobs for the future.

OUR VISION: U.S. global leadership in advanced manufacturing through the development and transition of innovative technologies into scalable, cost-effective, and high-performing domestic manufacturing capabilities.

OUR MISSION: To connect people, ideas, and technology to solve industry-relevant advanced manufacturing challenges, thereby enhancing industrial competitiveness.

GOALS: Manufacturing USA works to achieve this vision through four goals:[3]

- **Goal 1:** Increase the competitiveness of U.S. manufacturing
- **Goal 2:** Facilitate the transition of innovative technologies into scalable, cost-effective, and high-performing domestic manufacturing capabilities
- **Goal 3:** Accelerate the development of an advanced manufacturing workforce
- **Goal 4:** Promote a network of institutes that build long-term support for and within their communities

[2] *Research and Development: U.S. Trends and International Comparisons. Science and Engineering Indicators 2024*. National Science Board, National Science Foundation. 2024. NSB-2024-6. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20246/.

[3] In FY 2023, the program's participating agencies updated and began implementing Goal 4, as outlined in the *Strategic Plan for the Manufacturing USA Program (2024).* Advanced Manufacturing National Program Office, National Institute of Standards and Technology, Department of Commerce. Available at: https://www.manufacturingusa.com/news/manufacturing-usa-releases-2024-strategic-plan

17 Institutes

Members in **50 States + Puerto Rico**

9 Partner Federal Agencies

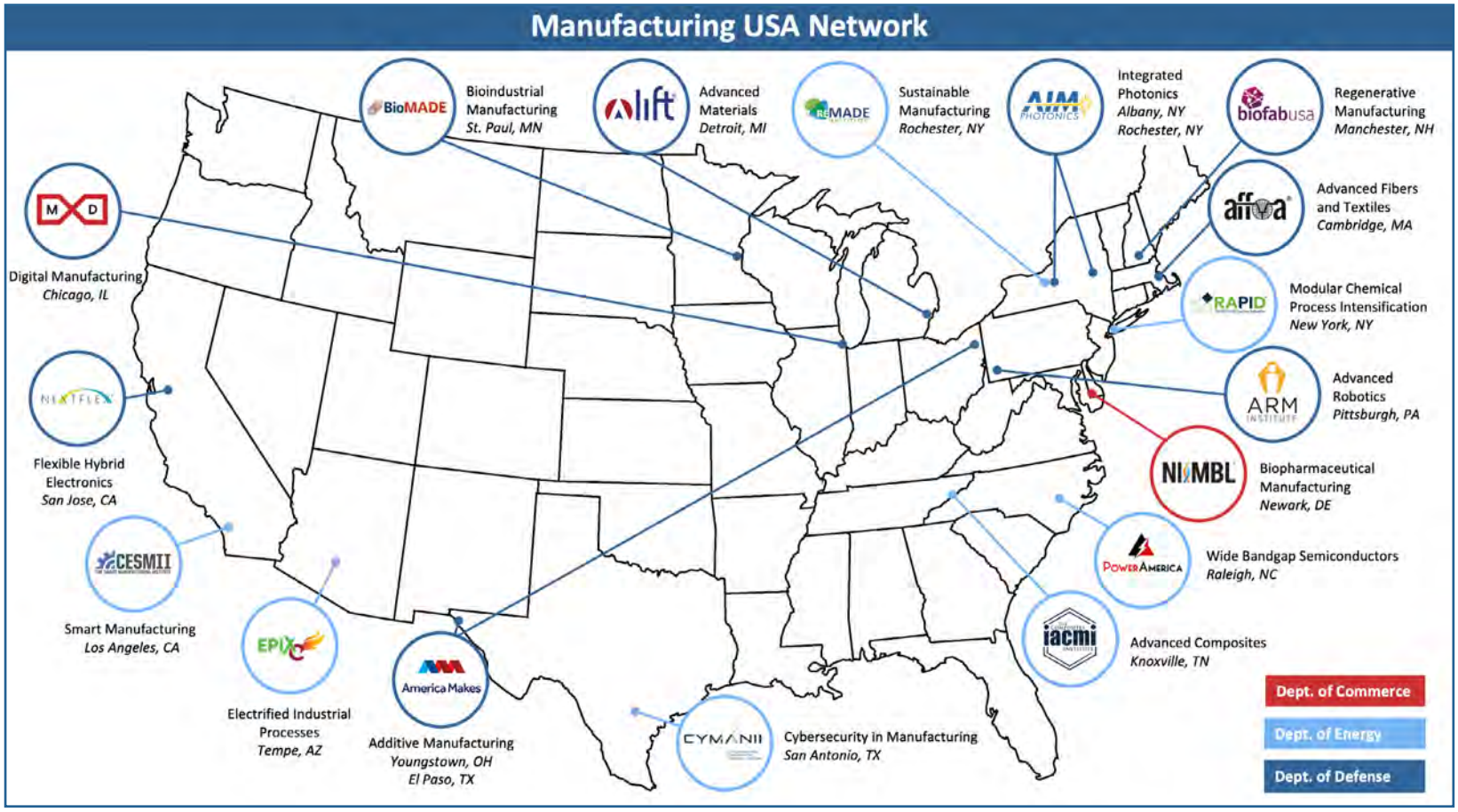
DOC sponsors **1 Institute** and serves as overall **Program Office**

DoD sponsors **9 Institutes**

DOE sponsors **7 Institutes**

In FY 2023, Manufacturing USA operated through a network of 17 manufacturing innovation institutes sponsored by the Departments of Commerce, Defense, and Energy. Each institute is a public-private partnership concentrating on a unique advanced manufacturing technology, all working towards securing the future of manufacturing in the U.S. The institutes are hubs for innovation, where manufacturers, academic institutions, and government agencies collaborate on research and development projects, share risks, and pool resources to tackle key manufacturing challenges.

Through its network of institutes, the Manufacturing USA Program leverages the strengths of many partners to advance the state of manufacturing in the United States. This collaborative approach accelerates technological innovation and fosters a vibrant, globally competitive manufacturing sector and supply chains, driving economic growth and creating high-value jobs.



*Manufacturing USA Network at time of publication, March 2026. Credit: NIST

MANUFACTURING USA PROGRAM PERFORMANCE **AT A GLANCE**

Manufacturing USA's vision and mission guide its participating agencies and institutes to achieve its four program goals.

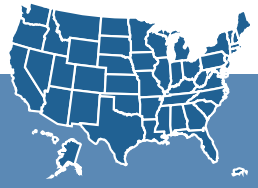
Through collaboration, the program accelerates technology transition from early-stage research to practical and commercial applications, unleashing domestic manufacturing potential and industrial innovation.

A comprehensive, collaborative approach is essential to Manufacturing USA's success. In FY 2023, its institutes invested approximately $540M, including $380M from private, state, and federal sources, and $160M in base federal funding, to strengthen America's manufacturing leadership.

Manufacturing USA institutes bring together manufacturers, research institutions, academia, start-ups, and government agencies to drive innovation. This collaboration speeds the development of new technologies that improve products and manufacturing processes, reduce costs, boost efficiency, and expand capabilities. In FY 2023, the institutes managed over 900 research and development projects.

Manufacturing USA also links members, federal agencies, and workforce development partners to attract untapped American talent and create opportunities for high-paying advanced manufacturing careers. In FY 2023, over 150,000 workers, students, and educators participated in its programs. Over 17,000 workers completed certificate, apprenticeship, or training programs, while 130,000 students and 3,300 educators participated in activities featuring new curricula, industry-verified certificate pathways, and targeted upskilling.

FY 2023 Network Metrics



Increase the Competitiveness of U.S. Manufacturing

2,900+
Member Organizations

493
Large Manufacturers

1,315
Small Manufacturers

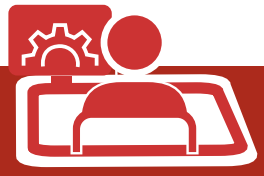
655
Academic Organizations

458
Other Entities

Facilitate the Transition of Innovative Technologies into Scalable, Cost-Effective, and High-Performing Domestic Manufacturing Capabilities

920+
Applied Research and Development Technology Projects

85%
Key Project Technical Objectives Met in 2023



Accelerate the Development of an Advanced Manufacturing Workforce

150,700+
Workforce Training Participants

17,071
Professional Development Certifications, Apprenticeships, and Training Programs Completed

Promote a Network of Institutes that Build Long-Term Support for and within their Communities

$539.9M
Total Expenditures

$160.4M
Federal Base Funding

2.4 to 1
Co-Investment

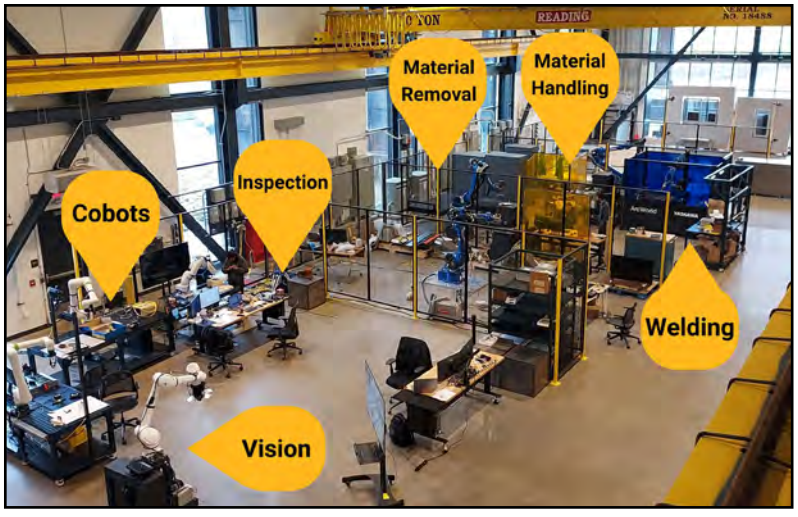
**FY 2023 data. Credit: NIST*

GOAL 1: INCREASE THE COMPETITIVENESS OF **U.S. MANUFACTURING**

Improving manufacturing production capabilities will boost the global competitiveness of U.S. manufacturers. Achieving this goal requires advancing U.S. leadership in manufacturing research, innovation, technology development, and industry deployment. Manufacturing USA institutes play a key role by fostering strong networks and strategic technical portfolios to drive innovation and productivity. By deploying advanced manufacturing innovations, manufacturers can adopt new technologies, lower production costs, and bring innovative products to market, further strengthening their global competitiveness.

Examples of institute projects to increase the U.S. manufacturing competitiveness include:

Improving Quality Control through Human-Robot Collaboration: The Advanced Robotics for Manufacturing (ARM) Institute developed an advanced system of sensors and software, improving quality inspection through human-robot collaboration. This integrated 3D inspection system was designed for easy programming and compatibility with existing computerized maintenance management systems. The system not only strengthens manufacturing efficiency and reliability but also bolsters industrial competitiveness by improving resolution, cycle time, and programming efficiency while offering actionable insights for future advances. It has been successfully implemented at Stellantis (Fiat Chrysler Automotive) in the United States. By automating the qualification process with AI-driven, high-resolution 3D scanning and industrial collaborative robots designed to work alongside humans, it addresses quality backlog issues and detects process drift earlier. ARM is now expanding the implementation to seven additional parts across 12 plants.



Credit: ARM Institute.

Credit: AIM Photonics/NIST.

AIM Photonics Offers New Cost-Effective Opto-Electronic Testing Services: American Institute for Manufacturing (AIM) Photonics has launched Opto-electronic Testing Services to provide cost-effective access to advanced test and measurement tools, addressing a significant barrier for start-ups and smaller companies, as well as larger companies. Offered through its Rochester, NY facility—the only shared U.S. center providing photonic and electronic test, assembly, and packaging prototyping for substrates up to 300 mm wafers—the service includes over 30 tools for testing photonic integrated circuits (PICs) and conventional electronic ICs. By enabling rapid verification and optimization of devices and manufacturing processes, AIM Photonics helps members and customers save time and resources, fostering innovation without cost-prohibitive infrastructure investment. This initiative strengthens U.S. integrated photonics manufacturing, driving technological advancements and increasing U.S. competitiveness globally.

GOAL 2: FACILITATE THE TRANSITION OF INNOVATIVE TECHNOLOGIES INTO SCALABLE, COST-EFFECTIVE, AND HIGH-PERFORMING **DOMESTIC MANUFACTURING CAPABILITIES**

Advanced manufacturing technologies often face technical and economic barriers that impede their transition from research laboratories to scalable production environments. Innovations originating in universities and manufacturers frequently stall at the scale-up stage, adversely affecting U.S. manufacturing productivity. Manufacturing USA institutes tackle these challenges by de-risking technology development, making new technology accessible to manufacturers of all sizes—small, medium, and large. They offer shared resources and expertise to address challenges related to facility and equipment access. An important benefit of their connected network is the enhanced scale-up of newly developed manufacturing capabilities.

Examples of Manufacturing USA projects transitioning innovative technology into domestic manufacturing capabilities include:

Credit: LIFT/NIST.

LIFT Leads Effort to Build Department of Defense Electrochemical Separator Production in Detroit: LIFT launched a project to establish a pilot line for producing electrochemical separators—critical components for energy storage and conversion systems—at its Detroit facility. The initiative addresses the lack of U.S.-based manufacturers for these high-quality, corrosion-resistant separators in the power range required by DoD. During the two-year trial period, LIFT will design and operate the production line, delivering units for testing before transitioning to full-scale production. By securing the supply chain, reducing costs, and strengthening domestic manufacturing capabilities, this project not only supports defense applications but also bolsters U.S. competitiveness in technology innovation.

RAPID Advances Continuous Process Manufacturing to Cut Costs and Improve Product Quality: Leveraging RAPID's principles of modular process intensification, the University of Pittsburgh collaborated with Lubrizol Corporation to transform a key chemical dispersant production process from batch to continuous manufacturing, resulting in dramatic cost reductions. The team developed a compact, shipping container-sized continuous production module. This innovation enabled the production of higher-quality products while reducing capital costs by 65% and operating costs by 60%, demonstrating the potential for scalable, efficient, and cost-effective domestic manufacturing solutions based on modular process intensification.

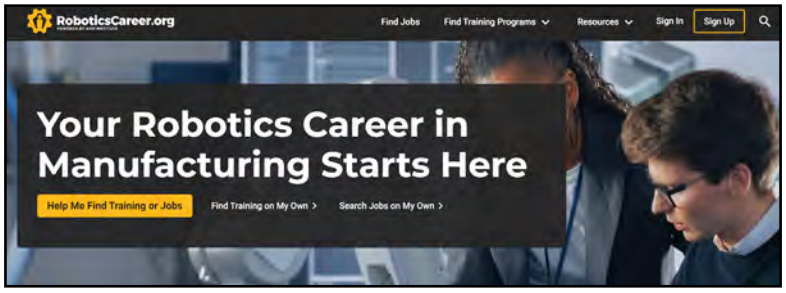
Credit: RAPID.

GOAL 3: ACCELERATE THE DEVELOPMENT OF AN **ADVANCED MANUFACTURING WORKFORCE**

Adoption of new manufacturing technologies requires a skilled workforce across all education and training levels. The Manufacturing USA Program plays a unique role in developing an advanced manufacturing workforce, including skilled technicians, production workers, engineers, scientists, and laboratory personnel. Innovative manufacturing technologies have the potential to create millions of secure, high-wage jobs, many of which do not require a four-year degree. However, the gap between the skills needed for these technologies and those possessed by the workforce is significant and growing. Workforce development must keep pace with evolving skill demands to address this gap and continue to include jobseekers who are veterans, people with disabilities, and those reentering the workforce.

Examples of Manufacturing USA initiatives that accelerate the development of an advanced manufacturing workforce include:

The ARM Institute's RoboticsCareer.org platform connects students, job seekers, and training providers with effective training programs and manufacturing jobs: The ARM Institute's RoboticsCareer.org platform, developed in collaboration with its member consortium, helps bridge the manufacturing workforce gap by connecting individuals to opportunities in robotics. The platform links future workers to over 16,700 robotics training programs, evaluates and endorses top training programs, and provides personalized, up-to-date job listings. All programs and jobs align with the skills and competencies defined by the ARM Institute's industry-led membership for robotics roles in manufacturing. Training providers can list their programs for free, and employers gain access to qualified workers through its talent database. In 2023, ARM enhanced RoboticsCareer.org by introducing job-matching features to better connect employers with candidates.



Credit: ARM Institute.

Credit: IACMI.

IACMI's InnoCrate Paves the Way for Advanced Manufacturing Careers: Developed and piloted in 2023, IACMI's InnoCrate learning kits accelerate the development of an advanced manufacturing workforce by introducing K-12 students to foundational skills in composites. The teaching tools are divided by age levels, culminating with high school students being taught manufacturing workforce-oriented concepts, including computer-aided design (CAD) modeling, computerized numerical control (CNC) machines, molding techniques, and metal casting. Over 1,000 kits have been distributed to 13 schools, reaching approximately 2,000 students, with a focus on rural areas. To support educators, IACMI provided free "Train the Trainer" sessions to teachers from nine schools in East Tennessee. By making advanced manufacturing concepts accessible and engaging, InnoCrate equips students with the knowledge and inspiration needed to pursue careers in this critical field, fostering a pipeline of skilled workers for the future.

Manufacturing USA Network Workforce Initiatives

In 2023, Manufacturing USA launched two network-wide initiatives to expand access to workforce training best practices and to inspire interest in advanced manufacturing careers:

A Manufacturing USA Workforce Roadmap: To attract and retain students and workers, Manufacturing USA created a first-of-its-kind roadmap[4] aimed at building a robust advanced manufacturing workforce. Developed in consultation with industry and government, the roadmap identifies scalable and ready-to-go vocational, student, and workforce programs with the highest potential to address critical gaps and ensure long-term sustainability.

Each institute in the network addresses workforce needs within its specific technology area, while a coordinated, network-wide expansion of efforts amplifies the impact across U.S. manufacturing. Guided by the roadmap, the network focuses on common workforce development activities—often through regional and sectoral partnerships—to tackle workforce challenges and support the sustained growth of advanced manufacturing nationwide.

Credit: NIST.

Roadmap Priorities

Priority 1: Equip an advanced manufacturing workforce with evolving skills.

Provide opportunities for individuals to develop advanced manufacturing skills and succeed in today's evolving manufacturing ecosystem

Priority 2: Broaden access to advanced manufacturing career pathways.

Remove barriers to career pathways to expand the advanced manufacturing workforce

Priority 3: Spark interest in advanced manufacturing careers to secure a steady workforce talent pool.

Improve perceptions of today's manufacturing careers to encourage the future workforce to pursue pathways to advanced manufacturing careers

Credit: NIST.

[4] *Revitalizing America's Manufacturing Workforce: A Manufacturing USA National Roadmap* (2023). Advanced Manufacturing National Program Office, National Institute of Standards and Technology. Available at: https://www.manufacturingusa.com/pages/revitalizing-americas-manufacturing-workforce-manufacturing-usa-national-roadmap

MODERN MAKERS

In FY 2023, Manufacturing USA launched the Modern Makers initiative to showcase the pathways individuals take to enter and advance in the manufacturing workforce. By highlighting success stories from within the Manufacturing USA network, the initiative promotes careers in advanced manufacturing. The inaugural cohort comprises 16 Modern Makers nominated by Manufacturing USA institutes.[5] Through their work, these individuals transform the perception of manufacturing careers. Their stories have the power to transform perceptions of manufacturing careers.

Adonis Summerville (IACMI)
Machining Mentor

Senior Metalworking Skills Instructor,
Jane Addams Resource Corporation

Interests: Machining mentor, muscle car fanatic, pool player

Aeon Williams (AIM Photonics)
Programmer

Software Application Engineer,
Spark Photonics

Interests: Gamer, cosplay character creator

Ashley Totin (America Makes)
Additive Manufacturing Force & TV Host

Former Senior Project Engineer,
America Makes

Interests: Lego enthusiast

Brenna Schneider (AFFOA)
Entrepreneur

Founder & CEO,
99Degrees

Interests: Economic impact champion, nature lover

Fatima Majid (LIFT)
Robotics Instructor

Senior Manager,
Talent Programs LIFT

Interests: STEM advocate, sci-fi fan

Jim DeKloe (BioMADE)
Biotech Pioneer & Teacher

Distinguished Professor of Biological Sciences, Biotechnology, and Biomanufacturing, Solano College

Interests: Community advocate

John Williams, Ph.D. (NextFlex)
Research & Development Standout & Teacher

Lead Engineer,
The Boeing Company

Interests: Scouting dad who leads tank wars

John Kreckel (REMADE)
Connector

Director of Membership and Workforce Development,
REMADE

Interests: Outdoor enthusiast

[5] The Modern Makers (2023). Advanced Manufacturing National Program Office, National Institute of Standards and Technology. Available at: https://www.manufacturingusa.com/modern-makers

John Louka (CESMII)
Technologist

Former Application Engineer, CESMII

Interests: Puzzle solver, tinkerer

Rachel Swamy (NIIMBL)
Biomedical Engineer

Research Associate, NIIMBL

Interests: Lifetime learner

Kim Lemay (BioFabUSA)
Connector

Operations Specialist, BioFabUSA

Interests: Safety guru, soccer mom, cribbage

Rodrigo Perez (MxD)
Mechanical Engineer

Manufacturing Systems Integration Engineer, MxD

Interests: Tech in manufacturing, athlete

Lance Miller (RAPID)
Aspiring Engineer

Student, Carnegie Mellon University

Interests: Theatre performer

Tymeeka Middleton (CyManII)
Builder of Cyber Careers

Former Director of Education and Workforce Development, CyManII

Interests: Helping veterans, baking, traveling

Maria Araujo (ARM Institute)
Technology Architect

Director of Advanced Technology, Johnson & Johnson Service, Inc.

Interests: Global tourist, local cyclist

Victor Veliadis (PowerAmerica)
Semiconductor Innovator

Executive Director and Chief Technology Officer, PowerAmerica

Interests: Karate, traveling

GOAL 4: PROMOTE A NETWORK OF INSTITUTES THAT BUILD LONG-TERM SUPPORT FOR AND WITHIN THEIR **COMMUNITIES**

The Manufacturing USA Program fosters a collaborative network of advanced manufacturing institutes, each firmly rooted in its community. These institutes ensure long-term viability by delivering tangible benefits to their partners, attracting co-investment, and engaging industrial, academic, and government stakeholders. This integrated approach strengthens local and regional economies, drives national prosperity, and enhances national security through a business model that supports the institutes' ongoing operations.

Examples of how the network of institutes builds long-term support for and from their communities include:

Minnesota Invests in Bioindustrial Manufacturing Facility: Minnesota has approved up to $100 million in co-investment with federal funding to establish a groundbreaking bioindustrial manufacturing campus to address the critical need for pilot-scale facilities that will transform American biomanufacturing for the 21st century. This initiative, spearheaded by BioMADE, positions the U.S. as the leader in cutting-edge bioindustrial innovation. By creating high-value products like bioplastics and durable fibers, the investment strengthens supply chains and will create high-paying manufacturing jobs in Minnesota, while serving as a model for the development of a national network of bioindustrial infrastructure, benefitting both urban and rural communities.

Credit: BioMADE

Credit: AFFOA

Cross-Institute Workshop Tackles E-Textile Innovation Challenges: E-textiles—fabrics embedded with electronic components for functions like sensing, heating, lighting, or data transmission—face significant hurdles in development and scalability. Their design often relies on slow, iterative physical prototyping, resulting in inconsistent performance and challenges when scaling manufacturing processes. To address these issues and enhance industry collaboration, the ARM Institute, NextFlex, and AFFOA hosted a pioneering workshop for their member organizations. This event brought together experts in functional fabrics, electronics design, manufacturing, and design tools to close critical gaps in digital tools for e-textile development. By fostering collaboration across industries and institutes and leveraging broad collective expertise, this initiative bolsters the sustainability of institute efforts while strengthening the innovation networks of all the participants.

INSTITUTE ACTIVITIES AND IMPACT

INSTITUTE @WORK

2012
ESTABLISHED

259
MEMBERS

7
project calls
AWARDED OVER $36M

Participated in 20+ conferences
AND OTHER EVENTS

AMERICA MAKES.US

America Makes

America Makes

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

Headquarters: Youngstown, OH

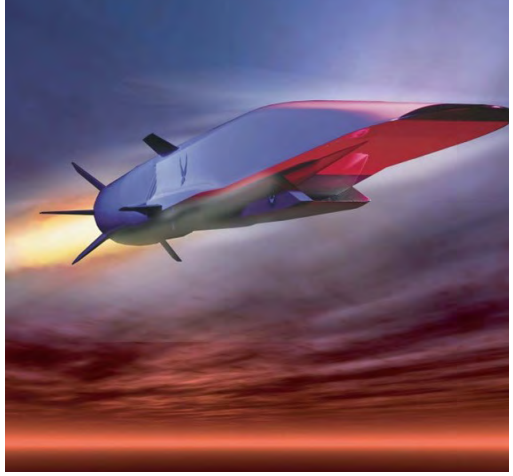
Consortium Organizer: National Center for Defense Manufacturing and Machining (NCDMM)

Satellite Locations:

- The W.M. Keck Center for 3D Innovation at The University of Texas at El Paso (El Paso, TX)
- Texas A&M Engineering Experiment Station at Texas A&M University (College Station, TX)
- National Institute for Aviation Research at Wichita State University (Wichita, KS)

YEAR IN REVIEW

- NCDMM was recognized as a 2023 finalist for outstanding achievements in the categories of Digital Supply Chain and Engineering and Production at the Manufacturing Leadership Council's Manufacturing Leadership Awards.
- America Makes solicited information on the current state of the AM supply chain.
- America Makes and the American National Standards Institute (ANSI) announced the publication of the Standardization Roadmap for Additive Manufacturing, Version 3.0, developed by the America Makes and ANSI Additive Manufacturing Standardization Collaborative (AMSC).
- America Makes held its annual Members Meeting and Exchange (MMX) and 2023 Ambassador Awards and Distinguished Collaborator Awards.

Left: AMMO AMPED Workshop held at MxD in June 2022. Credit: America Makes. Middle: The Boeing X-51 Waverider is an unmanned research scramjet experimental aircraft to operate at Mach 5 (3,300 mph) at an altitude of 70,000 feet. Credit: Boeing. Right: America Makes impacts DoD casting and forging supply base. Credit: America Makes Institute and Deloitte.

America Makes builds technical teams with capabilities beyond those of any single organization to address the specific needs of DoD. Through this collaborative mindset, America Makes accelerates the development and deployment of AM solutions to enhance military readiness and improve business performance and overall manufacturing affordability.

TECHNOLOGY ADVANTAGE

Graded Alloy Transitions for High-Mach Systems: A Boeing-led project developed AM techniques for processing high-temperature and dissimilar material sets for high-Mach applications. This project demonstrated the feasibility of using blown metal powder, Laser-Directed Energy Deposition Additive Manufacturing to deposit functionally-graded structural transitions between C103 niobium alloy and three different Ti alloys – Titan-23, QuesTek-Ti, and Ti-6242.

WORKFORCE DEVELOPMENT

Defense Manufacturing Communities Support Program (DMCSPs): America Makes is a proud collaborator and partner across many DMCSPs nationally. Ten local DMCSPs are scaling programs and growing impact by deploying the institute's best practices. Many of these programs support outreach and training programs across the broad range of workforce and talent, including veterans and separating service members. A few larger-scale programs also create new assets to be deployed nationally through America Makes' AMNation Pipeline Portal for education and workforce.

SUPPORTIVE INNOVATION NETWORKS

Domestic AM Supply Chain Meetings Explore Space Propulsion Opportunities: The workshop and participants, including NASA, AFRL, MDA, DOE, DoD, industry, academia, and non-profits, addressed needs and gaps associated with technological and manufacturing challenges, as well as opportunities facing the extensive adoption of AM technologies for space and defense propulsion applications.

> "Through our collaboration with America Makes we were able to secure a grant to test our capability with [the Office of the Secretary of Defense] and develop our 3D printers for DoD demonstration and deployment later this year.
>
> **–Eric Shnell, Chief Executive Officer, Craitor**

INSTITUTE @WORK

2017
ESTABLISHED

415
MEMBERS

16,700+
TRAINING PROGRAMS ON ROBOTICSCAREERS.ORG

Funded 19
NEW TECHNOLOGY PROJECTS IN FY 2023

ARMINSTITUTE.ORG

The ARM Institute

The ARM Institute accelerates the development and adoption of robotics technologies that are the foundation of every advanced manufacturing activity today and in the future.

Headquarters: Pittsburgh, PA

Consortium Organizer: Carnegie Mellon University

Satellite Locations: St Petersburg, FL

YEAR IN REVIEW

- ARM Institute hosted the first Office of the Secretary of Defense ManTech Point of Need Manufacturing Challenge Project Call for the 9 DoD-sponsored Manufacturing USA institutes.
- ARM Institute launched the Robotics Manufacturing Hub, providing complementary evaluation services to small and medium-sized manufacturers in Southwestern PA.
- ARM Institute's workforce website introduced job matching support for job seekers to complement the national training program capability.
- ARM Institute opened its Tampa Bay Innovation Center in St. Petersburg, FL.


Left: Credit: ARM. Middle: and Right Credit: ARM/NIST.

The ARM Institute is leading the way to a future where people and robots work together to respond to our nation's greatest challenges and to develop and produce the world's most desired products.

TECHNOLOGY ADVANTAGE

Human Robot Collaboration in Quality Inspection: This ARM Institute project developed an integrated suite of sensors and software to enhance collaborative inspection. The system developed has been transitioned into production for one engine component at Stellantis (Fiat Chrysler Automotive). Now, ARM is expanding transition for seven parts at 12 additional plants.

WORKFORCE DEVELOPMENT

BotsIQ Serves 200+ Students Through Summer Day Camps: BotsIQ works with area schools and community groups to deliver the RoboRecharge Program in middle and high schools across western Pennsylvania. BotsIQ hosted over 200 students through six-week summer day camps including a manufacturing company tour.

SUPPORTIVE INNOVATION NETWORKS

Recruiting New Integrators through BBB Grant: To support the efforts of the Robotics Manufacturing Hub, ARM Institute is recruiting new systems integrators to provide proposals on robotic installations for small/medium manufacturers in the 11-county Pittsburgh region. These organizations will be valuable assets of the consortium in facilitating more tech transition of the project portfolio.

> "For Universal Robots, going through the ARM endorsement training was an excellent initial step in offering an educational platform that meets the industry's needs.
>
> –Corey Adams, Educational Program Manager, Universal Robots

INSTITUTE @WORK

2020
ESTABLISHED

46
MEMBERS

Opened 17,000ft²
MANUFACTURING DEMONSTRATION FACILITY

10 entities
COLLABORATING ON $4.7M RFP PROJECTS

CYMANII.ORG

CYMANII
the cybersecurity manufacturing innovation institute

Cybersecurity Manufacturing Innovation Institute

CyManII secures and sustains U.S. manufacturing through the development of partnerships and the deployment of innovative technologies that will empower a skilled workforce.

Headquarters: San Antonio, TX

Consortium Organizer: The University of Texas at San Antonio

Satellite Locations: George Mason University, Fairfax, VA

YEAR IN REVIEW

- **Cybersecurity on the Factory Floor** – Launched Industry Use Cases with partners to validate cybersecurity innovations in real manufacturing environments.
- **Mobile Cybersecurity Training** – The Mobile Training Vehicle delivered cybersecurity education directly to manufacturers and students.
- **Facility & R&D Expansion** – Established the C4M Hub and Lab Six facilities as national testbeds to secure manufacturing, hosting industrial demonstrations and training.
- **Breakthrough Research & Innovation** – Advanced industrial cybersecurity with new Cyber Weakness content, four research publications, and the Cyber-Physical Passport validating product integrity to strengthen supply chain security.


Left: CyManII headquarters in downtown San Antonio. Middle: Students from area high schools in front of CyManII's Mobile Training Vehicle. Right: Students from San Antonio area high schools participating in cyber training inside CyManII's Mobile Training Vehicle. Credit: CyManII.

CyManII is advancing cybersecurity in manufacturing by deploying real-world security solutions, expanding workforce training, and driving R&D innovation. Through cutting-edge technology, industry collaboration, and education, CyManII strengthens U.S. manufacturing resilience, energy dominance, and supply chain security in an evolving digital landscape.

TECHNOLOGY ADVANTAGE

DOE Announces Up to $4.7 Million for Manufacturing Cybersecurity Innovation: DOE, in collaboration with CyManII, announced up to $4.7 million to support projects that enhance the cybersecurity landscape within American manufacturing in three critical areas: Industrial Control Systems, Secure Industrial Digitalization, and Industrial Additive Manufacturing. Ten projects were awarded to partners such as GE Vernova, Authentise, Humtown, Clean Energy Smart Manufacturing Innovation Institute (CESMII), Kry10 Corporation, Purdue University, Michigan Technical University, The University of Texas at El Paso, The University of Texas at San Antonio, and The Ohio State University.

WORKFORCE DEVELOPMENT

CyManII Training Next Generation of Cyber Talent Through Workforce Development: The first of its kind, Mobile Training Vehicle (MTV) trained more than 10,500 people as it visits local schools and manufacturers providing a variety of training programs and competition-style activities to engage the current and future workforce. MTV is expected to engage more than 40,000 students and workers in 2024 and hundreds of thousands over the next few years.

SUPPORTIVE INNOVATION NETWORKS

Strengthening the Cyber Workforce to Protect Critical Infrastructure: In alignment with national efforts to strengthen America's manufacturing and energy sectors, CyManII launched the first Cyber-Informed Engineering lab to equip a highly skilled workforce with cutting-edge expertise in securing industrial control systems. This initiative directly supports the need for next-generation energy security solutions by advancing cybersecurity knowledge, fostering innovation, and preparing the workforce for critical roles in advanced manufacturing.

> "Our partnership with CyManII will support its mission to secure and sustain advanced manufacturing in the U.S.
>
> –Nick Graham, Chief Revenue Officer, Formlabs

INSTITUTE @WORK

2014
ESTABLISHED

290
MEMBERS
$6.2 M AWARDED TO ADDRESS SKILLS GAP

Manufacturing Leadership Council's
AWARD FINALIST

MXDUSA.ORG

MxD

MxD provides the federal government and U.S. manufacturers with the digital tools needed to transform American manufacturing.

Headquarters: Chicago, IL

Consortium Organizer: MxD

YEAR IN REVIEW

- MxD launched its Cyber Resource Hub and MxD Learn Virtual Training Center, online resources that help manufacturers navigate cybersecurity needs and gain digital manufacturing skills.
- The Learn Advisory Committee was established to drive MxD Learn programming and outcomes and ensure that the program meets industry needs.
- MxD was recognized as a finalist at the Manufacturing Leadership Council's Manufacturing Leadership Awards for outstanding project achievements in Engineering and Production Technology, Digital Supply Chain, and Digital Network Connectivity, as well as in next-generation leadership.
- MxD convened its members through events such as its annual Member Summit, a roundtable with the White House Office of the National Cyber Director, and a Supply Chain Summit.

Credit MxD.

MxD strengthens U.S. economic prosperity and national security by driving digital adoption in manufacturing. MxD partners with manufacturers to harness the power of the digital thread to drive forward advanced manufacturing technologies, while equipping the workforce and the supply chain with the skills and cyber resiliency needed to ensure an innovative, secure, and prepared defense industrial base.

TECHNOLOGY ADVANTAGE

MxD Enables Verification of Cybersecurity Compliance Across Supply Chains: Through a project with MxD, Heartland Science & Technology Group developed supply chain visibility features along with reporting, sorting, and self-assessments to provide prime contractors an aggregated user-friendly view of suppliers' Cybersecurity Maturity Model Certification (CMMC) self-assessment and accreditation status.

WORKFORCE DEVELOPMENT

MxD Learn Virtual Training Center (VTC) Offers Digital Manufacturing and Cybersecurity Courses: MxD's VTC platform features courses from several university programs. North Carolina A&T developed a course that provides a comprehensive introduction to Internet of Things (IoT) and related technologies and common issues in the adoption of IoT on a large scale. UMBC developed the Cybersecurity for Manufacturing Operating Technology (CyMOT) course for manufacturing professionals to increase their cybersecurity skills and to protect manufacturing plants from cyber breaches.

SUPPORTIVE INNOVATION NETWORKS

Betacom Establishes Private 5G Ecosystem and Opens Interactive Exhibit at MxD: Betacom, along with Google Cloud and Ingram Micro, opened an exhibition of Industry 4.0 innovations at MxD's Chicago Innovation Center. The interactive exhibit is part of a collaborative effort to equip manufacturers with digital tools and expertise needed to increase productivity and strengthen U.S. manufacturing. By bringing together different technologies and device manufacturers on the Factory Floor Lab, the project aims to accelerate manufacturers' automation and digitalization initiatives by demonstrating complete solutions that are available today.

> "EY US is thrilled to open the doors of the Digital Operations Hub at MxD leveraging our capabilities to serve as a digital transformation architect for companies across a variety of sectors.
>
> –Brad Newman, EY Americas Advanced Manufacturing & Mobility Industry Market Leader, EY

INSTITUTE @WORK

2015
ESTABLISHED

110
MEMBERS

300 mm
STATE-OF-THE-ART TAP FACILITY

$27.5M
INVESTMENT FROM THE NEW YORK STATE PHOTONICS BOARD

AIMPHOTONICS.COM

AIM Photonics

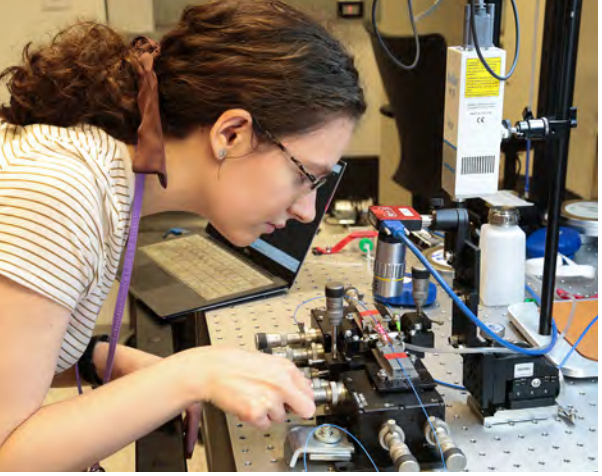
AIM Photonics advances integrated photonic circuit manufacturing technology development while simultaneously providing access to state-of-the-art fabrication, packaging, and testing capabilities for small-to-medium sized enterprises, academia, and the government.

Headquarters: Albany/Rochester, NY

Consortium Organizer: Research Foundation for the State University of New York

YEAR IN REVIEW

- AIM Photonics named in two of the four Innovative NORDTECH R&D Projects selected for federal awards from U.S. Department of Defense.
- Government Directed Project (GDP 6): BIO INSPECT launched.
- New PIC Component Library in collaboration with Spark Photonics expands automated design enablement capabilities for integrated photonics prototype development.
- U.S. Congressional Representative Paul Tonko (NY District 20) visited the Institute.
- U.S. Air Force Awarded AIM Photonics' member NLM Photonics $1.8M contract for PDK development.
- AIM Photonics launches podcast series: Photonics in Focus.



Left and Right: Credit: AIM. Middle: Credit: AIM/NIST.

AIM Photonics is advancing the use of light for applications traditionally addressed through electronics to enable significant new technological opportunities in a wide range of areas critical to the defense industry.

TECHNOLOGY ADVANTAGE

AIM Photonics Offers New Opto-Electronic Testing Services: Purchasing advanced test and measurement tools can be cost-prohibitive for many companies, particularly start-ups with limited resources. To ease this burden and help further advance the U.S. integrated photonics ecosystem, AIM Photonics officially launched Opto-Electronic Testing Services, featuring a full suite of advanced tools for testing photonic integrated circuits (PICs) and conventional electronic ICs. The comprehensive toolset expands access to all companies to advanced testing capabilities for their PIC prototype development.

WORKFORCE DEVELOPMENT

Students Gain "Real-World" PIC Design Experience with AIM Photonics Online Courses: While many U.S. photonics programs teach PIC design theory, few offer practical experience in designing manufacturable integrated photonic chips. AIM Photonics' online courses, Fabless Design of Photonic Integrated Circuits and PIC Sensor Design and Fabrication, provide students with the tools and knowledge to create PICs suitable for fabrication through AIM Photonics' multi-project wafer (MPW) services, bridging the gap between theory and real-world application.

SUPPORTIVE INNOVATION NETWORKS

AIM Photonics Expands Scalable MPW Runs for Cost-Effective Prototyping: AIM Photonics enhances scalability with volume-discount pricing for additional die per wafer, benefiting small to medium-sized enterprises. By offering incremental increases in MPW die while maintaining reliability, companies can better manage chip production for prototyping, testing, and research. AIM Photonics continues to advance MPW solutions, providing accessible, reliable, and cost-effective options for integrated photonics development at the wafer scale.

> "AIM Photonics has had a big impact on the U.S. photonics infrastructure. It's critical to have a high-quality, high-volume CMOS capability.
>
> - John Bowers, Director of the Institute for Energy Efficiency and Professor of Electrical and Computing Engineering and Materials at the University of California, Santa Barbara

INSTITUTE @WORK

2015
ESTABLISHED

197
MEMBERS

45,000
MEDICAL DIAGNOSTIC DEVICES DELIVERED

31
WORKFORCE DEVELOPMENT PARTNERS ADDED

NEXTFLEX.US

NextFlex

NextFlex achieves its mission by accelerating cutting edge innovation in hybrid electronics (HE), fostering collaboration with industry, academia, and government, growing skilled talent pathways and pipelines, and driving technology transition and adoption for the U.S. commercial and defense industrial base.

Headquarters: San Jose, CA

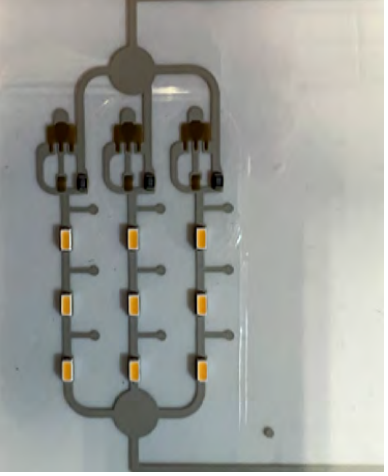
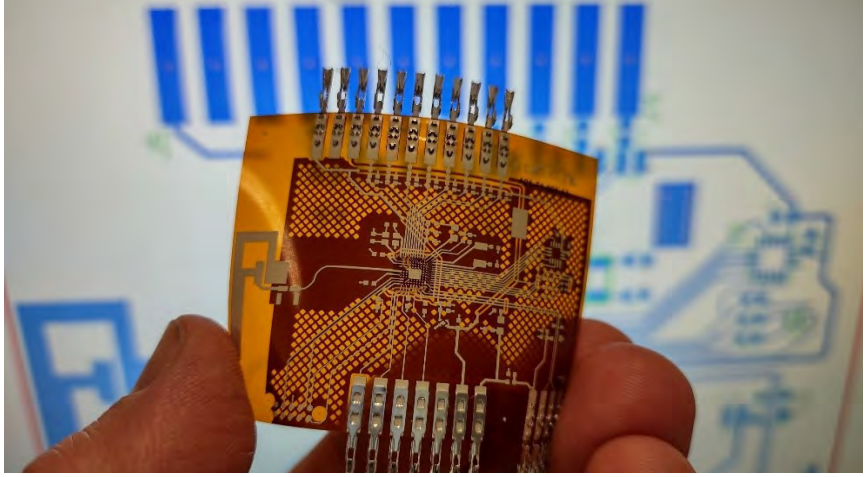
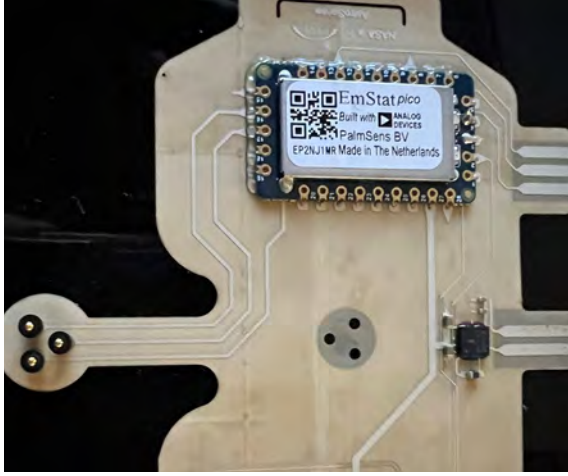
Consortium Organizer: FlexTech Alliance

Satellite Locations:

- Massachusetts
- Missouri
- New York

YEAR IN REVIEW

- NextFlex's 8th project call, which focused on HE performance and reliability and improved environmental sustainability, resulted in five awards worth $6.5M.
- The NextFlex Missouri Node, organized by the Jordan Valley Innovation Center at Missouri State University and supported by the State of Missouri, ran its first project call, funding seven projects worth $5.2M.
- NextFlex members GE Healthcare, Binghamton University, Tapecon, and their supply chain partners produced 50 vital-sign monitoring devices for aeromedical care. These devices were integrated into the battlefield-assisted trauma distributed observation kit (BATDOK) system and evaluated as part of Bold Quest 2023 in Camp Pendleton.

Left and Right: Credit: SunRay Scientific. Middle: Credit: NextFlex.

NextFlex facilitates the development and manufacturability of HE technology that integrates printed and additively-manufactured electronics with the performance of thin semiconductors to create a new category of stretchable, bendable, conformable, structural, and flexible electronic devices.

TECHNOLOGY ADVANTAGE

Scalability of flexible hybrid electronic (FHE) light-emitting diode (LED) Products for Aerospace and Automotive Applications: SunRay Scientific and Auburn University developed FHE-enabled high-power LED Electroactive Light Sheets using broadband white light LEDs. Featuring high-density LED arrays on flexible substrates, these conformal sheets illuminate around corners, inside cavities, and other hard-to-reach spaces. The project validated their assembly, reliability, and scalability for next-generation lighting applications.

WORKFORCE DEVELOPMENT

Manufacturing USA Workforce Development Summit: NextFlex hosted a Summit bringing together leaders and stakeholders to develop a 10-year workforce development strategy in collaboration with the Departments of Labor and Education and the Manufacturing Innovation Institutes. This initiative aims to address workforce shortages and establish a strategic framework for the future of manufacturing.

SUPPORTIVE INNOVATION NETWORKS

AFRL Tech Sprint: NextFlex organized a two-day, intensive Tech Sprint focused on fatigue monitoring of airmen held near the Air Force Research Laboratory in Dayton, OH. The Sprint involved 38 subject matter experts working in teams to collaboratively develop concepts that could meet pilots' needs.

> "I could not point to a better example of an organization helping to develop critical technology and processes to help build manufacturing capabilities in the USA. Growing technology while devoting attention to workforce development is terrific!
>
> - Chris Stossel, Senior Manager, Process Development & External Innovation, Eastman Chemical

INSTITUTE @WORK

2015
ESTABLISHED

88
MEMBERS

Commercialized
10+ WIDE BANDGAP TECHNOLOGIES

40%
OF PROJECTS HAVE REACHED (OR ARE SET TO REACH) COMMERCIAL STATUS

POWERAMERICAINSTITUTE.ORG

PowerAmerica*

PowerAmerica is a privately funded institute accelerating efficient wide bandgap semiconductor chip fabrication and insertion in power electronic systems, creating jobs, saving energy, and contributing to energy security.

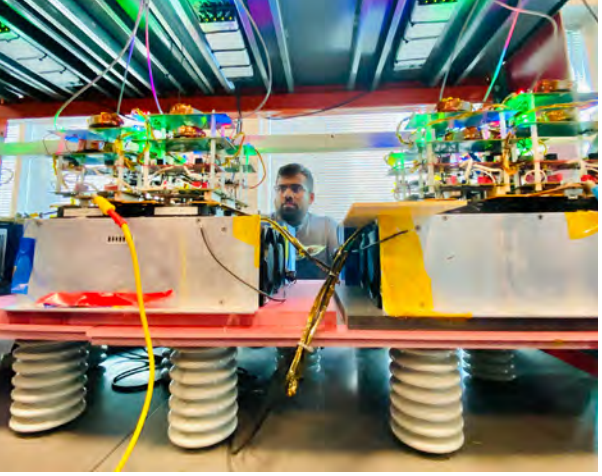
Headquarters: Raleigh, NC

Consortium Organizer: Member-driven and led.

YEAR IN REVIEW

- Two productive PowerAmerica Annual Meetings, in Raleigh, North Carolina, drew 700 in-person and virtual attendees.
- Eighty-two members gave input to PowerAmerica's $64M Department of Energy (DoE) renewal-funding proposal, which is under consideration.
- Victor Veliadis presented over 31 keynotes, tutorials, and invited talks.

* Institute did not receive base funding from sponsoring agency in this reporting period.



Credit: PowerAmerica/NIST.

Since launching in 2015, PowerAmerica has executed 212 projects, trained more than 420 masters and PhD students, and engaged over 7000 attendees in short courses, tutorials, and presentations. PowerAmerica is a privately funded member-driven consortium of industry, universities, and national labs accelerating the commercialization of energy-efficient power semiconductor technologies.

WORKFORCE DEVELOPMENT

Broadening the Manufacturing Workforce: PowerAmerica partnered with the North Carolina Clean Energy Technology Center (NCCETC) to provide solar and alternative energy workforce and professional training opportunities nationwide. NCCETC developed virtual curricula for courses on the fundamentals of solar design and installation and solar storage. They targeted educators, students, and working technicians. The first two rounds of classes involved more than 120 participants from 33 states. Forty-four attendees have registered to take the North American Board of Certified Energy Practitioners' PV Associate exam, an internationally recognized credential.

> "PowerAmerica has advanced John Deere's wide bandgap power electronics R&D work by more than five years.
>
> - Dr. Brij Singh, Manager External Relationships, John Deere Fellow

INSTITUTE @WORK

2017
ESTABLISHED

179
MEMBERS

14%
MEMBERSHIP INCREASE

7
PROJECTS LAUNCHED AND

19
PROJECTS COMPLETED

CESMII.ORG

CESMII – The Smart Manufacturing Institute

CESMII accelerates smart manufacturing (SM) adoption to radically impact manufacturing performance through measurable improvements in areas such as quality, throughput, costs/profitability, safety, and energy productivity.

Headquarters: Los Angeles, CA

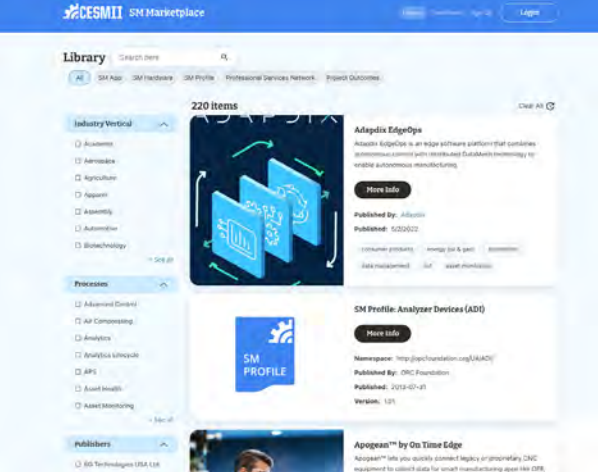
Consortium Organizer: University of California at Los Angeles (UCLA)

Satellite Locations: (Smart Manufacturing Innovation Centers)

- North Carolina State University (Raleigh, North Carolina)
- Rensselaer Polytechnic Institute (Troy, New York)
- University of California, Los Angeles (Los Angeles, California)
- Purdue University (West Lafayette, Indiana)
- Penn State New Kensington Digital Foundry (New Kensington, Pennsylvania)
- ATS (formerly Feyen Zylstra, Inc. (Grand Rapids, Michigan)
- Case Western Reserve University (Cleveland, Ohio)

YEAR IN REVIEW

- CESMII's fourth Request for Proposals was issued emphasizing scaling and deployment.
- The Smart Manufacturing Interoperability Platform-based Carbon/GHG tracking and reporting demonstrator was showcased at the Hannover Messe trade fair.
- OPC Foundation accepted CESMII's recommended GraphQL implementation for OPC UA.
- A new institute member model was established to enable greater SMM (small and medium-sized manufacturers) participation.
- The SM Executive Council with 31 manufacturing company leaders was launched.



Left and Right: Credit: WVU Department of Industrial and Management Systems. Middle: Credit: CESMII.

CESMII was formed to dramatically increase manufacturing competitiveness using Smart Manufacturing technologies. CESMII has a collaborative ecosystem comprising 179+ manufacturers, academia, non-profit organizations, systems integrators, technology providers and equipment builders across 37 states and 7 SM Innovation Centers and 10 satellite locations throughout the nation.

TECHNOLOGY ADVANTAGE

CESMII Project Enables Small- and Medium-Sized Manufacturers to Scale More Efficient Hop Drying: Oregon State University worked with four regional hop-drying SMMs to develop dynamic drying protocols driven by real-time process parameter measurements to reduce energy consumption in the hop drying process while maintaining product quality. The team installed temperature and humidity sensors at critical locations in the dryers, developed a machine learning model to predict the drying process, and created optimized set points that reduced drying times by 14% and energy consumption by 10%.

WORKFORCE DEVELOPMENT

Scalable Curricula for the Smart Manufacturing Shop Floor: Festo and West Virginia University led this project to create a modular and scalable curriculum that allows students to learn in a hands-on manner how Industry 4.0 technologies and data-driven analytics are applied in smart manufacturing systems. The project team developed Smart Manufacturing training modules and organized them so professors can select and combine sub-modules for the unique needs of different programs and students.

SUPPORTIVE INNOVATION NETWORKS

Smart Manufacturing Interoperability Platform (SMIP) Advancement: In the last year, the SMIP ecosystem has enhanced capabilities while gaining endorsements from manufacturers and technology providers. Over 130 SM Profiles™ (reusable, structured information models) and 18 SM Applications were added to the CESMII SM Marketplace. There is now a stronger integration between the CESMII SM Platform and the Cloud Library where the SM Profiles are stored.

> “By working with CESMII, we are able to leverage not only their expertise, but relationships with their members, the U.S. Department of Energy, and additional industry contacts to promote smart manufacturing as a critical enabler for advancing and improving U.S. automotive manufacturing processes.
>
> –Dr. Steven Przesmitzki , Executive Director, USCAR

INSTITUTE @WORK

2017
ESTABLISHED

74
MEMBERS

4 NumberUp
INNOVATION SUMMER CAMPS

7 teams
COMPETED AT CHEME CUBE COMPETITION

AICHE.ORG/RAPID

RAPID Manufacturing Institute®

RAPID advances modular chemical process intensification technologies to reduce energy consumption, improve process efficiencies, and reduce investment and operating requirements.

Headquarters: New York, NY

Consortium Organizer: American Institute of Chemical Engineers (AIChE)

YEAR IN REVIEW

- RAPID held a series of roadmapping workshops with its members that focused on
  - Existing Programs and Best Practices for Technician and Operator Training
  - Current and Future Industry Needs for Technician and Operator Training
  - Prioritizing Virtual Training Development Needs
- RAPID's innovation ecosystem had a presence at the 2022 AIChE Annual Meeting (technical sessions & ChemE Cube competition) and the 2023 AIChE Spring Meeting (Boards/Members Meeting & technical sessions).
- RAPID hosted technology showcases that featured SoCalGas and Technológica de Monterrey.



Credit: NIST/RAPID.

RAPID is an innovation ecosystem dedicated to transforming the process industries. Members range from Fortune 500 companies to technology start-ups, research labs, and academic institutions.

TECHNOLOGY ADVANTAGE

Developing active pharmaceutical ingredient precursors: RAPID-led team members Teich Process Development, LLC, AVN Corporation, and Procegence, LLC constructed an accelerated framework for process development and demonstrated its use to develop a modular process for producing active pharmaceutical ingredient (API) precursors.

WORKFORCE DEVELOPMENT

NumberUp Innovation Camp introduces K-12 students to advanced manufacturing education and careers: RAPID partnered with Miami University and the Cincinnati Recreation Commission to develop four five-day summer camps for middle school students. Forty-eight students participated. The NumberUp Innovation program introduces K–12 students to advanced manufacturing engineering education and careers in multidisciplinary design and manufacturing environments. The program is focused on advanced processing technologies and general engineering principles.

SUPPORTIVE INNOVATION NETWORKS

A team at the University of Pittsburgh worked with Lubrizol Corporation to convert one of their key legacy processes for chemical dispersants from batch to continuous and incorporate the principles of modular process intensification. The project team succeeded in building a continuous process production module about the size of a shipping container in a pilot lab in Pittsburgh. They were able to make a better-quality product while reducing capital by 65%, reducing operating costs by 60%, and reducing atmospheric heat loss by a factor of 10.

> “RAPID enables us to connect and work with other organizations on technical challenges facing the entire industry. This advances everyone’s understanding of the subject material more effectively than a sole partnership or project could bring.
>
> **–Mike Parent, VP and Technical Director, 3M**

INSTITUTE @WORK

2023
ESTABLISHED

Electrified Processes for Industrial eXCellence

The EPIXC mission is to develop and scale innovative electric heating concepts for advanced manufacturing to improve flexibility and enhance the energy efficiency of industrial process heating.

Headquarters: Scottsdale, AZ

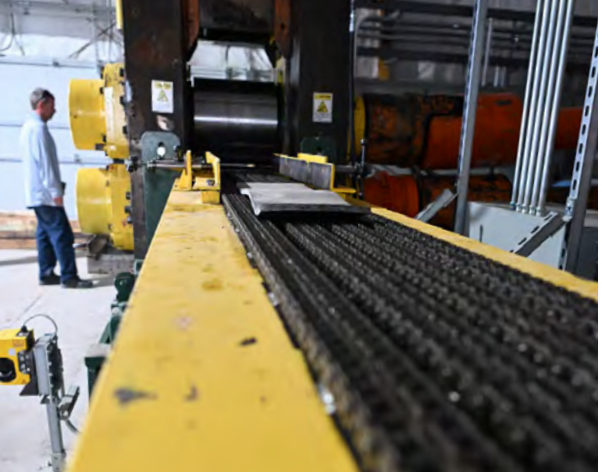
Consortium Organizer: Arizona State University

EPIXC Core Team:

- Arizona State University
- Idaho National Laboratory
- Missouri University of Science and Technology
- National Energy Technology Laboratory
- National Renewable Energy Laboratory
- Navajo Technical University
- North Carolina State University
- Stanford University
- Texas A&M University
- Tuskegee University
- University of Texas at Austin

EPIXC.ORG

* EPIXC was established during FY 2023 and, therefore, did not yet have a complete year of data to report.



Left: Credit: EPIXC/NIST. Middle: Credit: Ben Hilgers. Right: EPIXC/NIST.

Credit: EPIXC/NIST.

Credit: EPIXC/NIST.

> "EPIXC advanced heating projects provide a physical or digital test bed to connect all the existing technical solutions to show they can work as a system. We hope to close the critical knowledge gaps and help industrial investments for deployment of these cost-effective heating solutions at scale for advanced manufacturing needs.
>
> –Sridhar Seetharaman, (former) CEO, EPIXC

INSTITUTE @WORK

2017
ESTABLISHED

200
MEMBERS

>$2B
INVESTMENT SINCE 2017

200+
NOVEL PRODUCTS

Registered Apprenticeship
PROGRAM FOR BIOFABRICATION TECHNICIANS

ARMIUSA.ORG

BioFabUSA

BioFabUSA makes practical the scalable, consistent, and cost-effective manufacture of cell-based products and trains the advanced manufacturing workforce essential for US leadership in biomanufacturing.

Headquarters: Manchester, NH

Consortium Organizer: Advanced Regenerative Manufacturing Institute (ARMI)

YEAR IN REVIEW

- Advanced key platform technologies to drive the translation of cell-based products.
- Defined biomanufacturing career pathways and launched new workforce development programming that contributed to a national Advanced Manufacturing Workforce Sprint.
- Launched a commercialization accelerator for biofabrication companies.
- Enabled regulatory breakthroughs and market entry for novel regenerative medicine technologies.



Credit: BioFAbUSA.

BioFabUSA is building a highly skilled, innovative and globally competitive domestic cell-based biomanufacturing industrial base that will secure U.S. leadership of this sector and will fundamentally change healthcare for chronic illness and traumatic injury. To fuel industry growth, BioFabUSA is training a skilled, capable U.S. biomanufacturing workforce.

TECHNOLOGY ADVANTAGE

BioFabUSA and Members Demonstrate Novel Point of Need Manufacturing Technologies: BioFabUSA successfully executed two DoD Point of Need Manufacturing Challenge awards. With Safi Biotherapeutics and Sciperio, BioFabUSA developed the consistent, scaled red blood cell biomanufacturing in -40 degree Celsius austere conditions. Partnering with DEKA, BioFabUSA developed a self-administrable intradermal therapeutic applicator and portable manufacturing station, enabling rapid, low-cost self-administration of treatments for viruses, allergens, and emerging threats—without requiring skilled medical personnel in the field.

WORKFORCE DEVELOPMENT

New Biofabrication Technician Registered Apprenticeship Program: BioFabUSA developed and launched a novel Biofabrication Technician Registered Apprenticeship Program with industry-informed curriculum and training standards officially approved by the U.S. Department of Labor. This contributed to a nationwide Advanced Manufacturing Workforce Sprint.

SUPPORTIVE INNOVATION NETWORKS

BioFabUSA Enables Regulatory Breakthrough and Market Translation: BioFabConsulting provided member company Dimension Inx with comprehensive regulatory advisory services, from initial strategy development to the drafting of a successful 510(k) submission. Dimension Inx, an innovative biomaterials company, received the first-ever FDA clearance [510(K) acceptance] of a 3D printed regenerative bone graft product: CMFlex™. BioFabUSA also supported member company Epibone's achievement of Investigational New Drug clearance from the FDA to begin clinical trials with an allogeneic osteochondral graft for cartilage damage.

> "As long time ARMI | BioFabUSA members, we look forward to expanding our work to fulfill the organization's mission of bringing revolutionary products to patients in need.
>
> –Benjamin Fryer, CEO, Pluristyx

INSTITUTE @WORK

2020
ESTABLISHED

237
MEMBERS

17
NEW PROJECTS

100+ member
ORGANIZATIONS AND
36 U.S. GOV. OFFICES
WERE AT THE 2023
MEMBERS MEETING

BIOMADE.ORG

BioMADE

Bioindustrial Manufacturing and Design Ecosystem

BioMADE enables domestic bioindustrial manufacturing at all scales by developing technologies and infrastructure to enhance U.S. bioindustrial competitiveness and expanding the biomanufacturing workforce to realize the economic promise of industrial biotechnology.

Headquarters: Twin Cities, MN and Emeryville, CA

Consortium Organizer: Bioindustrial Manufacturing and Design Ecosystem

YEAR IN REVIEW

- Held second in-person Members Meeting with 350 attendees.
- Hosted a National Manufacturing Day roundtable discussion.
- Hosted first Application Workshop, connecting BioMADE members with the Combat Feeding Directorate.
- Announced vision for a national infrastructure network of 12-15 bioindustrial manufacturing pilot facilities, including a site in Minnesota.


Credit: BioMADE.

BioMADE, the Bioindustrial Manufacturing and Design Ecosystem, is securing America's future through biomanufacturing innovation, education, and collaboration. BioMADE is moving the bioindustrial manufacturing industry forward by funding innovative research, reducing barriers to scale-up and commercialization, and lowering risk in relevant infrastructure investments.

TECHNOLOGY ADVANTAGE

Probiotic Field Trials: Through a BioMADE project, General Probiotics has produced a spray-dried product containing their probiotic, which protects against the pathogen *Clostridia perfingens,* which sickens and kills chickens. The probiotic powder was produced through fermentation trials at the University of Minnesota and Iowa State University at a scale of up to 1500 L. Subsequent blending with sugars and spray drying results in a powder that can be added to feed by the animal producer.

WORKFORCE DEVELOPMENT

Development of Biosecurity Sequence Screening Training Course for Bioengineers: Biosecurity screening is an important practice to avoid unintended issues in biomanufacturing. However, guidelines are minimal, and screening processes are difficult for many bioengineers to access. A BioMADE project resulted in a course designed to increase bioengineers' awareness of the practice and introduce the SeqScreen tool, which helps illustrate common challenges in biosecurity screening.

SUPPORTIVE INNOVATION NETWORKS

Minnesota Legislature Approves Support for Bioindustrial Manufacturing Facility: BioMADE worked with the Minnesota legislature to establish up to $100M in cost share with federal funding to build a first-of-its-kind bioindustrial manufacturing campus, filling a critical need for pilot-scale biomanufacturing innovation facilities that will transform American manufacturing for the 21st century. Aspects of this model can be used to inform the establishment of the national network.

> "This ceiling increase demonstrates the importance of bioindustrial manufacturing to the Department of Defense. BioMADE's research and engagement with industry is creating a reliable pipeline of bio-based chemicals and materials for defense purposes and growing the industry at large.
>
> –Dr. Angela Campo, BioMADE Program Manager, Air Force Research Laboratory

INSTITUTE @WORK

2017
ESTABLISHED

226
MEMBERS

$370k
AWARDED TO 5 SITES FOR 2024 NIIMBL EXPERIENCE

$4M
ANNOUNCED FOR PROJECT CALL 7.1

NIIMBL.ORG

The National Institute for Innovation in Manufacturing Biopharmaceuticals

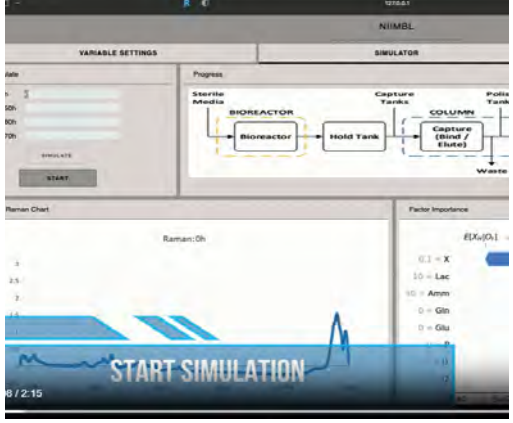
NIIMBL accelerates biopharmaceutical manufacturing innovation, supports the development of standards that enable more efficient and rapid manufacturing capabilities, and educates and trains a world-leading biopharmaceutical manufacturing workforce.

Headquarters: Newark, DE

Consortium Organizer: University of Delaware

YEAR IN REVIEW

- Announced NIIMBL BioPhorum Buffer Skid Data and Design for Open Access.
- Announced first Faculty Fellow – Dr. Sarah Harcum.
- Announced $1.7M for 3 new vaccine projects as part of Project Call 6.1.
- Selected 44 students for 2023 NIIMBL eXperience cohort, the largest to date.
- Announced RFI for Next-generation Sequencing Study.



Credit: NIIMBL.

NIIMBL advances new technologies to enable cost-effective, rapid, and safe manufacture of lifesaving medicines and vaccines. The Institute's workforce development initiatives expand talent pipelines by creating training programs and connecting industry to new sources of talent.

TECHNOLOGY ADVANTAGE

Noninvasive Process Analytical Technology for Aluminum-Adjuvanted Vaccines: Vaccines often contain adjuvants that boost the effectiveness of the antigen in stimulating an immune response. A project led by the University of Maryland, Baltimore determined that nuclear magnetic resonance (NMR) imaging could be used to noninvasively detect the adsorption of antigens to adjuvant—an important critical quality attribute of aluminum-adjuvanted vaccines. By eliminating the need for sample preparation, water proton NMR saved one hour for every three samples analyzed.

WORKFORCE DEVELOPMENT

Modularized PAT Online Training Platform to Accelerate Workforce Innovation in Biopharmaceuticals Manufacturing: Hands-on workforce training can be slow, expensive, and insufficient to meet the needs of the rapidly growing biopharmaceuticals industry. Investigators at Northeastern University and the Massachusetts Institute of Technology collaborated to develop more flexible, scalable, and cost-effective approaches to biomanufacturing workforce training. The team turned to the concept of a "digital twin," a computer program that uses real-world data to re-create processes as virtual simulations.

SUPPORTIVE INNOVATION NETWORKS

NIIMBL eXperience Expands with Regional Grants: In 2023, NIIMBL awarded $200k to three member organizations to expand the NIIMBL eXperience program. Albany College of Pharmacy and Health Sciences (New York), Raritan Valley Community College (New Jersey), and BioKansas (Kansas-Missouri region) hosted programs featuring interactive sessions, facility tours, and networking with companies in the region. Forty-four students were selected to participate in a NIIMBL eXperience program in 2023, more than double the combined total from 2019 to 2022.

> "Our project demonstrated that NIIMBL is nimble. It brought together partners to identify and pursue priorities and take the research in the direction that would ensure that industry needs were met."
>
> –Sean Hart, Ph.D. , CEO and CSO, LumaCyte, Inc.

INSTITUTE @WORK

2016
ESTABLISHED

156
MEMBERS

20+
CONFERENCES AND EVENTS

185+
ATTENDEES AT AFFOA MEMBERSHIP SUMMIT

AFFOA.ORG

Advanced Functional Fabrics of America Institute

AFFOA rekindles 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.

Headquarters: Cambridge, MA

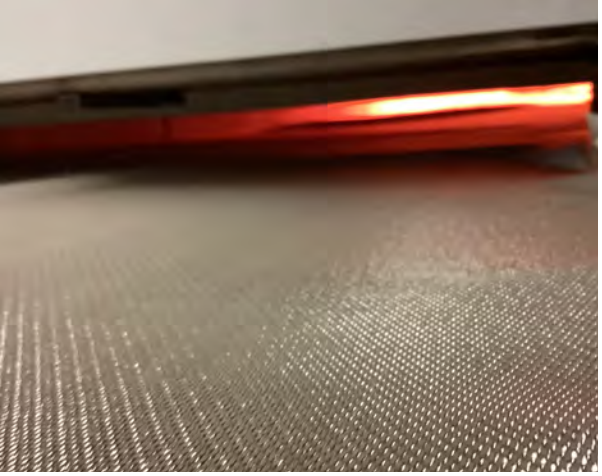
Consortium Organizer: Massachusetts Institute of Technology

Satellite Locations:

- Drexel University (Philadelphia, PA)
- MIT Lincoln Laboratory (Lexington, MA)
- University of Massachusetts, Lowell (Lowell, MA)

YEAR IN REVIEW

- AFFOA launched its first Product Accelerator for Advanced Functional Fabrics, which will enable members to utilize the equipment and expertise of AFFOA staff to expedite their product development to commercialization.
- AFFOA partnered with the National Family and Consumer Sciences education leaders to create a curriculum that recognizes skills needed for the textile industry.



Left: AFFOA helped Auburn Manufacturing Inc. in Mechanic Falls, Maine, to develop the capability to produce high-temperature silica fabric, a critical material for the US Military and aerospace. Credit: Auburn Manufacturing Inc. Middle: Mbadika hosting a workshop to increase awareness of fabric science through hands on experiences using the M-Lab Field Kit 2.0. Credit: Mbadika. Right: Early prototype BSL4 suits made with downselected new materials being tested for movement and comfort. Credit: AFFOA.

AFFOA addresses the spectrum of manufacturing challenges associated with developing and scaling advanced fibers and textiles from design through pilot production, helping to transition innovative technologies into commercial application, and training the next-generation manufacturing workforce.

TECHNOLOGY ADVANTAGE

Heated Insoles for Extreme Cold Weather: AFFOA, in partnership with New Balance, is developing heated insoles to enhance the performance of operators in extreme cold with minimal weight increase. For the Army Combat Boot (ACB) portfolio, AFFOA identified, developed, and validated insulative materials, designed a closed-loop heating system, and integrated it into an ACB. This resulting insole concept improved durability, efficiency, and heat distribution, offering a robust solution for extreme temperature protection.

WORKFORCE DEVELOPMENT

Increasing Awareness through Advanced Fabric Stem Kit Development: AFFOA partnered with Mbadika and Ministry of Supply to scale-up the M-Lab Field Kit 2.0, a STEM kit for middle school and high school students. Mbadika hosted 21 workshops and a textile education session, engaging 700+ participants across Massachusetts, Rhode Island, and Pennsylvania. Events included Girl Scout activities, experiences on the Boston Harbor Islands with United Way Power the Future, and outreach to Family and Consumer Science teachers.

SUPPORTIVE INNOVATION NETWORKS

BioSafety Level 4 Suit: With the sole manufacturer of BioSafety Level 4 (BSL4) suits ceasing production, the U.S. Departments of Agriculture and Defense faced a limited inventory and urgent need for new suits. AFFOA leveraged its expertise to identify U.S.-made materials, designing a thinner, softer, yet durable suit. Over the next year, the project will finalize materials, refine the design, and establish a robust domestic supply chain.

> **“ AFFOA provides essential technical and financial support to specialty textile makers like AMI. Our close collaboration with AFFOA is speeding our product entry into aerospace applications from years to months, while providing assurance that our products will meet rigorous technical requirements.**
>
> **–Kathie Leonard, President & CEO, Auburn Manufacturing Inc.**

INSTITUTE @WORK

2015
ESTABLISHED

142
MEMBERS

300+
ATTENDED 2023 MEMBER MEETING

2 Member-Funded
R&D PROJECTS COMPLETED AND
3 Announced

IACMI.ORG

Institute for Advanced Composites Manufacturing Innovation

IACMI leads advanced composites innovation and critical workforce solutions to strengthen domestic manufacturing, competitiveness, and national defense.

Headquarters: Knoxville, Tennessee

Consortium Organizer: Collaborative Composite Solutions Corporation, a not-for-profit corporation under the University of Tennessee Research Foundation

Satellite Locations:

- IACMI Scale-Up Research Facility (SuRF) (Detroit, MI)
- University of Dayton Research Institute's Composites Laboratory (Dayton, OH)
- The Composites Manufacturing Education and Technology Facility (CoMET) at the National Renewable Energy Laboratory's Flatirons Campus (Boulder, CO)
- The Composites Manufacturing & Simulation Center Indiana Manufacturing Institute at Purdue University (West Lafayette, IN)
- The University of Tennessee's Fibers and Composites Manufacturing Facility (FCMF) at Innovation South (Knoxville, TN)
- The Manufacturing Demonstration Facility (MDF) and Carbon Fiber Technology Center (CFTC) at Oak Ridge National Laboratory (Oak Ridge, TN)
- Vanderbilt University's Laboratory for Systems Integrity and Reliability (LASIR) (Nashville, TN)
- The University of Kentucky Center for Advanced Energy Research (Lexington, KY)

YEAR IN REVIEW

- IACMI released three requests for proposals of up to $50k to fund precompetitive technical projects.
- IACMI leadership, members and technical directors presented and were panelists at JEC World 2023 International Composites Show (Paris), the only trade show that unites the global composite industry to take in the full spectrum of processes, new materials, and composite solutions.
- IACMI leaders and members participated in the Composites & Advanced Materials Expo (CAMX), the largest composites and advanced materials event in North America. IACMI conducted eight Innovation Insights webinars to showcase and highlight new products, technology/innovation, and services from IACMI industry members and core R&D partners.

* Institute did not receive base funding from sponsoring agency in this reporting period.

Left: Credit: IACMI. Middle: Credit: IsoTruss. Right: Alex Stiles/IACMI.

IACMI – The Composites Institute is a 140+ member community of industry, academia, and government agencies leading innovation and workforce development initiatives to drive the adoption of advanced composites, grow U.S. manufacturing, and support national security. In April 2023, the DOE announced renewed funding for IACMI, furthering commitment to advanced composites R&D and manufacturing in the U.S.

TECHNOLOGY ADVANTAGE

Demonstrating New Fire Resistance Products: In 2023, IACMI committed funding to a fire resistance (FR) testing project proposed by two of its SMM members – Trimer Technologies, a resin supplier, and Orenco, a fabricator of composite parts. The funding enabled the two SMMs to conduct three FR tests (ASTM E1354, E84, and E119) that are specific to infrastructure and construction (I&C) applications. The composites demonstrated very good fire resistance performance in all three tests, convincing Trimer and Orenco that they have an attractive product offering for numerous I&C applications.

WORKFORCE DEVELOPMENT

Innovate with InnoCrate: IACMI developed and piloted InnoCrate learning kits in 2023 to expand the horizons of K-12 students while equipping them with foundational knowledge for careers in composites, CNC machining, and metal casting. Over 1,000 kits for K-12 dissemination have been distributed to 13 schools, which serve approximately 2,000 students. During the pilot phase, IACMI provided free "Train the Trainer" sessions to 12 teachers from nine schools in East Tennessee, representing four counties largely in rural areas.

SUPPORTIVE INNOVATION NETWORKS

Continued National Support: On April 11, 2023, the U.S. Department of Energy announced renewed funding for IACMI, furthering commitment to advanced composites R&D and manufacturing in the U.S. IACMI became the first institute renewal by DOE. The announcement indicated that "the ideas, the partnerships, the passion blooming throughout IACMI has made it an innovation incubator for some of America's sharpest minds and most creative thinkers."

> "IACMI has given us the opportunity to connect with its complete supply chain from advanced materials and design, modeling and simulation, to prototyping. Making full scale prototypes in its R&D facilities helps us demonstrate and reach our goals and accomplishments.
>
> –Hendrik Mainka, Volkswagen Group of America, Inc., Knoxville, TN

INSTITUTE @WORK

2014
ESTABLISHED

340
MEMBERS

100,000
SQ. FT. ADVANCED MANUFACTURING FACILITY

Expanded
INSTITUTE OPERATIONS TO PUERTO RICO

LIFT.TECHNOLOGY

LIFT

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

Headquarters: Detroit, MI

Consortium Organizer: American Lightweight Materials Manufacturing Innovation Institute (ALMMII)

YEAR IN REVIEW

- LIFT project led to $20.2 million award to save warfighter lives: The Army awarded Ricardo's Defense business unit a $20.2 million contract to continue delivering Antilock Brake System/Electronic Stability Control retrofit kits to improve the safety of operation of the U.S. Army's High Mobility Multi-purpose Wheeled Vehicle.
- The LIFT Ecosystem Accelerator Program (LEAP) had an open call.
- LIFT named the Company of the Year for 2023 by the British American Business Council of Michigan: The award recognizes exceptional businesses that have excelled within their respective industries and consistently contributed to strengthening economic ties between the U.K. and the U.S., particularly in Michigan.



Left and Right: Credit: LIFT/NIST. Middle: Credit: LIFT.

LIFT leaned into its focus areas of Materials Research, Manufacturing Processes, Systems Engineering and Talent Development in FY 2023 by expanding its reach in each of those areas by continuing to connect industry, academia and government to achieve the collective goal of Driving American Manufacturing Into the Future.

TECHNOLOGY ADVANTAGE

LIFT Leads Effort to Build Department of Defense Energy Systems in Detroit: LIFT launched a project developing a pilot to produce electrochemical separators for DoD energy systems at the institute's Detroit facility. As part of this project, LIFT will design a production line and produce units for testing over the next two years before moving into full production. Afterwards, LIFT will assist in locating a permanent provider and home for the production line to continue operation.

WORKFORCE DEVELOPMENT

LIFT Launches No-Cost Skilled Trades Training Program for Low-Income Wayne County Residents: LIFT established a free skilled trades training program, specifically geared towards low-to-moderate income Wayne County residents. The program is funded through the Michigan Economic Development Corporation Regional Talent Innovation Grant and support throughout Wayne County.

SUPPORTIVE INNOVATION NETWORKS

LIFT and Department of Defense Sign New $49 Million Agreement to Continue Advanced Manufacturing Technology and Talent Development: LIFT announced it has signed a new Cooperative Agreement with the Department of Defense Manufacturing Technology (ManTech) Program to continue to operate the public-private partnership and national manufacturing innovation institute (MII) for the next five years.

> "Michigan's growing defense footprint bolsters our state's economy and strengthens our national defense. LIFT is a key asset right here in Detroit that is leading the way in advanced manufacturing, and I'm pleased their partnership with the Department of Defense will continue.
>
> –Senator Gary Peters, U.S. Senate, Michigan

INSTITUTE @WORK

2017
ESTABLISHED

168
MEMBERS

Selected 14 projects
FOR $20M INVESTMENT

9 Certificate Pathways
EXPANDED ON REMADE ACADEMY

REMADE INSTITUTE.ORG

REMADE Institute

REMADE℠ enables early-stage applied research and development of key industrial sectors that could dramatically reduce the embodied energy associated with industrial-scale materials production and processing.

Headquarters: Rochester, NY

Consortium Organizer: Sustainable Manufacturing Innovation Alliance Corp.

YEAR IN REVIEW

- REMADE's workforce roadmap was updated based on extensive responses to a national Request for Information and industry interviews. This feedback informed updated short course and tiered certificate pathways and avenues for increased dissemination.
- REMADE's technology roadmap was updated based on extensive responses to a national Request for Information, industry interviews, and ongoing analysis of technical performance metrics impacts. It informs solicitations for technology proposals.
- License agreements and patents are pending for three institute project technologies that increase recycled aluminum content in alloys for the automotive industry, remove metallic impurities from recycled aluminum melts for improved quality, and decrease the cost of metal recovery from electronic waste.



Credit: REMADE.

REMADE Institute had many noteworthy accomplishments including the release of funding opportunities, the selection of new projects, licensing of new technologies for commercialization, and the REMADE℠ Circular Economy Technology Summit and Conference, which convened over 300 stakeholders across public and private sectors.

TECHNOLOGY ADVANTAGE

Achieving 100% recycled aluminum in die casting applications: The automotive industry relies on primary aluminum for structural applications because contaminants like iron and zinc can result in inferior mechanical properties. Dr. Alan Luo's team developed a die-castable recycled aluminum alloy with the necessary properties required for structural automotive applications, cutting costs by 50% and drastically reducing energy use. In May 2023, Ohio State University (OSU) and Audubon Metals signed a licensing agreement to commercialize this technology.

WORKFORCE DEVELOPMENT

REMADE has nine certificate pathways in topics such as Systems Analysis Tools, Fundamentals of Remanufacturing, Mechanical Recycling of Plastic, Emerging Trends in Plastics Recycling, and Fibers Recycling. This year, REMADE launched projects to create new certificates in Chemical Recycling and Software Tools for Alloy and Process Optimization. Additionally, REMADE has collaborated with John Deere to link REMADE's online "Fundamentals of Remanufacturing" certificate training to the John Deere employee training portal.

SUPPORTIVE INNOVATION NETWORKS

REMADE, in partnership with the Ellen MacArthur Foundation and supported by the Department of Energy's Office of Energy Efficiency and Renewable Energy, convened the inaugural REMADE Circular Economy Technology Summit and Conference in Washington, D.C. More than 300 experts participated, with 59 peer-reviewed research papers and nearly 30 R&D project posters presented.

> "REMADE membership is key because the Institute really provides an ecosystem that focuses on circular economy, and as such, you find people and entities that have the same vision on circularity.
>
> –Robert Radulescu, Executive Fellow, Michelin North America

APPENDIX A: MANUFACTURING USA METRICS MAP AND PERFORMANCE METRICS DATA

Measuring Manufacturing USA Program Performance

Manufacturing USA's performance metrics provide the basis for evaluating the program's success in meeting its goals. Table 1 illustrates how each metric category aligns with the program's goals,[6] which are based on the legislative program purposes.[7] Twenty-six metrics are currently monitored, with a strong emphasis on workforce development efforts, as shown in Tables 2 and 3. In these tables, FY 2023 metrics are compared to those from FY 2022.

In addition to the Manufacturing USA program metrics shared here, each funding agency has developed specific metrics to align with its unique mission. These additional metrics are collected and evaluated separately by each funding agency to ensure a comprehensive assessment.

Table 1. Performance Metrics Mapped to the Manufacturing USA Program Goals

Institute Metric Category	Goal 1 Increase competitiveness of U.S. manufacturing	Goal 2 Facilitate the transition of innovative technologies into scalable, cost-effective, and high-performing domestic manufacturing capabilities	Goal 3 Accelerate the development of an advanced manufacturing workforce	Goal 4 Promote a network of institutes that build long-term support for and within their communities
1. Impact to U.S. Innovation Networks				
2. Financial Leverage				
3. Technology Advancement				
4. Development of an Advanced Manufacturing Workforce				

The collaborative efforts and strategic initiatives led by Manufacturing USA institutes have catalyzed advancements in technology innovation and workforce development. In FY 2023, the institutes experienced a 14% growth in overall membership, reflecting increasing enthusiasm and support for their initiatives. The Manufacturing USA network has over 2,900 member organizations and fosters broad engagement in collaborative research, development, and workforce training efforts.

Notably, industrial companies lead institute membership, comprising 62% of member organizations, 73% of which are small and medium-sized manufacturers (SMMs). SMMs are crucial to spreading innovation and play a pivotal role in Manufacturing USA, reflecting the network's inclusive membership strategy. Community colleges and major research universities account for 22% of memberships, while non-profits and government organizations comprise the remaining 16%.

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[6] *Strategic Plan for the Manufacturing USA Program (2024).* Advanced Manufacturing National Program Office, National Institute of Standards and Technology, Department of Commerce. Available at: https://www.manufacturingusa.com/news/manufacturing-usa-releases-2024-strategic-plan

[7] 15 U.S.C. § 278s(b)(2)). https://uscode.house.gov/view.xhtml?req=(title:15%20section:278s%20edition:prelim)

Table 2. Technology and Program Development Performance Metrics*			
Specific Metric	**Unit of Measure**	**FY 2022**	**FY 2023**
Impact to U.S. Innovation Ecosystem			
Organizations with institute membership agreements	Total number of memberships	2,572	**2,921**
Type of member organizations	Number of large manufacturers (each with more than 500 employees)	436	**493**
	Number of small manufacturers (each with 500 or fewer employees)	1,177	**1,315**
	Number of academic members (universities, community colleges, etc.)	568	**655**
	Number of other entities (government members, government laboratories, not-for-profits, etc.)	330	**458**
Financial Leverage			
Federal investment	Federal base funding in the fiscal year	$145.7M	**$160.4M**
Co-investment	Cost-share expended and federal funding not part of the base federal funding in fiscal year	$307.8M	**$379.5M**
Total expenditure	Total institute expenditures in fiscal year	$453.6M	**$539.9M**
Technology Advancement			
Active research and development projects	Number of ongoing projects	678	**929**
Key project objectives met	Percentage of key project milestones met	85%	**85%**

*Data includes 16 institutes; the 17th institute, EPIXC, joined the network during FY 2023 and, therefore, did not yet have a complete year of data to report.

In FY 2023, Manufacturing USA institutes managed 929 applied research and development projects, demonstrating a strong commitment to fostering innovation and maintaining the United States' global competitive advantage. The focus on high-priority technology projects supports both national and economic security and ensures that the United States remains at the forefront of manufacturing advancements. The substantial $540 million financial commitment by the public and private sectors includes $160 million (30%) from sponsoring federal agencies, effectively catalyzing $380 million (70%) in co-investment. This high level of co-investment highlights the unwavering commitment of private industry, states, and federal agencies to strengthening domestic advanced manufacturing. This strong financial support is essential for executing impactful projects and programs, accelerating technological advancements, and building the workforce. The financial commitments from the federal government and partner sources demonstrate confidence in Manufacturing USA's mission and represent a tangible investment in the future of manufacturing.

In FY 2023, the institutes effectively managed 216 workforce development projects, marking a 40% increase from the previous year. These initiatives received funding of $43.3 million, with 80% sourced from the federal government. The extensive involvement in workforce development programs, which reached over 150,000 participants, highlights Manufacturing USA's dedication to cultivating a highly skilled workforce capable of excelling in the advanced manufacturing sector. By nurturing a group of manufacturing professionals capable of leveraging and contributing to technological innovations, the institutes actively support continuous innovation and production capabilities aligned with the latest technological advancements.

Table 3. Education and Workforce Development (EWD) Performance Metrics*			
Metric	**Unit of Measure**	**FY 2022**	**FY 2023**
STEM activities	Total number of students participating in institute projects or internship programs and training	79,229	**130,286**
	Workers completing a certificate, apprenticeship, or training program	23,059	**17,071**
Educators and trainers	Teachers or trainers completing institute-led training	4,037	**3,361**
Total number of EWD participants		106,325	**150,718**
Source of funding for institute EWD projects or activities	**Base-funded projects:** base federal funding from the original cooperative agreement or technology investment agreement	43	**56**
	Commercial-funded projects: support provided from industry, regardless of membership status	22	**74**
	Federal agency-funded projects: resourced from federal funding outside the base Cooperative Agreement (CA) or Technology Investment Agreement (TIA) funding	44	**51**
	State-or locally-funded projects: resourced from state or municipal government funding	26	**17**
	Other funded projects: resourced from philanthropic organizations, nonprofits, foundations, or associations	19	**11**
Total number of EWD projects and activities operated by institutes		154	**216**
Funding amount expended for EWD projects and activities	**Base funding expended:** resourced by institute using base federal funding from the original CA or TIA	$8.7M	**$10.4M**
	Commercial expenditures: provided by industry, regardless of membership status	$2.3M	**$0.3M**
	Federal agency expenditures: resourced from federal funding outside the base CA or TIA funding	$22.3M	**$24.1M**
	State or local funding expended: resourced from state or municipal government funding	$4.9M	**$4.1M**
	Other expenditures: resourced from philanthropic organizations, nonprofits, foundations, or associations	$2.1M	**$3.7M**
Total expenditures for EWD projects and activities		$40.3M	**$43.3M**

*Data includes 16 institutes; the 17th institute, EPIXC, joined the network during FY 2023 and, therefore, did not yet have a complete year of data to report.

The FY 2023 metrics data for Manufacturing USA showcases the network's significant accomplishments and highlights its essential role in advancing U.S. manufacturing capabilities. As Manufacturing USA expands its influence, the emphasis on innovation, collaboration, and workforce development remains crucial in cementing the U.S.'s position as a global leader in advanced manufacturing.

APPENDIX B: **SPOTLIGHT ON MANUFACTURING USA**

The Manufacturing USA network comprises numerous thought leaders who possess extensive knowledge about manufacturing trends. They are well-versed in the impact of emerging technologies on the manufacturing industry and strategies for attracting workers to the industry. Many of these thought leaders have shared their insights through various channels to make valuable information easily accessible to the manufacturing community. Additionally, members of the institutes have emphasized the significance of public-private partnerships in accelerating the development of manufacturing technologies, bolstering domestic supply chains, and expanding access to manufacturing careers.

Below is a sampling of this thought leader insight offered via a variety of media channels.

Join the Innovation Revolution with NextFlex and Manufacturing USA

Electronic Engineering Journal

Interviewee: Art Wall, Director of Engineering and Fab Operations, NextFlex

https://www.eejournal.com/article/join-the-innovation-revolution-with-nextflex-and-manufacturing-usa/

Transforming the Fabric of Manufacturing: AFFOA

Smart Manufacturing Magazine

Interviewee: Sasha Stolyarov, CEO, AFFOA

https://www.sme.org/technologies/articles/2023/january/transforming-the-fabric-of-manufacturing-affoa/

Building Innovative Safeguards Against Cyberattacks

Problem Solved: The IISE Podcast

Interviewees: Howard Grimes, CEO, CyManII; Krystel Castillo, VP for Energy Efficiency, CyManII

https://podcast.iise.org/episodes/building-innovative-safeguards-against-cyberattacks

A More NIIMBL Biotech Workforce with John Balchunas

Business of Biotech (Podcast)

Interviewee: John Balchunas, Director of Workforce Development, NIIMBL

https://www.bioprocessonline.com/doc/a-more-niimbl-biotech-workforce-with-john-balchunas-0001

Solutions to the Skills Gap

Industry Today

Contribution: Dale Brosius, Executive Vice President & Chief Commercialization Officer, IACMI

https://industrytoday.com/solutions-to-the-skills-gap/

R&D Institutes Transport Future to Here and Now

EE Times

Interviewees: Nicholas Fahrenkopf, Former Photonics Engineering Manager, AIM Photonics; Malcolm Thompson, Former Executive Director, NextFlex; Arnie Kravitz, Chief Innovation Officer, ARM Institute; Mike Thurston, Node Lead, Remanufacturing & End-of-Life Reuse, REMADE

https://www.eetimes.com/rd-institutes-transport-future-to-here-and-now/

APPENDIX C: FY 2023 ADVANCED MANUFACTURING NATIONAL PROGRAM OFFICE INTERAGENCY WORKING TEAM PARTICIPANTS

Advanced Manufacturing National Program Office

Michael F. Molnar (Sponsor)

Robert Rudnitsky

Kelley Rogers

Zara Brunner

Lisa Fronczek

Christina M. Jones

Brad R. Conrad

Amelia Stephens

Kimmai Tran

Department of Commerce

Mojdeh Bahar

Jyoti K. Malhotra

Department of Defense

Keith DeVries (Sponsor)

Steve Recchia

MicKenzie Frith

Mark Gordon

Abhai Kumar

Samantha Lewis

Aaron Sasson

David Heckman

Department of Education

Gregory Henschel (Sponsor)

Robin Utz

Department of Energy

Becca Jones-Albertus (Sponsor)

Diana Bauer

Nebiat Solomon

Kathryn Peretti

Sudarsan Rachuri

Chad Schell

Department of Health and Human Services

James Coburn, FDA (Sponsor)

Jeff Baker, FDA

Department of Labor

Robin Fernkas (Sponsor)

Jenn Smith

National Aeronautics and Space Administration

John Vickers (Sponsor)

Frank Ledbetter

Justin Jackson

National Science Foundation

Bruce Kramer (Sponsor)

Celeste Carter

Andrew Wells

U.S. Department of Agriculture

World Nieh (Sponsor)

Daniel Cassidy

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Advanced Manufacturing National Program Office

https://www.manufacturingusa.com/

N2025-0301 *NIST AMS 600-19*
This publication is available free of charge https://doi.org/10.6028/NIST.AMS.600-19