



## Project Profile: Massachusetts

### Impact Statement

Massachusetts has built an ecosystem of support for the region’s extensive array of military installations and defense suppliers. They have focused activities on assisting defense firms to increase their ability to service defense and commercial markets, growing the pipeline of skilled technical workers, and addressing cybersecurity needs to the benefit of DOD and the warfighter. OEA Industry Resilience (IR) funds were used to seed the University of Massachusetts at Lowell Research Institute (UMLRI), a collaborative ecosystem where industry, small business, workforce training, entrepreneurs, startups and venture capital intersect with Massachusetts’ aerospace and defense industry to create community, spark innovation and stimulate business growth. The Research Institute established the UMass-Lowell Advanced Manufacturing Consortium to meet a state-validated critical need for “next generation technicians” supporting additive and advanced manufacturing. These activities increase the resiliency and readiness of the DoD by leveraging regional support for defense suppliers and addressing defense-related business challenges.

### Key Project Takeaways

Through its Industry Resilience grant, the Massachusetts IR team created the University of Massachusetts at Lowell Research Institute (UMLRI), developed curriculum for electro-mechanical advanced manufacturing and 4- and 5- axis CNC machining certifications, provided technical assistance and business services, supported firms to become compliant with DoD cybersecurity regulations, and managed a network of collaborators in support of the defense industrial base beyond the grant. The development of an additive and advanced manufacturing ecosystem, especially in R&D activities such as cold spray, benefits the DoD by helping the local defense industrial base grow its capacity to support new commercial and defense markets. With OEA funds, Massachusetts grew industry and stakeholder awareness of new and relevant opportunities in defense, helped grow the capabilities of participating manufacturers, and built an active network of manufacturing leaders with the mindset and skills to advance innovation within their companies’ and collaboratively across the entire defense sector. Providing an effective set of technical assistance and business services to defense-related manufacturers strengthens the nation’s defense industrial base by growing the capacity of those manufacturers to support new and existing DoD programs.

### Project Description

#### Rationale

The defense industry and military are highly visible in Massachusetts, with the state hosting several of the nation’s largest defense contractors – Raytheon, General Electric, General Dynamics, MIT, Draper Labs, MITRE, Lincoln Labs, and Natick Labs – as well as several large military installations. A recent analysis of the state’s manufacturing base found that 1,700 of 7,000 manufacturers in the state support the DoD at some level of the supply chain. Much of Massachusetts’ contributions to the DoD is through research and development, engineering, and professional services contracts that support the



development, production and maintenance of engines, turbines, communications and detection equipment, and guided missiles. The state's high-tech defense sector mirrors other segments of the state's economy, translating into a focus on utilizing technology to promote economic development. As the state developed its response to DoD program cuts, it focused its attention on how those cuts might impact the state's ability to innovate in defense and non-defense sectors, which translate into investments in the creation of new products and technologies. The state's strategy to assist the defense industrial base also included efforts focused on protecting and improving the DoD's technological superiority by growing the capacity of manufacturers.

### Program Activities

The Massachusetts Development Finance Agency (MassDevelopment) used OEA funding to support Massachusetts-based defense contractors in several ways. In Phase I, MassDevelopment developed a defense industry diversification plan to mitigate the potential impact of any changes in defense expenditures on the state and regional economy. The program provided resources to the UMLRI to promote the development of a new curriculum tied to a critical DOD technology and establish the SBIR Center of Excellence. The program also partnered with the Massachusetts Manufacturing Extension Partnership (Mass MEP) to support supply chain activities including business optimization, business strategy, product commercialization, and the implementation of cybersecurity controls. To ensure that defense contractors are cybersecurity compliant, Mass MEP developed resources to help companies learn more about the NIST DFARS 800-171 requirements, conducted cybersecurity assessments, and helped manufacturers develop cybersecurity controls implementation plans.

In Phase II, the UMLRI began implementing priorities from the Defense Industry Diversification Plan developed with OEA support from the first phase of funding. To provide rapid and innovative solutions for defense and commercial customers, the UMLRI led an initiative linking core competencies, academic programs, labs, resources, and institutions to Department of Defense requirements. As part of this effort, UMLRI created an interactive manufacturing ecosystem through UMLRI's four foundational pillars: Defense Acquisition and Procurement R&D Programs, Additive Manufacturing, Academic Offerings with DoD focus, and the UMass SBIR Center of Excellence. UML plans to formalize the Defense Industry Strategic Steering Committee (DISSC) to support defense-related SMEs pursuing SBIR/SSTR grants through mentorship, assistance, and SBIR technology evaluations.

Additionally, UMLRI established the UMass-Lowell Advanced Manufacturing Consortium (UML AMC) to meet a state-validated critical need to train the pipeline and incumbent workforce in additive and advanced manufacturing technologies and develop "next generation technicians." The next generation technicians will have skills cross-applicable with electromechanical engineering technicians. Workers trained in advanced manufacturing technologies can support the evolving needs of the Massachusetts defense industrial base and encourage partnerships with Natick Labs and Hanscom Air Force Base.



## Resiliency Impacts

### Increasing Awareness of the Defense Industrial Base

MassDevelopment engaged TIP strategies to develop a defense diversification plan to address challenges facing the regional defense industry resulting from changes in defense spending. This study provided several specific initiatives to advance workforce development and improve manufacturing processes for defense-related small and medium enterprises (SMEs) in Massachusetts. The initiatives included assisting small manufacturers and R&D firms commercialize their products and technologies and diversify their business portfolios, providing consulting services and technical assistance, and helping defense-related firms export their products and services. The plan also helped UMLRI establish the SBIR Center for Excellence (SBIR COE) to provide services to SMEs seeking to obtain an SBIR award. The SBIR COE connects SMEs to an established pipeline of SBIR talent pools, innovation leaders, the innovation ecosystem, defense primes, and state-wide resources.

The SBIR COE at UML and US Navy co-hosted the Department of the Navy's Partnering Summit, where the naval acquisition community, government, industry and research organizations can meet to discuss naval priorities, share best practices and learn about partnership opportunities with SBIR and STTR. At this Summit, an estimated 134 companies from 26 different cluster areas collaborated with the Navy Research's Shared Technology Transfer Program. The year-long Navy Program helps companies commercialize their products and/or meet potential investors. The summit also included one-on-one sessions, where contractors and small businesses could meet with Navy acquisition officers to discuss Naval priorities. The OEA MA team hired a consultant to survey companies during the SBIR and STTR summit to capture metrics.

Using OEA funds, UMLRI established the UML AMC, a consortium of regional community colleges and defense industry partners to support the development of the next generation workforce. The UML AMC leverages UML's long-standing partnerships with defense contractors and research laboratories with a history of providing cooperative education internship programs with the university to advance manufacturer's knowledge of advanced manufacturing techniques. UML has partnerships with Raytheon, GE – Lynn, BAE, MACOM, Army Research Labs, Office of Naval Research, Air Force Research Labs, and other defense and private industry organizations. These organizations will benefit from the AMC's training of incumbent and entry-level workers and innovations in advanced manufacturing.

### Enhancing Force Multipliers to Support the Defense Industrial Base

Through the OEA investment, UML expanded its capability to support new technologies with defense applications as well as develop curriculum delivered at several universities, including beyond the state of Massachusetts, to train workers in the application of cold spray material joining technologies. As a seed investor in the formation of the UML Research Institute, OEA support was instrumental in creating the support infrastructure for all the programs that this new center of excellence has implemented.

OEA funding also supported staff salaries and leasing space for UML's Defense Acquisition and Procurement Division, another foundational pillar of the institute. UMLRI established partnerships with large and small defense industry primes under multiple contracting vehicles to compete for and win



defense contract research and development projects. The defense acquisition and procurement division pulls together teams prior to proposal development to compete for indefinite delivery/indefinite quantity contracts. UML developed this capacity to help partner primes as well as partner organizations.

### Commercial Diversification of Defense Companies to Sustain the Industrial Base

As part of university's effort to create an innovation ecosystem, the UMLRI established the UMass SBIR COE as one of its foundational pillars. The SBIR COE provides a critical state-wide center for SBIR recipients to commercialize innovations, and connect with defense primes, SBIR-recipient defense SME's, and other critical resources. The university linked the SBIR COE with existing SBDC innovation programs to promote a synergy between the two entities to provide critical assistance to the SBIR community and the region's defense industry.

Increased capacity by UML has already payed dividends for the regional defense innovation economy. UMLRI contributed to the development of the next-generation technical specifications for command and control display equipment (CCDE) used in defense systems that can communicate with devices around the world. As a result, Professional Project Services (PPS) selected ULMRI as its subcontractor when applying for a potential multimillion-dollar contract that includes the creation of 7 full-time positions, with 4 full-time employees at PPS and 3 full-time employees at ULMRI.

## Readiness Impacts

### Training and People Support

UML addresses the talent pipeline beginning with students in high school. UML's Advanced Additive Manufacturing Division partnered with area vocational-technical (vo-tech) schools to create dual enrollment programs for K-12 students as part of their high school advanced placement classes. The program provides participating students with 6 college credits that can be transferred to a 2-year Associate of Science Engineering Technology degree program or a 4-year Bachelor of Science of Engineering Technology degree program. UML started its first vo-tech program cohort in the spring of 2019 with 30 students from South Shore Regional Vocational Technical High School. The Massachusetts Department of Elementary and Secondary Education, Department of Labor, and MassDevelopment recognize the value of UML's vo-tech program by initiating a proposal, HB 1399, to provide funding for student tuition. The bill would provide \$750 in assistance to each student. UML plans to offset the remaining costs of students' tuition through \$400,000 in in-kind support. UML expanded the program to 5 additional high schools, 2 traditional high schools, and 3 vo-tech high schools, with the capacity to enroll 30 students from each school. UML is currently building partnerships with defense companies to encourage sponsorship for dual enrollment students as well as internship and mentorship opportunities.

Leveraging these state-wide efforts, the university used the OEA investment to develop the curriculum for the "Next Generation Technician" program, an incumbent worker training program for area defense contractors. The program is aimed at developing the next generation of electro-mechanical manufacturing professionals while addressing the future needs and critical workforce shortage of autonomous manufacturing professionals. Tapping into the UML Defense Industry Strategic Steering Committee, the university asked representatives from several defense companies (including the state's



five major OEMs -- Textron, Raytheon, General Dynamics), the Kendall Square innovation community, and the MIT Manufacturing Innovation Center to guide the development of the program curriculum.

In addition, UML developed the National Institute for Metal Working Skills (NIMS) certification to provide training for incumbent defense contractor workers on 4- and 5-axis machining tools. The university currently offers a Manufacturing Advancement Center Workforce Innovation Collaborative level three CNC certification used for training displace workers. UML used this foundational knowledge to build the 4- and 5- axis machining certification using OEA support. The training is built around experiential hands-on lab work using the CNC machines where students learn machine processes, controls, and reasoning/learning methods. This program prepares trainees to support CNC finishing required in additive manufacturing processes, such as in 3D metal and polymer printing, metal cold spray, and plasma/flame spray ceramic coating techniques.

### Cybersecurity Preparedness

Mass MEP positioned itself as the principle resource for manufacturers seeking to improve their cybersecurity posture. Using OEA funds, Mass MEP provided cyber-risk assessments and developed NIST DFARS 800-171 compliance plans for 2 defense-related SMEs. Using Phase 2 funds, UML plans to develop a publicly available cybersecurity module that helps firms become compliant with DFARS requirements.

### Lessons Learned

#### Greatest Challenge

The grantee found the UMass Lowell Office of Research Administration (ORA) team, who handles the university grants and contracts, faced a steep learning-curve regarding the various DoD grant and contracting vehicle requirements. Additionally, the ORA faced resource constraints such as administrative time and limited software resources. The ORA supports the University of Massachusetts and its colleges, but their turnaround timelines were not always conducive to DoD requirements and deadlines. Furthermore, the ORA also had limited software for grant and contract tracking.

The grantee also faced challenges with staffing for the OEA grant, especially where tenured faculty were not able to provide FTE support beyond their tenured duties.

#### Most Important Lessons Learned

The Massachusetts IR team identified several lessons learned which included:

1. Hire talented, high energy staff that have deep expertise in their field but are not afraid to tackle any challenge. The type that gets you to “yes.”
2. Establish a supporting entity that provides effective and efficient contracting and grant support to your organization.
3. Proximity matters—find a location that brings value to multiple stakeholders.
4. Access a 501(c)3 entity that permits a University entity to enter into Multi-year ID/IQ contracts; State entities may not be able to commit funds or resources beyond current FY.
5. Never give up on things you believe could be “game-changers.”



### Sustainability

The OEA grant allowed the UMass Lowell Research Institute (UMLRI) to open its doors in November 2018 to a DOD-focused initiative linking core competencies to DoD requirements for rapid and innovative solutions that meet the needs of defense and commercial customers.

To sustain these efforts, UMLRI will establish the UMass Lowell Applied Research Corporation as the contracting entity. Organized as a 501(c)3 for the UMass Lowell Research Institute, this new “board of trustees” ensures the organization will have a firm footing. The organization will model its structure on the Georgia Tech Research Institute and will provide contracting, grant, and research administration services for UMLRI. UMLRI has \$19 million in proposed projects in the pipeline and plans to expand the institute’s office space from 2,000 square feet to 18,000 square feet. The Institute also has strong partnerships with two active duty military installations and is currently working on a Naval sustainment initiative for cold spray.

Additional sustaining funds include:

- Army Research Labs – external program funding status
- \$200,000 received for initial system set-up (K-Tech) and test laboratory
- \$300,000 program for testing and training program development due in August 2019
- Verbal commitment for an additional \$400,000 to procure and install VRC Gen III Viper Cold Spray system; formal award expected in August 2019