

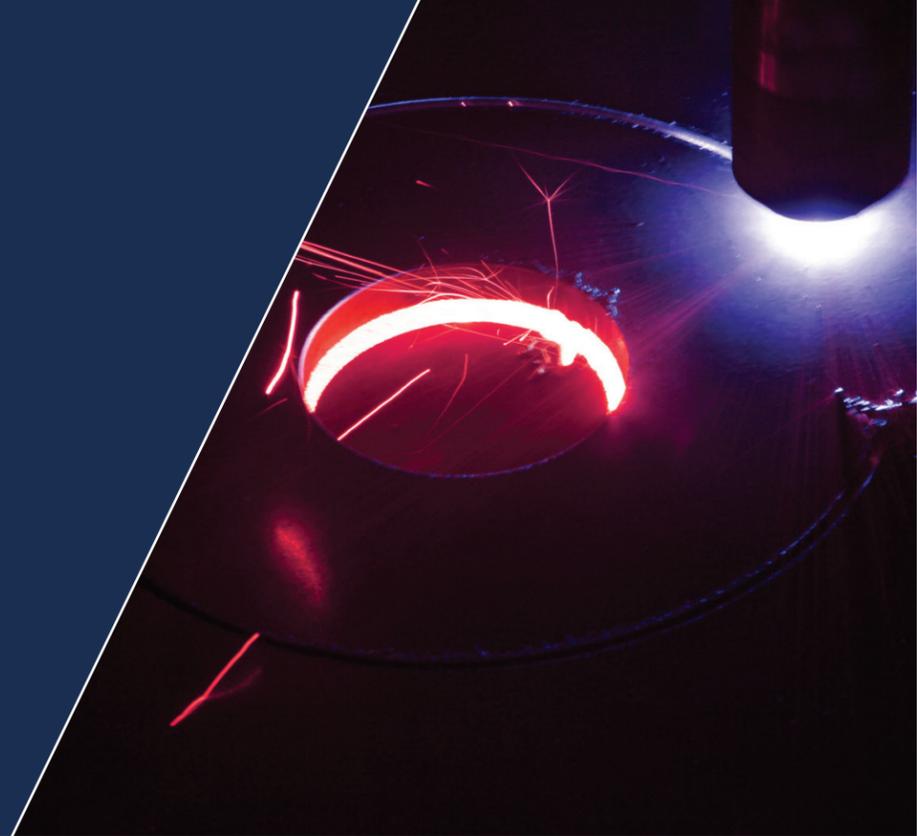


# EXECUTIVE SUMMARY



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## BACKGROUND

President Obama proposed the U.S. make a one-time, \$1 billion investment to create the National Network for Manufacturing Innovation (NNMI), establishing a manufacturing research infrastructure for the U.S. to reduce the cost and risk associated with commercializing transformative new technologies. Preliminary Design Principles for the National Network were released in January 2013, by the Executive Office of the President, National Science and Technology Council, and Advanced Manufacturing National Program Office. The NNMI is comprised of regional hubs—public-private partnerships called Institutes for Manufacturing Innovation—that share common goals, but with each having a unique specialty. Each Institute consists of industry, government, and academic partners working collaboratively and leveraging their resources to nurture manufacturing innovation and accelerate commercialization. Since 2012, the President has established seven Institutes, with two more in development:

- The National Additive Manufacturing Innovation Institute in Youngstown, OH, focused on additive manufacturing (3D printing).
- The Next Generation Power Electronics Manufacturing Innovation Institute, headquartered at North Carolina State University and focused on enabling energy-efficient, high-power electronic chips.
- The Digital Manufacturing and Design Innovation Institute—headquartered in Chicago and led by UI Labs—focused on reducing manufacturing costs across multiple industries through digital technology.
- Lightweight Innovations for Tomorrow, led by LIFT, focused on applied development for lightweight metal alloy production and component/subsystem manufacturing technologies.
- The Institute for Advanced Composites Manufacturing Innovation - headquartered in Knoxville, TN - focused on advanced polymer composites.
- The American Institute for Manufacturing Integrated Photonics, located in Rochester, NY - focused on photonic integrated circuit (PIC) technology.
- The Flexible Hybrid Electronics Manufacturing Innovation Institute, located in San Jose, CA - focused on developing a new flexible hybrid electronics

The Lightweight Innovations for Tomorrow (LIFT), formerly Lightweight and Modern Metals Manufacturing Innovation (LM3I) Institute was established in February, 2014, following a competitive process led by the U.S. Department of Defense through a solicitation issued by the U.S. Navy's Office of Naval Research. The winning proposal team, American Lightweight Materials Manufacturing Innovation Institute (ALMMII) is a non-profit organization founded by Ohio-based manufacturing technology

non-profit EWI, the University of Michigan, and The Ohio State University. Its headquarters are on Rosa Parks Blvd. in Detroit, Michigan, with significant activities in Columbus, Ohio. The LIFT consortia is regional in nature, but serves the entire nation by involving more than 200 companies, universities, non-profit research institutions, and workforce development intermediaries from around the country.

LIFT is a public-private partnership that develops and deploys advanced lightweight materials manufacturing technologies for defense and commercial applications, and implements education and training programs to prepare the advanced manufacturing workforce for jobs in the application of innovative lightweight metal production and component/subsystem manufacturing technologies. The Institute's mission is to serve U.S. manufacturing by acting as the bridge between basic research and final product commercialization of new, advanced lightweight materials and innovative manufacturing technologies and practices. This enables the development of cost effective light weight components for the defense, aerospace, automotive, sea and over-the-road truck industries. LIFT's efforts encompass the entire transportation supply chain, nurturing innovations from conception through design, development, and production. Economic benefits accrue to its region, which includes five states: Michigan, Ohio, Indiana, Kentucky, and Tennessee. However, LIFT integrates partners nationwide for research and workforce development.

Priorities for LIFT are defined by technology, workforce, and economic development needs for the defense and commercial industrial sectors, with particular focus on transportation requirements. LIFT's scope of activity includes more than \$100 million in technology projects undertaken by its industry and university partners, and within five years, these activities are expected to have an impact on the supply chain of approximately 10,000 jobs in the metal stamping, metalworking, machining and casting industries. LIFT also facilitates technology commercialization through improvements in manufacturing processes, working with incubators to assist startups bringing new technologies to market, and other technology transition efforts through its network partners. Technology transition is central to LIFT's strategy and is absolutely essential to realize the widespread defense, economic and industrial base impacts expected from the federal investment.

## WHAT IS LIGHTWEIGHTING?

Lightweight materials enable reduced weight of a product, component, or system while maintaining or enhancing performance, operational supportability, survivability and affordability. When executed efficiently, weight reduction encompasses the early integration of design, development, and implementation of lightweight materials, component fabrication, assembly, joining, and other technologies, as well as the capability to manufacture and produce such materials and components at reasonable cost.

### Sectors to be impacted

Lightweight materials are increasingly important to the competitiveness of transportation manufacturing sectors, including suppliers in the automobile, aerospace, light and heavy ground vehicles, small boat and large ship, rail, and defense manufacturing industries. Lighter vehicles for the military, industry, and consumers alike have better performance and use less fuel. They can carry larger loads and travel the same distances at lower cost and with fewer carbon emissions.

### Impact of these sectors on economies of the LIFT region

LIFT will have world-class capabilities and will serve the metal production, metalworking, and casting manufacturing sectors across the nation, yet will have particularly strong regional impacts. LIFT's regional focus will encompass an area roughly following the I-75 corridor from Michigan through Tennessee. This region includes a broad range of industrial companies from large OEMs and suppliers to small and medium enterprises (SMEs) in the defense, aerospace, and automotive sectors. Because of the concentration of metals producers and users in the LIFT region, the economic impact will be large. For example, the 2011 census estimated that over 400,000 people were employed nationally in the metal stamping, metalworking, machining, and casting industries, with almost half of the metalworking jobs located in Michigan, Ohio, and Indiana.

### LIFT REGION



MICHIGAN



OHIO



INDIANA



TENNESSEE



KENTUCKY



## INDUSTRY PARTNERS IN LIFT

LIFT acts as an anchor in the Midwest region, with synergistic facilities comprising an industrial commons to enable the mission of the Institute. The key to success for LIFT is the composition of its innovation ecosystem. LIFT consists of working members from OEMs, suppliers and SMEs, academia, research institutes, education, workforce development organizations, and professional societies.

<p><b>Industries &amp; Professional Societies</b></p>	<p><b>Academic &amp; Research Partners</b></p>
<p><b>Small/Medium Manufacturers</b></p>	<p><b>Startups</b></p> <p><b>Workforce/Education</b></p>

### LIFT Technology Development Partners

The company members represent many industry sectors that seek to employ lightweight technologies to support both defense and commercial applications. These companies represent defense and commercial transportation industries in aerospace, shipbuilding and light and heavy vehicle manufacturers. Material suppliers are represented spanning high-strength steels, aluminum, magnesium, and titanium.

## TECHNOLOGY PROJECT SELECTION

Industry plays a central role in LIFT, identifying the priorities for technology development with guidance from Navy Program Executive Offices. LIFT is comprised of member companies spanning the full supply chain of the transportation industry from primary metal producers to component and equipment manufacturers to OEMs, enabling up-front commercialization plans and allowing start-up companies and non-industry research partners to integrate their developments directly into industry-driven roadmaps. LIFT's industry partners also will provide financial support

for both pre-competitive and proprietary research. State governments have committed funding to support economic development, facilities, and equipment, as well as education and workforce development activities.

LIFT has created the Lift Executive Advisory Council (LEAC), a focused tactical entity, to oversee the formulation and execution of its projects based on industry requirements and the optimization of resources. The LEAC includes industry representatives knowledgeable of process for successfully developing and transitioning new and innovative technologies in advanced manufacturing to production and commercial use. The LEAC will establish key technical and workforce requirements in consultation with the government and industry stakeholders and will approve a proposed portfolio of technology and workforce projects leveraging government and industry funding.

**The LIFT leadership team is committed** to providing its customers with the optimal set of assets and capabilities required for each technical project regardless of the source of those assets. Project teams are formed based on customer needs, technical capabilities, past performance, availability of key personnel and assets, cost, and an appropriate business case. Candidate projects are submitted to the LEAC Technical Committee for their concurrence on the recommendations and the associated resource requirements, schedule, deliverables, educational and transition plans, asset utilization plans, and team members of each technical project and development activity.

In order to develop a project portfolio spanning the wide range of materials and processes, the LIFT technical areas are partitioned into Technology Pillars of the major lightweight material manufacturing processes: Melt processing, powder processing, thermo-mechanical processing, novel processing, coatings, and joining and assembly. Individual projects are managed as part of an overall portfolio that will utilize an integrated approach for design, cost modeling, supply chain, and life cycle.

**TECHNOLOGY PILLARS**

	<b>MELTING</b>		<b>COATINGS</b>
	<b>THERMO-MECHANICAL PROCESSING</b>		<b>JOINING</b>
	<b>POWDER PROCESSING</b>		<b>ICME</b>
	<b>AGILE LOW-COST TOOLING</b>		

### LIFT has developed several principles to govern the selection and execution of projects in its technology portfolio

1. Apply diverse capabilities of our partners and broader national capabilities on focused areas of lightweight materials manufacturing
  - Develop a common agenda that takes advantage of synergies across industrial sectors and applications, while ensuring that we do not work to the "lowest common denominator"
2. Set technology focus area priorities by industry with government agency input
  - Utilize "targeted member" proposals where appropriate (majority of projects)
  - Broadcast RFP's to solicit additional ideas and capabilities
3. Recognize and take advantage of the capabilities and cost share commitment of LIFT membership
  - While ensuring compliance with federal contracting standards
  - While ensuring that the best projects in priority areas are identified
  - While ensuring efficient use of industry partner meeting time
4. Develop a stream-lined process to enable fast response to industry needs
  - All projects must have up-front, company-identified applications
  - Technology transition plans are required
5. Ensure industry buy-in beyond setting priorities
  - Project impact – Which applications / companies are targeted? How big is the benefit? How many sectors can use it?
  - Technology approach – Is the status MRL4; Difficulty of challenge and degree of innovation in the approach
  - Portfolio balance – Does this project fit into the technology area roadmap/theme? Is there synergy with other projects? Does the execution of the project lead to additional LIFT capabilities?
  - Project team – Is the proposal using the best available facilities and people? Are the budgets and timing realistic?
6. Use four key criteria for project selection
  - Are there cost share considerations?



## LIFT RESEARCH PARTNERS

The LIFT industry partners bring world-class capabilities in many of the technologies critical to developing advanced manufacturing methods for lightweight multi-material structures. These capabilities are augmented through partnerships with key universities and non-profit laboratories that bring complementary competencies. Together, the LIFT research partners have extensive expertise, knowledge, and capabilities in novel materials, primary processing, secondary processing, and product/process integration that span design, standards, and certification. The researchers are recognized experts in the fields of materials and mechanical engineering with leading-edge knowledge and know-how in the use and implementation of ICME.

To enable fast response to requests from government and industry, LIFT has established partnerships with these universities and non-profit laboratories. By having these relationships in place, including the necessary standardized partner agreements concerning IP and technology transition, LIFT will implement a streamlined process that will facilitate the rapid award of new projects.



## PROJECTED RETURN ON INVESTMENT (ROI)

The implementation of advanced metal manufacturing technologies across defense and commercial manufacturing sectors will significantly impact the supply chains for these sectors, technology commercialization opportunities, and the need for an educated and skilled Advanced Manufacturing workforce.

**Supply Chain.** The 2011 census estimated that over 400,000 people were employed nationally in the metal stamping, metalworking, machining and casting industries, with almost half of the metalworking jobs located in Michigan, Ohio and Indiana. For example, the five-state LIFT region has 73 % of the total U.S. employment in metal stamping. Based on published automotive industry projections on the adoption of hot-stamped ultra-high strength steels, advanced hot-press forming technology alone could create more than 7,000 jobs.

**Technology Commercialization.** The LIFT IP approach will facilitate technology commercialization. This will involve not only implementing manufacturing improvements, but also working with regional incubators to encourage small technology start-ups that can take new technologies to market.

**Workforce.** By working to expand educational capacity and attract additional talent, LIFT will significantly impact the current skills gap. LIFT will target increasing the pipeline of metal-related engineering professionals as well as skilled trades workforce. LIFT will also target up-skilling current employees. The defense and commercial industries will benefit from the increased availability of a workforce which has a strong foundation in the Science, Technology, Engineering and Math skills and is proficient in the application of advanced lightweight metal alloys, manufacturing technologies and design methods (e.g., ICME) important to the future of modern metals manufacturing.

## WORKFORCE / EDUCATION PILLAR OF SUCCESS

In addition to its technology development projects, LIFT is convening industry, government, economic development, non-profit, academic, and workforce development partners to design and deliver education and workforce development programs to help ensure an educated and skilled Advanced Manufacturing workforce ready to integrate new technologies and processes associated with lightweighting and modern metals and materials manufacturing. Integrative education, training, and workforce development is a core, sustained aspect of the LIFT mission. LIFT is applying a locally relevant economic development approach that connects to the larger, industrially driven National Network of Manufacturing Institutes. Workforce initiatives will significantly decrease the current skills gap by expanding educational capacity, attracting additional talent, enhancing curricula, linking programs together, and leveraging all of these resources to create a pipeline of talent capable of adopting the developed technologies and applying them to modern metals manufacturing. The total effort is executed by the LIFT Workforce and Education Working Group.

This working group represents all five states in the LIFT regional partnership, with cross-sector expertise in education, economic development and workforce development. National experts representing professional organizations, industry associations, federal programs, STEM education, labor, think tanks, and corporate foundations are also engaged. LIFT's Education and Workforce plan identifies strategic areas of focus, including:

- Attracting more young people to pathways to careers in Advanced Manufacturing
- Ensuring more students gain the necessary STEM foundational skills to be successful in Advanced Manufacturing careers
- Deploying pathways from K-12 through community colleges to university 4-year degree programs, with more "on" and "off" ramps to employment in Advanced Manufacturing
- Creating the enhancements/new modules for engineering curriculum in our nation's universities to ensure design capabilities using light weighting technologies
- Expanding work and learn opportunities to introduce more students to Advanced Manufacturing careers and enhance their education with work-based learning
- Reconnecting disconnected youth and adults to educational pathways to jobs and careers in manufacturing
- Connecting separating military personnel and veterans with fast-track skills development and career opportunities in Advanced Manufacturing
- Offering on-the-job training solutions for our industry partners to help them build their incumbent workers; skills related to new light weighting technologies and processes
- Linking and leveraging resources and related initiatives in the LIFT states and communities

LIFT's Education and Workforce program leverages the Institute's technical innovations toward the creation of a more integrated and experiential lightweight and modern metal manufacturing learning environment at all levels of education. Our goals are to:

- 1.** Broadly address training and education across all relevant manufacturing sectors;
- 2.** Link and leverage existing activities, implementing and expanding those with the best track records; and,
- 3.** Combine our Education and Workforce activities with outreach to OEMs and SMEs, in the civilian and military supply chains for the broadest possible impact.



# LIFT LEADERSHIP TEAM

## Lawrence E. Brown, Executive Director

Mr. Brown has more than 30 years of manufacturing, applied R&D, and technical project management experience with both the U.S. government and commercial programs. Throughout this time he has gained a working knowledge in various joining processes for metal alloys – both lightweight and high temperature superalloys. His efforts have led to advanced joining methodologies for fabrication of advanced military and commercial engine hardware, and have yielded six patents as co-inventor. As the Executive Director of LIFT, Mr. Brown is responsible for day-to-day management and leadership of the organization, including interface with the ONR Government Program Manager. Mr. Brown was most recently employed by EWI for 14 years, and most recently served as that organization's Director of Government Technology Programs. Previous to this role, he held several leadership positions as Director of the Project Management Office and Engineering. He also has served as the Director of the Navy Joining Center (NJC) where his responsibilities included planning and control of NJC technology development projects in support of the Office of Naval Research (ONR) ManTech Program. Brown received his bachelors degree in welding engineering and a masters of science in management from Indiana Wesleyan University.

## Alan Taub, Chief Technology Officer

Alan Taub joined the faculty of Materials Science and Engineering at the University of Michigan in the Fall of 2012. In this role, Taub is conducting research in advanced materials and processing and has a leadership role as Chief Technical Officer of the newly established American Lightweight Materials Manufacturing Innovation Institute. Taub retired from General Motors in April 2012. Prior to his retirement, he was vice president, Global Research & Development, leading GM's advanced technical work activity, seven science laboratories around the world, and seven global science offices. He joined GM R&D as executive director in 2001 and was named vice president in 2009. Before joining GM, Taub spent 15 years in research and development at General Electric, where he earned 26 patents and authored more than 60 papers. He also worked at Ford Motor Company for eight years. Taub received his bachelors degree in materials engineering from Brown University and master's and Ph.D. degrees in applied physics from Harvard University.

## Emily Stover DeRocco, LIFT Education & Workforce Director

Emily DeRocco is the Founder and CEO of a Washington, D.C.-based consulting practice focused on linking education, workforce and economic development assets for competitive advantage. DeRocco is the immediate past president of The Manufacturing Institute where she launched and implemented a strategic national agenda on education reform and workforce development, innovation support and services, and research on behalf of U.S. manufacturers. Under her leadership, the Institute developed and deployed a system of nationally portable, industry-recognized Manufacturing Skills Certifications.

Prior to her leadership in U.S. manufacturing, DeRocco was nominated by President Bush and confirmed by the U.S. Senate as the Assistant Secretary of Labor in 2001. In that position, DeRocco was responsible for managing a \$10 billion investment in the nation's workforce. She created and implemented regional economic development initiatives in 39 regions across the nation during her tenure, using talent development strategies to drive competitive advantage for America's businesses. DeRocco has represented the United States and led delegations in international forums on labor and workforce development. DeRocco is a graduate of The Pennsylvania State University and received her Juris Doctorate from the Georgetown Law Center.

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