lift

THIRD ANNUAL ALL-MEMBERS MEETING

DATE	DOCUMENT	LOCATION
September 25th - 27th, 2017	Meeting Program	Dearborn, MI

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Message from Larry

Welcome the Third Annual LIFT All-Members Meeting

SEPTEMBER 2017

We have reached a critical time in the history of our institute, and there is no doubt that we would not have gotten to this point if it weren't for all our members and partners from around the country and across industries.

With less than 18 months remaining in our original cooperative agreement with the Department of Defense and Office of Naval Research, we have reached a point where we must actively begin working towards the future. A future in which LIFT stands on its own, but is still fulfilling its original charter, which is to invest in the U.S. industrial manufacturing base and support our military men and women by enabling lightweight solutions to suit their needs.

We are thrilled to have the manufacturing, prototyping and engineering capabilities we now possess in our Detroit facility and are looking forward to working with each of you on how that equipment can benefit you and help LIFT continue to innovate.

To date, we have:

- Launched 40 education and workforce development initiatives to build a pipeline of talent, ready and willing to take the manufacturing industry into the future
- Kicked off nearly 20 technology programs spanning industries in search of lightweighting solutions to benefit the commercial and defense manufacturing base
- Invested in, with IACMI – The Composites Institute, nearly $50 million worth of equipment and infrastructure upgrades to our Detroit facility.

It is true that we are coming up on the end of our initial agreement with the Department of Defense, but in truth, this is just the beginning. We at LIFT are committed to innovating for years to come and we look forward to each of you joining us in that journey.

Lawrence E. Brown
Executive Director
LIFT

SECTION

LIFT Team

EXECUTIVE TEAM

Lawrence E. Brown
Executive Director

Emily Stover DeRocco
Director, Education and Workforce Development

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Chief Innovation Transition Officer

Susan Pinkowski
Chief Financial Officer

Alan Taub
Chief Technology Officer

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Senior Project Manager

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Director, Business Development & Member Relations

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Accounting Intern

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Director, Building Operations

Sandy Garbovan
Director, Business Operations

Kevin Griffin
Program Manager

Melvin Hawke
Project Manager

Rich Hoffer
Laboratory Operations Manager

Bob Kratzenberg
Operations Manager

Gregg Peterson
Principle Materials Engineer

Alessandro Posteraro
Apprentice Technician

Ketan Shah
Project Manager

Joe Steele
Director, Communications

Demaro Turner
Manufacturing Process Technician I

Magaly Urista
Front Office Admin

SECTION

Technology Projects

LIGHTWEIGHT INNOVATIONS

LIGHTWEIGHT METAL PILLAR PROCESSES & CROSS-CUTTING THEMES

Melt Processing

Pillar Leaders
Diran Apelian, Worcester Polytechnic Institute
Alan Luo, The Ohio State University

Melt processing uses molten metal to make products. The melt is cast in either disposable, semi-permanent, or permanent molds. Sand casting is an example of a process where the mold is disposable, whereas die casting uses a permanent mold.

Thermo-Mechanical Processing (TMP)

Pillar Leaders
David Matlock, Colorado School of Mines
Alan Luo, The Ohio State University

TMP refers to precise control of heat and deforming processes, e.g. forging, rolling, and extrusion, to produce materials and components with enhanced properties and performance.

Powder Processing

Pillar Leaders
William Peter & Sudarsanam Suresh Babu, The University of Tennessee, Knoxville

In powder processing, metal powder is generally squeezed, sintered, and/or sprayed to form parts, sheets, or plates. The process allows greater control over the final composition of end products, their properties, and yield.

Agile Low-Cost Tooling

Pillar Leader
Glenn Daehn, The Ohio State University

Agile, low cost tools are machines controlled by computers that can heat, cool, and deform material precisely, location by location. They shape metal like a potter shapes clay – providing shape and strength. They have great potential because they can be programmed quickly at low cost to respond to changing production needs.

Coatings

Pillar Leader
Rudolph Buchheit, The Ohio State University

Coatings are more than paint. Emerging coating processes are modifying the surface of metals to enhance their performance in exciting new ways.

Joining

Pillar Leader
Jerry Gould, EWI

A key challenge in using lightweight metals in manufacturing is joining them – to other lightweight metals, traditional steel alloys, or non-metallic materials.

ICME

Method Leader
John Allison, University of Michigan

Integrated Computational Materials Engineering (ICME) has great promise in creating computer "super models" that combine a much wider array of materials information than were previously possible. Using these new computer models will speed up the development of manufacturing innovations.

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Coatings-5: An Integrated Database and Computational Models for Corrosion-Resistant Microstructural Design

Lead Industry Partner: United Technologies Research Center

Lead Research Partner: The Ohio State University

Technology Pillar: Coatings

Project Summary

This project is taking steps to develop an integrated materials property database and computational model to assess localized corrosion susceptibility based on a specification of alloy composition, thermo-mechanical processing, heat treatment and service conditions. This project will develop the ICME framework and initial test cases to assess corrosion performance of high strength, aluminum alloy components and identify the tools needed for further development and assessment of alloy modifications. Efforts are focused on examples from the 2XXX (Al-Cu-Mg) series, including lithium-containing alloys, and the 7075 (Al-Zn-Mg-Cu) legacy alloy, where considerable background data exists, and where microstructural heterogeneity dominates the localized corrosion response.

Technology Gap / Need

The aerospace industry selects materials and manufacturing processes primarily on ensuring acceptable mechanical properties. Corrosion performance of microstructurally complex metallic materials may not be fully realized until the component is placed into service. Anticipating and managing corrosion susceptibility using computational models will save time and costs.

Focus/Proposed Technology

A combined approach will be used that includes microstructural and macroscopic modeling, characterizing how deformation during production affects corrosion, and rapid evaluation of corrosion samples. These techniques will identify ways to incorporate corrosion predictions into component designs. In addition, models for a mechanical property prediction will also be evaluated.

Project Benefits

When fully deployed, corrosion design and mechanical property design models can be used side-by-side to afford manufacturers the confidence to make alloy specifications during the design phase with a reduced risk of over-specification that might be made as a corrosion allowance, or of under-specification that might arise from unanticipated processing-induced susceptibility.

Workforce and Educational Impact

Two universities (OSU and UM) will be involved in this project to give STEM undergraduate and graduate students exposure to real world technology development. The industrial partners involved in the project are committed to mentoring these students and hiring a subset of them to work as summer interns and coops at their facilities.

Project Duration

Start: February 2016
End: January 2018

Funding

Total Project Value: $3.15M

Participants

Industry Partners

United Technologies Research Center

Lockheed Martin

DNV GL

Research Partners

The Ohio State University

University of Michigan

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Joining-3: Robust Distortion Control Methods and Implementation for Construction of Lightweight Metallic Structures

Lead Industry Partner: Huntington Ingalls Industries

Lead Research Partner: University of Michigan

Technology Pillar: Joining

Project Summary

The project will develop integrated computational materials engineering (ICME) tools that will accurately predict the distortion associated with the production of representative structural forms, such as complex welded structures, stiffened panels or other structures that are of interest to industrial participants.

Technology Gap / Need

Distortion control for complex structural assemblies in production environments remains largely empirical and experience-based due to:

(1) Effective distortion modeling techniques for complex structures must focus on key parameters that contribute to distortion on a structural level in order to achieve computational efficiency and robustness for practical applications.

(2) Detailed material constitutive behaviors, including microstructure change during welding, only contribute to local through-wall, self-equilibrating stress states and have little effect on structural distortions that by definition are global phenomena at structural levels.

(3) Without effectively separating local versus global effects, current distortion modeling methods become too complex to implement for structural distortion.

Proposed Technology

The project is developing distortion prediction models and validating distortion mitigation strategies for increasing the final quality of lightweight steel fabrication processes. Year 1 will focus on developing ICME models and correlating them with actual production distortion. Year 2 will focus on validating and refining distortion control methodologies and developing and verifying distortion prevention strategies for each stage of production. The project includes a detailed cost analysis of the distortion control methods studied.

Project Benefits

Implementing better distortion control predictions and processes will result in significantly improved first-time quality, less rework and increased productivity in construction of lightweight structural components. The benefits expected include improved shop-floor operating procedures, simple distortion estimation equations that engineers can use to optimize designs for production, and finite element-based distortion analysis procedures for further engineering design and manufacturing analyses.

Education & Workforce Impact

Work force training sessions will be performed during the second year at corporate analysts', design and production engineers', and shop-floor workers' levels. Educational impact will involve undergraduate and graduate level students throughout the projects and will be expected to become potential workforce candidates for the industrial sections involved in the project.

Project Duration

Start: December 2015
End: December 2017

Funding

Total Project Value: $3.75M

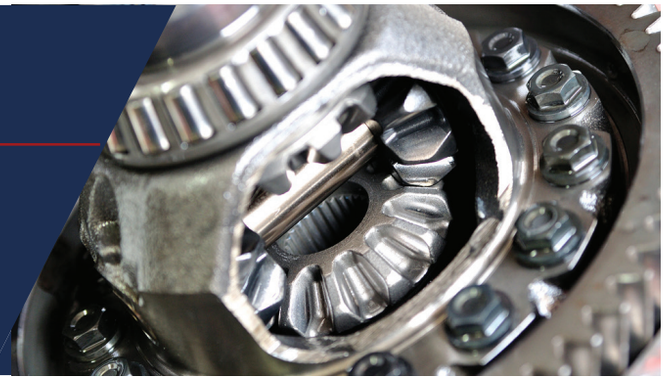
Participants

Industry Partners	Research Partners
Huntington Ingalls Industries	University of Michigan
Comau	EWI
ESI NA	MIT
	The Ohio State University

LIFT LIGHTWEIGHT INNOVATIONS

Project Title:

Melt 5a – Developing and Deploying Thin-Wall Ductile Iron Castings for High Volume Production



Lead Industry Partner: Grede

Technology Pillar: Melt Processing

Lead Research Partner: Michigan Technological University

Project Summary

This project will focus on the manufacturing process development required to bring thin-wall, vertical green sand-molded ductile iron (DI) castings to high volume production.

Technology Gap / Need

The ability to cast thin-wall DI castings is critical to leveraging the high stiffness and strength of these materials. Current components often have section sizes thicker (i.e., heavier) than dictated by mechanical requirements due to process and material limitations.

Proposed Technology

The high volume production of thin-wall ductile iron castings requires the integration of several recently developed technologies:

1. High precision molding machines
2. Utilization of pearlitic and high silicon, ferritic ductile iron alloys to mitigate carbide formation. Ferritic ductile iron alloys are currently in production but are not applied in thin-wall castings.
3. In-stream and in-mold inoculation practice to control microstructure
4. "Soft-touch" shake out and finishing operations

Project Benefits

By integrating and implementing improved methods and alloys, there is potential to decrease wall thicknesses of ductile iron cast parts by up to 50%, thus enabling light-weighting of transportation components by 30%-50% depending on component loading.

Workforce and Educational Impact

The American Foundry Society, through workshops, webinars, the annual Metalcasting Congress, and AFS's training arm (The Institute) will assist in the dissemination of knowledge and create new courses on how to manage this new thin-wall production environment. LIFT will support the development of integrated computational materials engineering (ICME) workforce training initiatives.

Period of Performance

Start Date: June 2015
End Date: June 2016

Funding

Total Project Value: $1.34M

Participants

Industry Partners

American Foundry Society

Comau

Eaton

Grede

PDA

Research Partners

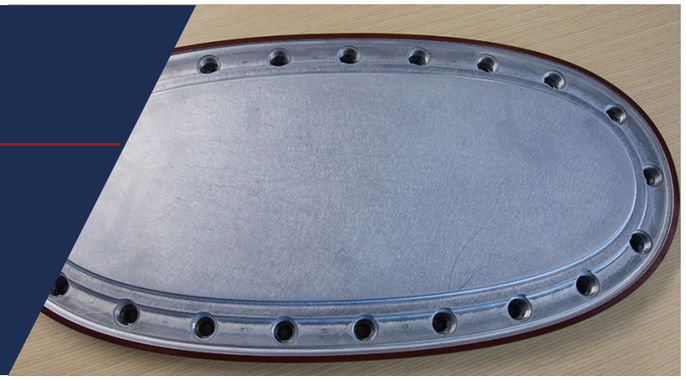
Massachusetts Institute of Technology

Michigan Technological University

LIFT LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Melt 5b – Thin-Wall Aluminum Die Casting Development



Lead Industry Partner: Boeing

Lead Research Partner: The Ohio State University

Technology Pillar: Melt Processing

Project Summary

This project focuses on the development of High Pressure Die Casting (HPDC) technologies for aluminum alloys that are required for producing high quality thin-wall aluminum die cast components.

Technology Gap / Need

The current technology gaps in the area of thin-wall aluminum HPDC castings create three opportunities for improvements:

- Reducing the minimum wall thickness of die castings to less than 3 mm in parts with larger surface areas, and still achieve complete mold fill.
- Reducing the variability of, and increase the minimum mechanical properties of HPDC castings, which currently limit their use for structural applications in both automotive and aerospace industries.
- Creating custom processes for designing die castings. Current casting design practice applies the minimum mechanical properties of cast alloys uniformly to the whole casting, which generally results in over-design of a casting, especially when a large safety factor is used.

Proposed Technology

Integrate key process technologies (super vacuum die casting and shortened heat treatment) with integrated computational materials engineering (ICME) tools for 300 series (Al-Si-Cu-Mg based) die casting alloys to reduce the variability in quality and improve the mechanical properties of high pressure die castings.

Project Benefits

- Reduction of the minimum wall thickness of parts to reduce weight
- Use of HPDC to replace unitized thin aluminum sheet metal built-up assemblies for manufacturing cost reduction
- Establishment of a mechanical property test database and design/ICME methods that are repeatable across the die casting supplier base, thereby increasing the competitiveness of domestic manufacturing of aluminum products.

Workforce and Educational Impact

The American Foundry Society (AFS) and the North American Die Casting Association (NADCA), through workshops, webinars, technical conferences, and training programs, will assist in the dissemination of knowledge and create new courses on how to manage this new thin-wall aluminum die casting in a production environment. LIFT will support the development of ICME workforce development initiatives.

Period of Performance

Start Date: July 2015
End Date: June 2017

Funding

Total Project Value: $2.2M

Participants

Industry Partners

Alcoa
American Foundry Society
Boeing
Comau
Eaton
NADCA
Nemak

Research Partners

Massachusetts Institute of Technology
Southwest Research Institute
The Ohio State University
University of Michigan
Worcester Polytechnic Institute

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

PHASE 1 – TMP-3b: Processing for Assured Properties in Al-Li Forgings by Development, Application and Validation of a Localized Physics-Based Visco-plastic Model

Lead Industry Partner: United Technologies Research Center

Lead Research Partners: University of Michigan
Case Western Reserve University

Technology Pillar: Thermomechanical Processing

Project Summary

This two-phase project will develop, implement and validate a localized physics-based visco-plastic finite element model (FEM) to predict mechanical deformation response, damage evolution mechanisms, and fatigue properties of forged Al-Li alloys. Phase one will focus on the development and validation of the predictive tools for Al-Li forging's to predict the effects of the material processing parameters on the part anisotropic mechanical properties.

Technology Gap / Need

Past Al-Li in structural applications have had serious issues due to high planar anisotropy, unusual crack paths, and a lack of thermal stability. A new generation of Al-Li alloys provide weight savings and improved properties. To meet significantly higher performance requirements of commercial aircraft engines, improved analytical methods are required to determine which material properties are best suited for a specific structure and how best to achieve the required mechanical and damage tolerant properties during material processing.

Focus/Technology

Objectives of Phase one are:

(i) Develop and implement a non-isothermal multiscale crystal plasticity (CP) constitutive model applied for 3rd generation Al-Li alloys

(ii) Develop and implement a microstructure based CP FEA framework to predict the effect of materials processing and local morphology on the mechanical behavior of the components

(iii) Experimentally calibrate and validate the predictive model.

Project Benefits

New FEM toolkits to guide process optimization of forged Al- Li alloy components will reduce the amount of development hardware and processing trials required for developing the next generation of aircraft turbine engines. By optimizing processes and designs, they will lead to components with improved performance and weight savings.

Education & Workforce Impact

Case Western Reserve University, the University of Michigan and the Forging Industry Educational Foundation (FIERF) will lead the development of project education and training efforts. Various delivery mechanisms have been made available through FIERF including instructor-led, on-line, learn-at-home self-study, video courses and workshops.

Project Duration

Start: **January 2016**
End: **December 2017**

Funding

Total Project Value: $3.2M

Participants

Industry Partners

United Technologies Research Partners

Lockheed Martin

Research Partners

University of Michigan

Case Western Reserve University

The Ohio State University

Southwest Research Institute

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Powder 3 - Development of Cost-Effective, Advanced Mechanical Alloying, Powder Consolidation Processes for Sub-Micron Reinforced AL MMCs

Lead Industry Partner: Materion

Lead Research Partner: Case Western Reserve University

Technology Pillar: Powder Processing

Project Summary

This project addresses the cost of Al-SiC metal-matrix composites (MMCs) derived from novel mechanically-alloyed powders. Considerations include process optimization, technical cost modeling and assessment of novel consolidation methods believed to be lower in cost than the baseline hot isostatic pressing (HIP) method, but yielding similar strength-to-weight benefits and superior specific stiffness of the composite compared to wrought aluminum comparator.

Technology Gap / Need

The applications of Al-based, sub-micron SiC-reinforced MMCs have been limited due mainly to the relatively high cost of the current hot-isostatic pressing (HIP) consolidation process. The development of these MMCs also includes powder synthesis, mechanical alloying, consolidation, and post-heat treatment - all of which add to the cost structure of finished components. Novel processes are required that could eliminate, or greatly reduce, these processing steps, enabling greater cost competitiveness and enhance the capability for high-volume production and subsequent expanded potential for weight reduction in transportation applications.

Proposed Technology

Alternative consolidation processes for mechanically-alloyed Al-SiC MMCs have shown the potential to reduce overall manufacturing costs by both minimizing time at temperature as well as introduction of concomitant mechanical deformation steps, leading to improved mechanical properties. Approaches include alternatives to HIP for consolidation of billets prior to extrusion (e.g. selective plasma sintering), as well as direct powder extrusion or forging of net shapes. Processes that can eliminate the canning and de-canning steps of HIP are particularly attractive.

Project Benefits

A complete understanding of cost structure, property prediction tools and alternative processing routes will allow materials developers to reduce time and costs to deliver aluminum-based MMCs for use in future transportation platforms. The team is exploring two immediate applications of Al-SiC MMCs where improved performance and greater weight-reduction opportunities are assessed relative to baseline aluminum alloy extrusions and alternative powder-metallurgy compacts.

Education & Workforce Impact

A training program for professionals and technical staff to capture innovation in powder synthesis, advanced consolidation manufacturing technologies and ICME will be initiated with local community colleges and geared towards providing a unique skill set for powder processing technologies.

Project Duration

Start: June 2016
End: June 2018

Funding

Total Project Value: $3.12M

Participants

Industry Partners

Materion
Lockheed Martin
Boeing
GKN

Research Partners

University of Tennessee - Knoxville
Case Western Reserve University
Penn State University
Massachusetts Institute of Technology

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Agile 1 - Agile Fabrication of Sheet Metal Components with Assured Properties

Lead Industry Partner: Boeing

Technology Pillar: Agile Processing

Lead Research Partner: University of Michigan
Northwestern University
The Ohio State University

Project Summary

This project will develop tools that can determine optimal forming routes for the fabrication of sheet metal parts without using matching dies, and meet both property design allowable and dimensional specifications. The project will develop validated chains of existing processes and an associated design methodology that can produce components within estimated costs with precisely controlled geometries and assured properties.

Technology Gap / Need

A business need exists to be able to quickly create dimensionally precise components, in aerospace for repair and low-volume production and for automotive repair, specialty and legacy vehicles. Technologies are emerging, but the major barriers to implementation are that commercial processes do not yet exist - including proven design methods, simulation, and assured design allowables for use in failure-critical or Federal Motor Vehicle Safety Standards (FMVSS) critical applications.

Proposed Technology

Many component technologies in agile sheet metal forming exist in high manufacturing readiness levels, for example, hydroforming is regularly practiced commercially and part of many military production specifications. Single point incremental forming (SPIF) has seen limited commercial application in demonstrations due to lack of geometric accuracy. Double point incremental forming (DPIF) has yet to see wide applications due to the need for special machinery, but there has been extensive work on programming tool paths and demonstrating the ability to form specific components with high accuracy. New aspects to be added here are to design processes for given parts and demonstrate these techniques to assess their readiness for commercial use with particular attention to simulation, assured properties with certification and cost modeling.

Project Benefits

Often times multi-million dollar aerospace assets are grounded in need of just a few parts, but only legacy techniques for making new parts can be used. The project will develop paths to certification for civilian and military use of agile sheet forming for aircraft and vehicle applications, allowing innovation in low-volume and custom production of sheet products.

Education & Workforce Impact

Outreach education, manufacturing competition and training events, a combination of lectures on theory and practice, hands-on manufacturing and experimentation, will be available to graduates and undergraduates, and relevant components will be available for K-12 education through the ASM Materials Camp network and associated projects.

Project Duration

Start: **August 2016**
End: **August 2018**

Funding

Total Project Value: $2.93M

Participants

Industry Partners

Boeing
Lockheed Martin
Comau

Research Partners

University of Michigan
Northwestern University
The Ohio State University
Massachusetts Institute of Technology

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Agile R2-4: Sustainable High Efficiency Machining

Lead Industry Partner: UTRC

Technology Pillar: Novel-Agile Processing

Project Summary

This project will develop and demonstrate advanced sustainable, high-efficiency machining technologies to achieve at least a 3x material removal rate improvement for machining lightweight materials using a systems engineering approach to integrate key machining technology to components including: cryogenic and ultrasonic machining; process dynamics modeling; and physics-based machining process optimization.

Technology Gap / Need

The project will improve material removal rate for machining lightweight materials, such as titanium and aluminum. It will adopt mature technology components related to cryogenic and ultrasonic machining necessary to achieve an improved rate. It will also develop and apply physics-based models and monitoring to optimize processing and predict effects of state-of-the-art machining processes.

Focus/Technology

The key focus areas of this project are:

Cryogenic Machining: Key to achieving high-speed machining of metals is controlling the temperature to allow efficient and effective heat transfer away from the workpiece without affecting the tool.

Ultrasonic Machining: Utilizing high-frequency vibration, ultrasonic machining significantly alters the frictional tool-chip force components imparting lower operational forces, improving tool life, and enabling increased feed rates.

Machining Process Dynamics: Machining process dynamic models are well developed and commercial tools based on these dynamic models are available to control dynamics such as chatter and vibration.

Model-based Machining Process Monitoring: Process health monitoring is critical to insuring the machining process runs smoothly without issue. Physics based machining models will establish these limits considering normal process parameter variations.

Project Benefits

Sustainable high efficiency machining technologies will significantly increase productivity, increase process capacity, reduce machining cost, improve part quality and reduce scraps and waste related to the processing of hard to machine lightweight metals. Enabling 3x or more material removal rate improvement through cryogenic or ultrasonic machining will significantly reduce machining cycle time and increase productivity of the industrial base. This will increase the capacity of the current production lines, and avoid the need for new capital equipment.

Education & Workforce Impact

The project will develop the future workforce by engaging senior undergraduate and graduate students at both the University of Kentucky and University of Michigan, and providing education materials on this advanced machining technology to the general public.

Project Duration

Start: January 2017

End: November 2018

Funding

Total Project Value: $2.5M

Participants

Industry Partners	Research Partners
UTRC	University of Kentucky
Lockheed Martin	University of Michigan
GKN	EWI
DNV GL	

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Coatings R2-3: Electrochemical Deposition of Metals Using Ionic Liquids

Lead Industry Partner: UTRC

Technology Pillar: Coatings

Lead Research Partners:
Case Western Reserve University

Project Summary

This project will explore new plating technologies, using ionic liquids, to provide a safer and more environmentally-friendly approach to forming metallic chromium layers. Current plating baths containing hexavalent chromium are being eliminated due to environmental concerns. Emerging aluminum plating technologies can replace electrolytic hexavalent plating , leading to potentially tremendous benefits in coating performance, green manufacturing and cost savings.

Technology Gap / Need

Acceptable alternatives to hard-chrome plating from hexavalent chromium (CrVI) containing plating baths as tribological and corrosion-resisting surface treatments have been elusive for decades. Environmental mandates call for elimination of Cr (VI) plating baths and other Cr (VI)-containing surface treatment chemistries. New plating technologies, predicated on the use of ionic liquids (ILs), provide a more environmentally-friendly approach to forming metallic chromium layers, potentially approaching the characteristics of traditional hard chrome.

Focus/Technology

Objectives of this project are:

Hard chrome replacement – Addressing the use of metallic chromium plated from ILs as a replacement for the Cr(VI) hard chrome tribological coatings as presently employed for such applications as engine valve stems, hydraulic rods and other tribological applications requiring a degree of corrosion resistance.

Aluminum substrates – Surface layer intended for overcoat coverage of alloyed and tempered aluminum substrates with a focus on novel Al-Li alloys.

High-strength steel substrates – Aluminizing from ionic liquids is intended to replace cadmium plating on steel for tribological and corrosion resisting applications and also offer an alternative to aluminum coating by physical vapor deposition.

Project Benefits

This project offers a practical and environmentally friendly approach to address the challenges associated with current practices, and further enables the use of advanced aluminum alloys and high strength steels for a variety of applications.

Education & Workforce Impact

Students engaged with this project will be trained in fundamental and applied aspects of ionic liquid based electrodeposition systems, and thus will be competitively positioned for industrial R&D jobs. Cross collaboration between industry and academia will provide unique educational experiences to students.

Project Duration

Start: December 2016
End: December 2018

Funding

Total Project Value: $5.2M

Participants

Industry Partners
DNV-GL
UTRC
Xtalic
Materion
Eaton
Lockheed Martin

Research Partners
Case Western Reserve University
University of Notre Dame
University of Texas

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Joining R3-1: Robotic GTA Welding of Thin Complex Contours with Variable Fit-Up

Lead Industry Partner: GKN Aerospace

Technology Pillar: Joining and Assembly

Lead Research Partners:
University of Notre Dame

Project Summary

The program will develop fully automated robotic welding of thin sheet metal parts with complex contours. Such parts have proven difficult to weld automatically because it has not been practical to achieve the precise fit-up needed to weld with a static set of weld parameters. The program will develop an adaptive weld approach wherein the joint is scanned for actual fit-up conditions and the weld schedule adjusts along the joint according to a database of predetermined weld schedules versus fitup conditions.

Technology Gap / Need

Automated welding of complex sheet metal shapes has proven extremely difficult. Normally an automated weld follows a constant weld schedule (set of parameter settings) established for a particular joint configuration. This weld schedule is established based on tests with ideal fit-up conditions – zero gap and zero mismatch. Industry experience shows that if the gap or mismatch exceed a small fraction of the material thickness, the pre-established weld schedule will not produce an acceptable weld. It will either fail to achieve full penetration or, more likely, it will burn through the material catastrophically.

Focus/Technology

This project will enhance the system to enable real-time adjustment of the weld parameters to adapt to variable fit-up and other part specific factors. The project will also produce a physics based model that will enable the approach to be efficiently adapted to multiple joint configurations and materials, streamlining the future advancement of the technology and enabling the robotic welding of complete systems.

Project Benefits

Today these complex structures must be welded manually. Even with a very skilled welder, defects are frequent. Weld speeds are slow so heat input and distortion are high. An automated system offers more than three times the throughput with no labor and much improved weld quality and repeatability.

Education & Workforce Impact

Graduate students involved in the process will review the large volume of data from the experimental welds and develop a physics based model of the process. This will enhance the fundamental understanding of the weld process as they continue in the classroom and/or enter the workforce.

Project Duration

Start: April 2017
End: April 2018

Funding

Total Project Value: $1.45M

Participants

Industry Partners
GKN Aerospace
UTRC
Lockheed Martin
Comau

Research Partners
University of Notre Dame
EWI

LIFT LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

TMP R2-5: Friction Stir Extruded Tubing

Lead Industry Partner: Lockheed Martin

Technology Pillar: Thermo Mechanical Processing

Lead Research Partners:
University of Notre Dame

Project Summary

This project will demonstrate a new method for extruding lightweight metallic tubing using friction stirring that enhances mechanical and metallurgical properties compared to traditional extruded tubes. The goal is to use new tubular products in applications where extruded tubing has not been considered previously, such as auto motive frames and marine heat exchangers.

Technology Gap / Need

The requirement for improved strength and versatility of hydroformed parts is ever increasing. Hydroformed aluminum tubes are typically made from the 5000 and 6000 series of alloys. The development of higher strength 2000 and 7000 series alloys for traditional extruded tubing has been attempted with little success, due to cracking and corrosion. A need exists to develop technology for enabling the use of higher-strength aluminum alloys that provide both an increase in strength-to-weight and improved corrosion resistance in order to achieve a substantial decrease in lifecycle cost of hydro-formed aluminum components.

Focus/Technology

Friction stir extruding 2000 and 7000 series alloys can produce a microstructure with improved formability that enables hydroforming of complex shapes without the risk of micro cracking. Implementing hydroformed tubing with higher strength will lead to thinner wall requirement and reduced weight.

These high strength-to-weight parts can be used universally on commercial and military vehicles to improve their range and fuel economy.

Project Benefits

The benefit of this project for the land-based transportation industry is the potential to reduce vehicle mass and promote a more efficient build approach by reducing part count and number of assembly operations. The benefits of this project to the heat exchanger industry is attributed to improving the life of process tubing in marine applications.

Education & Workforce Impact

The friction-stir machinery at LIFT will require both academic and workforce participation for installation, operation, and development of commercial products. The development phase will allow students to characterize new materials and find new and innovative applications for friction stir extruded tubing.

Project Duration

Start: September 2016
End: October 2018

Funding

Total Project Value: $4.3M

Participants

Industry Partners	Research Partners
Lockheed Martin	University of Notre Dame
Comau	University of Michigan
ABS	University of Tennessee - Knoxville
MTI	The Ohio State University
	Southwest Research Institute
	Oak Ridge National Labs

LIFT LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

SP-1: Lightweighting Development of Humvee Anti-lock Braking System with Electronic Stability Control

Lead Industry Partner: Ricardo Defense Systems, LLC

Technology Pillar: N/A

Lead Research Partners:

University of Michigan
Transportation Research Institute

Project Summary

This project will support further development of the Ricardo modified commercial off the shelf (COTS) ABS (Anti-lock Braking System)/ESC (Electronic Stability Control) system for the High Mobility Multipurpose Wheeled Vehicle (HMMWV). The system developed by Ricardo includes ABS/ESC functionality and improved brake calipers, pads and rotors which may reduce stopping distance by 8 truck lengths and 7 times component reliability improvement.

Technology Gap / Need

The need for this technology and solution is driven by the Army Chief of Transportation Operation Requirements Clarification to include ABS/ESC and improved brakes for the HMMWV. Rollovers with the HMMWV remain a problem today. Commercially available integrated ABS and ESC systems are limited, so this project will provide a modified Commercial Off the Shelf system to the Department of Defense and will have an immediate impact on the safety of our U.S. service men and service women.

Focus/Technology

Objectives of this project are to:

1 - (Advance the Manufacturing Readiness Level (MRL) of the HMMWV Brake and Stability kit. This project will provide the funding necessary to build multiple prototypes of the Ricardo Brake and Stability Control System (Manufacturing Readiness Level 6), and develop the system to MRL 8.

2- Investigate the application of advanced lightweighting processes and materials for application in a modern military vehicle environment. It will also examine lightweighting every part of the system with advanced casting techniques and with metal matrix parts.

Project Benefits

This project will have an immediate positive impact on the U.S. servicemen and servicewomen by reducing the fatal rollovers of HMMWV by up to 74 percent. Upon completion of the project, the modified Commercial Off the Shelf kits will be delivered to the Department of Defense for implementation.

Education & Workforce Impact

New Equipment Training (NET) will consist of a two-week course designed to transfer installation, operational, and maintenance procedures to the soldier/ other user. This class will provide an in-depth hands-on training approach through developed lesson plans, specifically designed to educate the soldier on every aspect of the ABS kit, from functionality to repair procedures and logistics support.

Project Duration

Start: October 2016
End: October 2017

Funding

Total Project Value: $7.5M

Participants

Industry Partners

Ricardo Defense Systems, LLC
Douglas Autotech
GKN
Brembo N.A
Continental Automotive

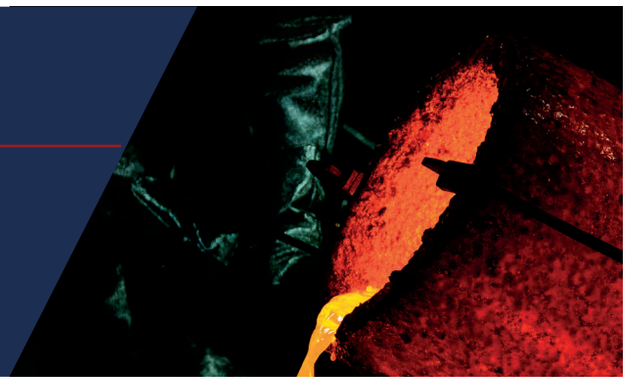
Research Partners

University of Michigan

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Melt R2-2: In-Situ Manufacturing of Nanoparticle Reinforced Aluminum Matrix Composites



Lead Industry Partner: North American Die Casting Associtaion (NADCA)

Technology Pillar: Melt Processing

Lead Research Partners:

Worcester Polytechnic Institute
The Ohio State University

Project Summary

This project intends to scale-up a process for producing aluminum-based nanocomposite material and develop process technologies for cast products with improved performance of large, single-piece cast products. The improved performance will increase stiffness and fatigue strength.

Technology Gap / Need

Aluminum alloys are used extensively in the automotive and aerospace industries because of their high strength-to-weight ratio. While some have very high strength, further strength improvements can be achieved by incorporating nano-sized particles in the aluminum matrix, as well as the mechanical properties at an elevated temperature. Monolithic aluminum alloys are not useful in such applications, so there is a need for a lightweight, thermally-stable material that can be produced economically with little disruption to existing manufacturing infrastructure.

Focus/Technology

Three routes have been identified. Each of the three process routes will be scaled up to produce several pounds of material. The material will then be cast in a laboratory and characterized by mechanical property and microstructural analysis in both the as-cast and heat-treated condition.
Machining studies will then be conducted to determine the machining process parameters.
The three process routes include:

- In-situ gaseous reaction
- In-situ self-propagating high temperature in the explosion mode
- Ex-situ ultrasonic dispersion

Project Benefits

The major benefits of this project are the reduction in component weight due to improved room temperature properties as the ability of aluminum to operate at higher temperatures due to better elevated temperature endurance.

Education & Workforce Impact

Students engaged with this project will be participating in real manufacturing environments and will be provided the opportunity to learn about aluminum nanocomposites, die casting and component design.

Project Duration

Start: March 2017
End: December 2018

Funding

Total Project Value: $2.3M

Participants

Industry Partners	Research Partners
NADCA	WPI
ECK Industries, Inc. Eaton	Case Western Reserve University
Terves	University of Michigan
Nemak	The Ohio State University
	MIT

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Joining R2-1: Development of Technologies for Joining Titanium to Steel

Lead Industry Partner: Tenneco Automotive

Lead Research Partners: EWI

Technology Pillar: Joining and Assembly

Project Summary

This project will investigate methods of maturing two specific processes of joining titanium to steel - lap and butt joining configurations. The applications for those processes to be explored as part of this project are automotive titanium exhaust system components and the bevelgear on a shaft.

Technology Gap / Need

The ability to reliably join dissimilar materials - such as titanium to steel - has gained attention recently as manufacturers strive to design and produce lightweight components that can meet the performance and reliability standards of the automotive, aviation, aerospace and defense industries. To lower production cost titanium and its alloys are often welded to steel to achieve high performance and cost-efficiency. However, reliable Ti/Steel joints can be difficult to produce due to poor compatibility resulting from the formation of hard and brittle intermetallic phases.

Focus/Technology

This project will focus on developing, validating and implementing Integrated Computational Materials Engineering (ICME)-based modeling to predict the welded joint performance. Once validated, the models will be verified on industrial partner-selected applications to ensure they accurately predict the required component performance, including lifecycle and corrosion resistance.

Project Benefits

Developing advanced computational methods which accurately predict material and joint properties of titanium to steel will significantly impact lightweight component design for automotive, aerospace and other transportation industries. Eliminating more complex joints will lead to more efficient designs, reduced weight, and reduced production time and cost.

Education & Workforce Impact

Graduate students participating in the project, along with engineers from industry partners, will assist in relevant project tasks, witness the lightweighting needs of industry and therefore, become better prepared to join the workforce.

Project Duration

Start: May 2017

End: January 2019

Funding

Total Project Value: $2.0M

Participants

Industry Partners	Research Partners
Tennecco Automotive	EWI
Boeing	University of Michigan
SFTC	Colorado School of Mines
	The Ohio State University

LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Joining R2-4: Processing and Properties Database for Refill Friction Stir Spot Welding of Aerospace Materials

Lead Industry Partner: Boeing

Lead Research Partner: EWI

Technology Pillar: Joining and Assembly

Project Summary

The program will explore friction stir spot welding as a more common application in the aerospace industry. Friction stir spot welds (FSSW) have many of the same solid state benefits of traditional continuous friction stir welding (FSW) but has the greater freedom of being localized and more readily implemented into robotic assembly systems. Additional benefits of FSSW include the ability to more closely maintain the wrought properties of the parent alloy. With the increased cost of specialized fasteners and adhesives, FSSW also helps to bring down the cost to join different components.

Technology Gap / Need

Two technology gaps will be addressed by this project. The first is regarding the Refill Friction Stir Spot Welding (rFSSW) of titanium. While conventional FSW has been performed with titanium using refractory metals, there is currently no literature concerning refill friction stir spot welding. The second point is the availability of process information and its connection to mechanical properties. The development of the database of process parameters and mechanical properties will help drive the final design guidelines and allow this technology to advance beyond this project

Focus/Technology

The objective of this project is to validate and further develop rFSSW using aerospace alloys. Much work to date has been performed in standard aluminum alloys such as AA 2XXX, 5XXX and 6XXX. This project will expand the Manufacturing Readiness Level beyond these basic alloys to include hard metals such as Ti-64 as well as Aluminum-Lithium and 7xxx series aluminum.

Project Benefits

This project will deliver: an initial process and properties database; initial design guidelines based on this process data; demonstration articles of the proposed applications; and expanded capabilities of rFSSW using titanium. Each of these deliverables will bring the technology closer to production in aerospace than the current state of the technology.

Education & Workforce Impact

Properties data will be included in company specific briefings to designers for integration into next generation components. Finally, the information will be available for dedicated training modules focused on tailoring the workforce for integration of these new technologies.

Project Duration

Start: April 2017
End: October 2018

Funding

Total Project Value: $2.08M

Participants

Industry Partners	Research Partners
Boeing Research and Development	EWI
GKN Aerospace	University of Tennessee-Knoxville
Lockheed Martin	ORNL
Comau	University of Michigan
Bond Technologies	
Coldwater Machine	

SECTION

Education and Workforce Development Initiatives

QUOTE

“Our goals are to eliminate the current skills gap in order to sustain, grow and attract manufacturing jobs across the country, and to prepare a technology-savvy next generation workforce.”

EMILY STOVER DEROCCO
DIRECTOR OF EDUCATION AND WORKFORCE DEVELOPMENT

LIFT LIGHTWEIGHT INNOVATIONS

WORKFORCE PROFILE 2017

THE MISSION

Innovation – or bringing "mind to market" – is only possible if we have the talent to put that new idea or new technology to work in our economy. So LIFT's vision, to be the world leader in lightweight materials manufacturing, can only be realized if we develop the educated and skilled workforce necessary to use new lightweighting technologies and processes.

Our plan to develop that educated and skilled workforce is comprehensive and spans both the continuum of jobs in manufacturing where the nation is now experiencing a "skills gap," and the continuum of education and training that must be available in communities and states seeking to sustain, grow, and attract manufacturing jobs in their economy.

The underlying principles of our work plan are:

First, **be "demand" and data-driven**. We will educate and train to the knowledge, skills and abilities in demand by manufacturers. Our first priority is to conduct regular demand-supply-and gap analyses on workforce needs in the 5 states directly related to the jobs in our impact sectors.

Second, **be transformational for sustainable results** in producing workers with the right skills. You can find thousands of "random acts of excellence" in workforce development with little or no impacts on the talent supply chain.

Third, **drive from the bottom up.** Recognize that all the systems we need to engage and use – education, economic development, and the workforce investment system – are highly devolved to state and local authorities. A top-down strategy will not work.

Fourth, **strategically focus** on opportunities, for example, target populations such as separating military personnel and "gaps" in the talent supply chain where there are clear disconnects between the demand for skills and the supply of skills.

Finally, **link and leverage the assets** available. Capture the initiatives to build educational pathways and link them via stackable credentials and articulation agreements across the education continuum. Align strategies to gubernatorial initiatives to increase educational attainment and put people back to work. Ride the wave of bipartisan support for restoring U.S. leadership in manufacturing globally.

PROCESS FOR IMPACTFUL INVESTMENTS

- Analyze the demand-supply-and gap data to identify where investments and strategies need to be focused. Publish bi-monthly demand-supply-gap analyses for each of the five LIFT states.

- Establish a high level Workforce & Education Working Group for the region, representing national expertise and the 5 states' education, workforce development, economic development, and industry sectors. Charge that working group with supporting the state teams that will be designing and implementing solutions that are demand-driven, results-oriented, replicable and scalable. The Workforce & Education Working Group was launched on September 23, 2014, and set the broad agenda for our work.

- Build five state core teams that will design and implement solutions appropriate to their state assets, demand/supply analysis, and roadmap to an educated and skilled manufacturing workforce. These solutions will fill "leaks" in their pipelines delivering talent to manufacturers. The 5 State LIFT Teams have been launched, involving over 135 top officials in education, workforce development, economic development, and labor.

- Align solutions to the 11 strategic focus areas identified by the high level working group.

Understanding workforce demand-supply gaps

Reconnecting disconnected youth to high quality, middle skills jobs

Teaching the teachers

Expanding work and learn opportunities for students

Creating enhancements to engineering curriculum using lightweighting technologies

Offering on-the-job training solutions for our industry partners

Attracting students and workers to educational pathways to careers in manufacturing

Connecting separating military personnel and veterans to fast track skills development and manufacturing careers

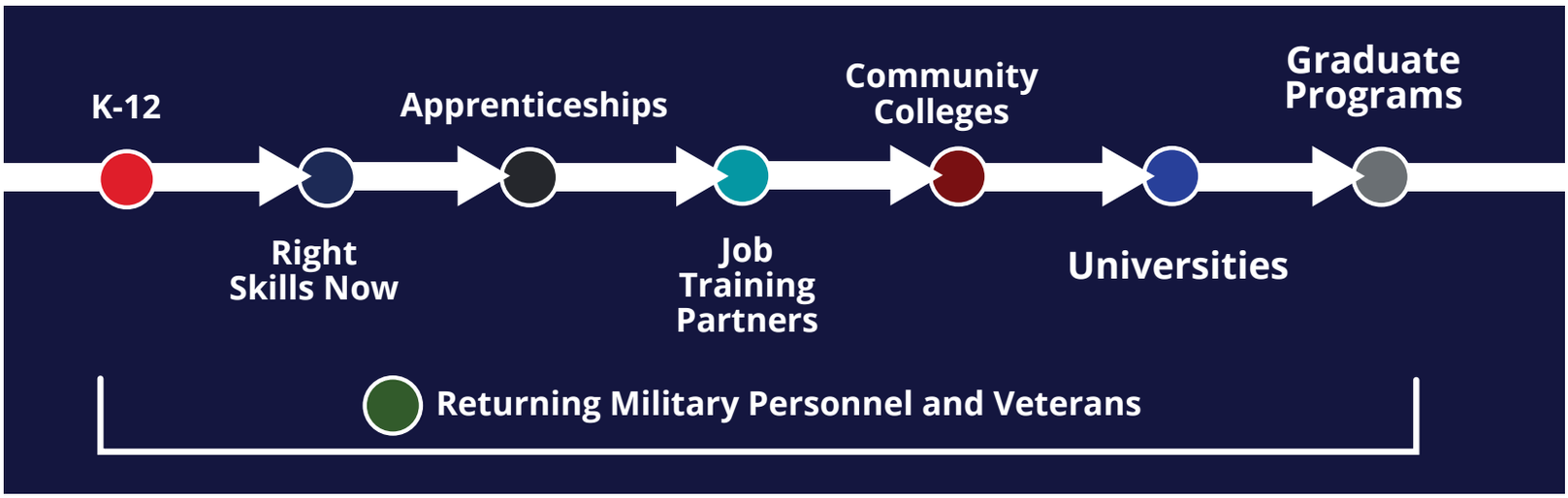
Deploying pathways from K-12 through community colleges to university four-year degree programs, with more on and off ramps to employment

Ensuring students gain STEM foundational skills for success in manufacturing careers

Linking and leveraging resources and related initiatives on the ground today

- Identify appropriate metrics and capture data as necessary to assess success.

INVESTMENTS THROUGH AUGUST 2017



LIFT Learning HUB
Across the talent continuum with an early emphasis at university level

Industrial Technology Maintenance Standards/Credentials/ Instructor Training
Community & Technical Colleges; Incumbent Workers

Tennessee's New ASM Bootcamps for Teachers
Community & Technical Colleges for Adult Workers and Incumbent Workers
* Reinvested in 2016

Kentucky's FAME 2.0 Initiative
Community & Technical Colleges for Adult Workers and Incumbent Workers

Tennessee's Student Engagement Strategy/Video Contest
STEM Education/K-12/CTE Community & Technical Colleges

National ASM-LIFT Materials Science Bootcamps for Teachers
Community & Technical Colleges for Adult Workers and Incumbent Workers
*Reinvested in 2016

Learning Blade: Mission LIFT interactive web-based curriculum (K-12)
Online curriculum for students serves K-12

Indiana Vincennes University Right Skills NOW: Machinist training for veterans
Veterans and Right Skills NOW

Kentucky's Externships
K-12 Teachers & Community College Instructors

Virtual Reality Lightweight Vehicle Manufacturing System: Virtual reality technology to teach lightweighting principles
Across the talent continuum

Ohio Manufacturing Careers Council: Industry-led council to inspire future manufacturing talent
Across the talent continuum

Work & Learn in Indiana: Career Exploration in Lightweight Metals Manufacturing
Apprenticeships, Jobs Training Partners, Community Colleges, Universities

High School evGrandPrix: Engaging High School Students in STEM Education for Manufacturing (HSevGP)
K-12, Universities, Job Training Partners, Graduate Programs

Pathways to Jobs in Detroit: Connecting Disconnected Youth & Adults to Manufacturing Careers
K-12, Jobs Training Partners, Community Colleges, Universities

Growing a Skilled Manufacturing Workforce: Work-Based Learning in Ohio
K-12, Jobs Training Partners, Community Colleges, Universities, Apprenticeships

Foundations for Manufacturing Careers: Worker Readiness in Ohio
K-12, Jobs Training Partners, Community Colleges

Ohio Means Internships & Co-ops 2.5 Program
Community Colleges, Universities, Graduate Programs

Manufacturing Technology: High School Career Pathways
K-12, Jobs Training Partners, Community Colleges, Universities

Adult Education: Pathways to Manufacturing Careers in Kentucky
Community Colleges, Universities, Job Training Partners, Apprenticeships

Leading a MakerMinded Vision
K-12, Job Training Partners

State Manufacturers Associations Collaboration Initiative
Across the talent continuum

The LIFT Prize in Robotic Blacksmithing
K-12, Job Training Partners, Community Colleges, Universities

On Track: Filling the Manufacturing Workforce Pipeline in Kentucky
K-12, Job Training Partners, Community Colleges

Modern Manufacturing Work-Study Program
Job Training Partners, Community Partners

Expert Educator Team
Expanding Work and Learn, Understanding Workforce Demand-supply Gaps, Foundational Skills

Professional Certification in Lightweight Additive Manufacturing
Foundational Skills, Attracting Students

Teaching Factory
Foundational Skills, Attracting Students

Online Training for LIFT Members
On-the-job Training, Enhancing Engineering Curriculum

Lightweighting Open Source Curriculum
Attracting Students, Foundational Skills

A Resource for Career Counseling
Attracting Students, Foundational Skills

Operation Next
Preparing Veterans, Enhancing Engineering Curriculum

Heroes Alliance
Attracting Students, Foundational Skills

LIFT Learning Lab Internships
Expanding Work and Learn Opportunities, Enhancing Engineering Curriculum

For more information about the education & workforce development initiative visit www.lift.technology

lift LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

LIFT ONLINE LIBRARY & LEARNING HUB

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Nearly 20% of 2.5 million workers related to lightweighting are over the age of 55 and will be retiring in the next 20 years, creating a large demand for almost 14% of the 5-state region's employment. Demand for workers with lightweighting knowledge is growing, but educators do not readily have resources available.

Currently, there is no mechanism for sharing information, curricula, and other educational material that professors and teachers can use to help teach students about lightweight metals and lightweighting technology.

THE SOLUTION

LIFT will serve as a hub to get information in the hands of educators to ensure that students have access to knowledge about the newest technology. They hope to inspire future careers by sharing materials and starting to teach more about lightweighting. By creating a database of educational materials related to lightweighting, educators will have the tools they need to teach tomorrow's workforce essential skills.

ABOUT THE PROJECT

A core team of experts will identify and develop materials and content related directly to lightweight metals and technologies that will help integrate lightweighting into educational pathways and professional occupations. The project will identify, gather, and evaluate currently available content and courses, develop products to ill gaps, and create distribution channels for the products to appropriate education and job training providers.

All content and curricula will be open-sourced to the extent feasible and to facilitate easy adoption into existing programs and courses. The target programs of study include: engineering degree programs, engineering technology degree programs, community college associate degree programs, industry-recognized credentialing programs such as the National Institute for Metalworking Skills and American Welding Society credentials, and introductory career and technical education programs.

PARTNERS

Co-Chairs

American Society for Engineering Education (ASEE)

University of Kentucky

FROM EDUCATION

Universities

University of Tennessee, Purdue University, Ohio State University, Tennessee Technological University, Austin Peay University, University of Michigan, Michigan State University, University of Cincinnati Research Institute, Wayne State University, Indiana University, and University of Notre Dame.

Community Colleges

Macomb Community College (MI), Pellissippi State Community College (TN), Lorain Community College (OH), Cincinnati State Community and Technical College (OH), and Sinclair College (OH), and the Kentucky Community and Technical College System (KY).

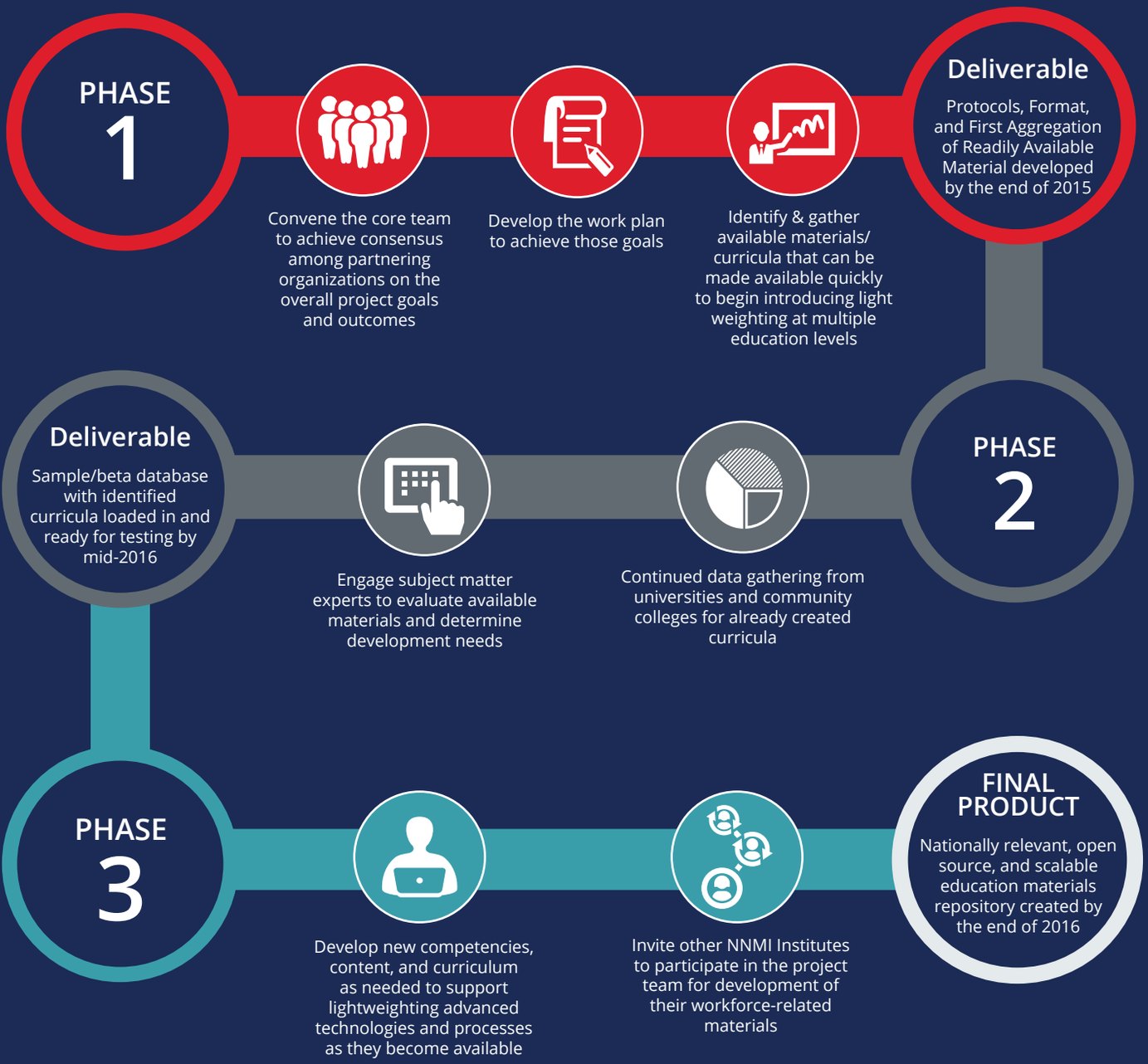
From Industry, Labor, and Certifying Organizations

National Institute for Metalworking Skills (NIMS)
American Welding Society (AWS)
Oak Ridge National Laboratory
International Association of Machinists & Aerospace Workers
ASM International
LIFT Founding Industry Members

From NNMI

Institute for Advanced Composites Innovation (IACMI)

PROJECT PHASES



GEOGRAPHIC FOOTPRINT

This initiative will have nationwide impact, with nationally recognized organizations participating in the core team work. Open-sourced products will enhance educational programming across the country, and provide the opportunity for other institutes in the National Network of Manufacturing Innovation Institutes (NNMI) to participate.

EXPECTED OUTCOMES

Content and curriculum enhancements developed in this initiative will help align educational programming related to lightweighting jobs and occupations at all levels. With open-source access to content and materials, the knowledge, skills, and abilities necessary for workers to integrate new lightweight technologies and materials into design and production processes will be readily available to educators across the nation.

For more information about the education & workforce development initiative visit www.lift.technology

lift LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

ASM-LIFT Teacher Camps: Materials Science in Action

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Nationwide, the talent pipeline for advanced materials and lightweighting is in critical condition. In 2013, only 100,000 students in the LIFT region completed certificates and degrees in areas related to lightweighting and materials technologies. The current level of student engagement is not enough. Not only have employers in the LIFT region posted 270,990 online job ads for lightweighting-related occupations in the past year, but employers will need to fill almost 500,000 vacancies created by the retirement of an aging workforce in the coming decade. The need for workers now is an important task and the pipeline of workers in the coming decade will be essential to manufacturing's success.

The opportunity to raise levels of awareness and understanding of these jobs and careers among students, parents, teachers and counselors is critical. As employer needs for this workforce increases - through business growth or through the need to replace an aging workforce - there must be a ready pipeline of individuals with the skills and interest to fill those jobs.

THE SOLUTION

Teachers are one of the most valuable resources for passing along critical career information to the future workforce. Because they possess the knowledge that students must learn, teachers are an essential piece of the talent pipeline puzzle. This is why ASM and LIFT are partnering to launch the Materials Camp program for teachers. The ASM-LIFT Materials Camp program is a nationwide outreach and STEM training initiative to prepare high school and middle school teachers to promote STEM education and career pathways awareness, ignite inquisitiveness, engage students and teachers, and educate them in new and interesting ways on physical science, chemistry, and other concepts integral to Materials Science courses.

The ASM Foundation has set goals around increasing the supply of technically capable young people entering the general arena of engineering and applied science in STEM careers. These camps will help develop a pipeline of workers equipped to meet current and future workforce demands.

PARTNERS

From Education

38 Host Educational Institutions

200 Master Teachers and Faculty

From Industry

Industry Volunteers at each camp site

ASM International & ASM Educational Foundation

EXPECTED OUTCOMES

Teachers from previously sponsored camps across the U.S. reported unanimously they were: "More confident in explaining complicated subjects," and "Gained new ideas and approaches to instruction" after attending this week-long training. With this training in-hand teachers can bring their knowledge back to the classroom to encourage more students to enter fields related to materials science and lightweighting. More students entering the field over time means that employers will have a robust pool of workers from which to hire, creating an advanced manufacturing talent powerhouse for the U.S.

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

- Ensure students gain STEM foundational skills
- Attract more young people to manufacturing careers
- Teach the teachers
- Expand work-and-learn opportunities

MATERIALS SCIENCE IN ACTION

Summer 2015

The Materials Camp for teachers focuses on enriching, stimulating, and enhancing the technical competence and teaching skills of high school and middle school STEM teachers. The program teaches high school and middle school teachers of Math, Science, or Technology to use every-day materials, to provide hands-on experiences and meaningful learning experiences that are proven to engage and inspire students in science, engineering, technology and mathematics. A key lesson in the camp encourages teachers to begin to implement new instructional methods by introducing hands-on, low-cost experiments to enhance classroom instruction.

This one-week training exposes teachers to valuable lessons in physical science and chemistry, from an engineering perspective. The information and concepts presented can be utilized as a basis for teaching their own Materials Science course or infusing the concepts into an existing science course to increase relevancy and student motivation. LIFT–branded instructional material will be provided, including YouTube training modules that can be used by both Master Teachers and teachers who are part of the camps. These open-source documents will cover the following topics:

- Value of Lightweighting (focus on math and using units)
- Essential Properties of Materials (focus on density, stiffness and strength)
- Strengthening Mechanisms in Metals
- Demonstrations in Strengthening
- Demonstrations in Aluminum Strengthening

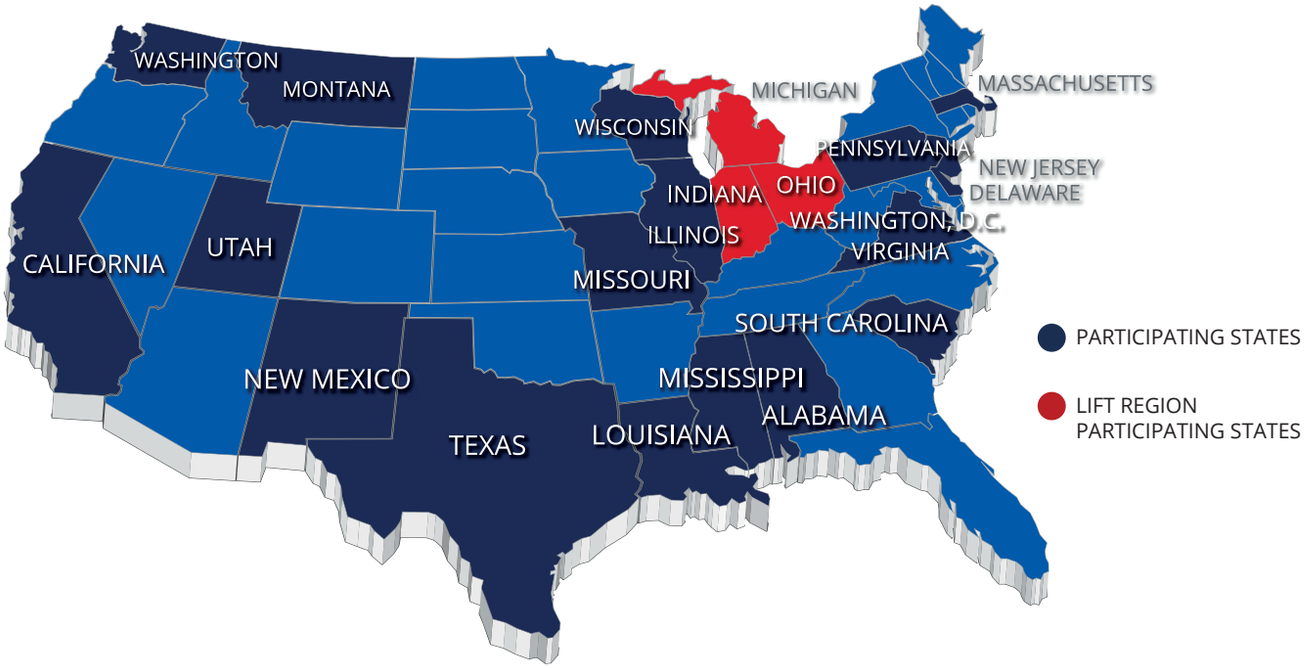
NATIONAL SCOPE

The ASM Materials Education Foundation will operate one week advanced instructional professional development workshops for middle and high school science teachers organized and orchestrated nationwide. Content on the use of lightweight metals will be integrated at all 45 camps in the summer of 2015 (see: http://www.asminternational.org/foundation/teachers/teacher-material-camps/schedule). The Materials Camp will involve 3 states in the LIFT region: Ohio, Indiana, and Michigan operating 12 camps during summer 2015 in the LIFT region.

The program will have national implications on multiple levels.

The model may be replicated by other states and educational institutions nationwide as the impact of "teaching the teachers" is realized. Furthermore, the 1,000 plus teachers touched by this curriculum will undoubtedly disseminate the information across state boundaries impacting students entering the STEM fields both locally and nationally.

STATE CAMP LOCATIONS



For more information please see lift.technology or contact LIFT Education & Workforce Director, Emily DeRocco at ederocco@lift.technology.

BUILDING 21st CENTURY MANUFACTURING TALENT

Teaching the Teachers: Advanced Manufacturing Externship Experience

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Currently, many Kentucky teachers do not possess expertise and knowledge necessary to present students with career pathways related to lightweighting technologies. Industry leaders are concerned that students are not getting enough exposure to 21st century high-tech advanced manufacturing. Many students choose careers away from manufacturing often due to lack of knowledge about the career options. Students who are introduced to career pathways in high school, or earlier preferably, understand how their course work translates to success in the careers they choose after graduation. Instructors and teachers remain critical facilitators to develop and cultivate connections between academic and technical skills.

THE SOLUTION

LIFT will partner with the Kentucky LIFT Workforce & Education Team and the Northern Kentucky Industry Council to establish a manufacturing-focused high school teacher/community college instructor externship experience for the summer of 2015. This program will emphasize employers who utilize or are transitioning to lightweight technologies and materials, and focus on both high school and community college instructors. With the expertise gained from the externship, these teachers can share their newfound knowledge with students to help encourage more students to take on advanced manufacturing careers post-graduation.

ABOUT THE PROJECT

The goal of the teacher/instructor externship experience is to connect classroom learning to authentic activities and encourage teachers to use that connection in their classroom instruction. Specifically, this project begins developing instructor understanding of emerging technologies such as those related to lightweighting and the opportunities and challenges these technologies pose for students.

The externship experience provides business partners and teams of teachers an opportunity to learn how technical and academic course content is used in a real-world manufacturing setting. Teams of teachers – importantly consisting of both technical and academic instructors – spend up to five days in partnership with an area manufacturing business learning about job and career opportunities and requirements, how classroom learning is applied in the workplace, and how to apply the manufacturing experience back into the classroom. Business partners assist teachers in understanding these realities and teachers then connect manufacturing practices to the content standards they are required to teach students in their respective courses.

PROJECT LEAD

Kentucky Community & Technical College System

PARTNERS

Bosch

Hahn Automation

Mubea Inc.

Steinkamp Molding

Boone County Public Schools

Kenton County Public Schools

Grant County Public Schools

Gateway Community & Technical College

PROJECT PHASES

EARLY JUNE

Action

Schools identify teacher teams that will participate

Businesses identify main contacts for the externship program

Final Deliverable

Thirteen to fifteen high school teachers and community college instructors are paired with business leaders for externship.

MID-JUNE

Action

Face-to-face meeting between teacher/ instructors and main contact(s).

Final Deliverable

Meeting to discuss goals/outcomes of the externship, provide business contacts information on the teacher team they will be working with and assist the groups in developing a schedule.

AUGUST – SEPTEMBER

Action

Externship experiences completed

Final Deliverable

Teacher/instructor teams will receive a formal evaluation and project summary report and take newfound knowledge back to their classrooms.

GEOGRAPHIC FOOTPRINT

The Teacher and Instructor Externship project will take place in the northern Kentucky area. If successful, this model can be replicated in other communities in the LIFT region and nationwide.

EXPECTED OUTCOMES

13 to 15 high school teachers and community college instructors will complete a manufacturing externship experience that will significantly influence their future instruction and the students in their classes in terms of their understanding of manufacturing and the career opportunities therein. If expanded, the program will help many more teachers and instructors gain knowledge and experience to pass to students encouraging advanced manufacturing careers.

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Ensure students gain STEM foundational skills

Teaching the teachers

Attract more young people to manufacturing careers

For more information about the education & workforce development initiative visit www.lift.technology and contact LIFT Workforce & Education Director, Emily DeRocco at ederocco@lift.technology

lift LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Teacher Training in Tennessee: Materials Science Bootcamps

An Education & Workforce Development Initiative for LIFT…Lightweight Innovations for Tomorrow

THE PROBLEM

In the State of Tennessee, demand for lightweighting skills continues to be significant. Employer demand, as defined by online job postings, has grown consistently and those postings are dominated by jobs for skilled materials workers, logistics workers, production and operations supervisors, electrical and mechanical engineers, and CNC machinists.

In Middle Tennessee during 2014 over 2,100 jobs were posted for lightweight-related job opportunities. On top of this, over 30% of jobs posted online advertise an annual salary of over $50,000 and nearly half are for jobs in skilled trade occupations. These are good jobs.

To add to employer needs, nearly 20% of lightweighting workers are over the age of 55 and will be retiring in the next 10 years. Only 21% of lightweighting workers are women, while women represent half of the total regional population. Not only are more workers needed right now to fill open positions but the pipeline of future workers must be strong in order to replace retiring workers. We must encourage more women and minorities to enter the field.

The opportunity to raise levels of awareness and understanding of these jobs and careers among students, parents, teachers and counselors is critical. As employer needs for this workforce increases - through business growth or through the need to replace an aging workforce - we must have a ready pipeline of individuals with the skills and interest to fill those jobs.

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

- Ensure students gain STEM foundational skills
- Attract more young people to manufacturing careers
- Teach the teachers
- Expand work-and-learn opportunities

THE SOLUTION

With support from LIFT, the Tennessee State LIFT Workforce & Education Team will leverage significant state investment from Tennessee's Labor Education Alignment Program ("LEAP") by developing and implementing teacher training opportunities in those LEAP areas that are focused on Advanced Manufacturing. LIFT and LEAP will bring in the ASM Educational Foundation's teacher bootcamp program to Middle Tennessee to train teachers in materials sciences. The ASM camps have been a successful model of teacher training across the U.S. Expanding the program in Tennessee, will allow many educators in the area to have access to this training for the first time.

The teachers who participate in the bootcamps will be able to return to their classrooms to share knowledge about materials science and help encourage students to pursue careers in the field.

PROJECT LEAD

South Central Tennessee Workforce Alliance

PARTNERS

LEAP - Closing Gaps Through Partnerships

Northfield Workforce Development & Conference Center

ASM Educational Foundation

Middle Tennessee Advanced Manufacturing Skills Panel

Tennessee STEM Innovation Network

Columbia State Community College

Tennessee College of Applied Technology - Pulaski

Austin Peay State University

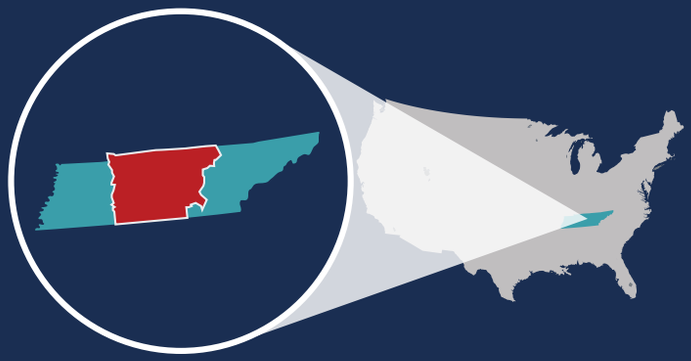
Tennessee College of Applied Technology - Hohenwald

THE PROGRAM

Teacher Bootcamps: Materials Science Education for Tennessee's Teachers

During July and August 2015, at least 50 teachers in Middle Tennessee will participate in one of two scheduled bootcamps at the Northfield Workforce Development & Conference Center and Austin Peay State University in Clarksville.

Geography



Projected Result

Minimum of 50 teachers complete camp requirements

Projected Result

Evaluation of the bootcamps will show success if the program meets or exceeds the 98% benchmark on participant evaluations. Of respondents, 98%:

- feel prepared to implement new labs/demos learned at camp
- feel they gained new ideas and approaches to instruction
- indicated they will use material science technology concepts in their classroom

Expected Outcomes

With this training in-hand, teachers can bring their knowledge back to the classroom to encourage more students to enter fields related to materials science and lightweighting. Middle Tennessee's students will now have more access to knowledge about careers in manufacturing and access to the basic learning required to move into manufacturing-related post-secondary programs. More students entering the field over time means that employers will have a robust pool of workers from which to hire.

About ASM-LIFT Bootcamps

The ASM-LIFT Materials Camp for Teachers is based on past experiences in the areas of curriculum development, teacher training and student programs in Materials Science developed at the University of Washington and Edmonds Community College and supported by the National Science Foundation's Advanced Technology Education program. These programs have demonstrated that Materials Science is an excellent tool to bring together academic and vocational instructors in a common goal of exciting students about science, technology and engineering. The ASM-LIFT Camp curriculum now includes a focus on lightweight materials and the evolving related technologies.

About LEAP

Passed into law in 2013, Tennessee's Labor Education Alignment Program ("LEAP") created a statewide, comprehensive structure enabling students in Tennessee Colleges of Applied Technology and community colleges to participate in technical training developed with input from area employers. The LEAP Grant Competition continued this effort by encouraging and facilitating local workforce and education alignment through a $10 million competitive grant process, led by the Governor's Office and the Workforce Subcabinet.

Grants were made available to eligible entities to facilitate development and implementation of employer-driven career pathways through specifically defined approaches. In November of 2014, twelve LEAP grants were awarded, eight of which are focused on Advanced Manufacturing.

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

lift LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Mission LIFT: Interactive Web-Based Curriculum from Learning Blade®

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

LearningBlade®
Growing interest and sharpening skills for STEM.

THE PROBLEM

Exposure to new technologies and careers is lacking in today's classrooms. Fewer and fewer students are entering science, technology, engineering, and math (STEM) fields than ever before. In 2009, only 18% of new college graduates completed a bachelor's degree in a STEM field. This is down from 24% two decades ago. While enrollment in STEM majors is declining, employer demand for workers with these skills is on the rise and the gap will continue to widen. Pending retirements coupled with a declining flow of new workers and an increasing need for talent are creating a large gap for the STEM economy. High-tech manufacturers will not have the talent they need for success if more students do not choose STEM careers. The #1 reason students do not choose STEM careers is lack of exposure!

This is especially a problem for high-tech manufacturers in the sectors poised to use new lightweight metals, composite materials, and technologies. As the manufacturing sector increases the use of lightweighting technologies and materials, students are less and less likely to pursue the educational opportunities to gain any related experience, making it difficult for them to know whether a career in manufacturing is right in their future.

Alignment to LIFT Workforce & Education Goals

Attract more young people to manufacturing careers

Ensure students gain STEM foundational skills

Reconnecting disconnected youth to high quality, middle skills jobs

THE SOLUTION

Technology allows today's students to have experiences and learning opportunities that expand beyond what a standard classroom can provide. Learning Blade® is an interactive, web-based STEM curriculum system focused on increasing student interest in and attitudes towards STEM careers. LIFT is partnering with Learning Blade® to bring lightweight technologies, materials and careers to life for middle and high school students. Using Learning Blade®'s unique Mission system, LIFT and Learning Blade® are creating a curriculum for students to explore the science and technology used by welders, machinists, industrial designers and drafters, engineers, and materials scientists. The learning materials are organized in Missions that focus on societal problems and needs. With Learning Blade®, students pursue engaging Missions and lessons that solve a problem, such as rescuing an injured dolphin and creating an artificial prosthetic tail, building an environmentally-sound orphanage after a major earthquake, or solving energy and transportation needs in a new city. Each activity in a Mission reviews specific academic skills presented in a real-life context that highlights how these STEM skills are used in the real world, and link to real careers using new technologies. The web-based Mission format provides a truly 21st century way of teaching the 21st century workforce.

PARTNERS

Thinking Media
The creators of Learning Blade® and the creators of ACT's KeyTrain® system

BattelleEd
Provides validation for the Learning Blade® system

STEMconnector®
Provides promotion and national exposure for Learning Blade® and STEM activities.

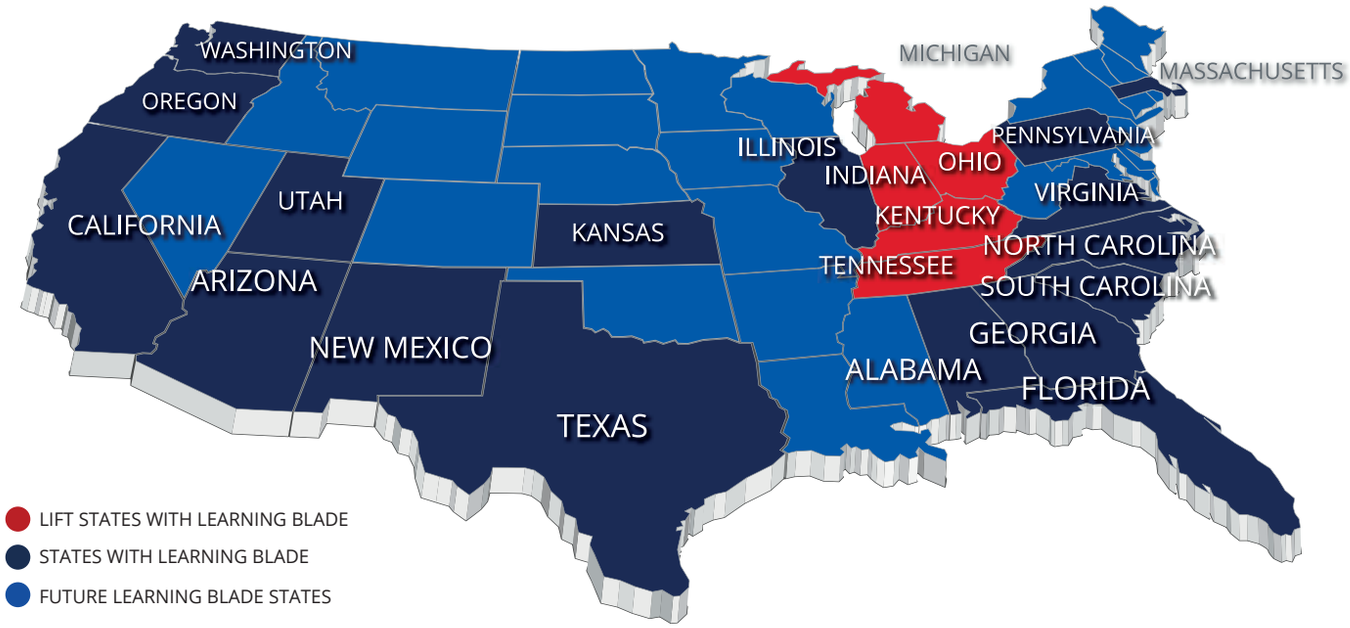
PROJECT DESCRIPTION

Thinking Media will create new online curriculum materials within the Learning Blade® platform focused on lightweight metals and manufacturing technologies and careers in the new Mission as part of the curriculum available to all Learning Blade® users nationally. The new "Mission Guide" and "Mission Conclusion" lessons will highlight the lightweight metals industry and will be disseminated to all Learning Blade® users in the Fall of 2015. In winter of 2015/2016, participating schools will provide feedback with a final evaluation and report in spring 2016.

LearningBlade®
Growing interest and sharpening skills for STEM.

NATIONWIDE IMPACT

All currently licensed Learning Blade® sites will have access to the new LIFT Mission curriculum, putting the new Mission in several hundred locations this Fall 2015. Learning Blade® is currently in schools within 22 states, including the five LIFT region states. Over 25,000 students are registered in the system.



EXPECTED OUTCOMES

As previous data and studies indicate, students who complete the Learning Blade® LIFT Mission will demonstrate a 70% greater awareness of lightweight metals and lightweighting technologies. Not only will students learn more about the science and materials, but also they will be more aware of careers that encompass lightweighting technologies. The LIFT Mission is designed to increase interest in manufacturing careers by 35% in students who successfully complete the curriculum and post-Mission activities.

Many students who would not otherwise have the opportunity to learn about or have exposure to lightweight materials and technologies will gain experiences and knowledge to increase the likelihood that they enter advanced manufacturing careers. More student exposure further increases the size of the potential workforce, closing a portion of the talent gap.

Learning Blade® has been validated as a supplemental tool for increasing STEM career awareness and interest by BattelleEd. Battelle Ed STEM Innovations & Networks

Learning Blade® was identified as a suggested STEM resource in ACT's Condition of STEM 2014 Report. ACT®

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

BUILDING 21st CENTURY MANUFACTURING TALENT

Rebuilding the Talent Pipeline in Tennessee: Advanced Manufacturing Video Contest

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Not enough young talent is going into manufacturing. A negative stigma surrounding manufacturing employment makes recruiting in target populations, like young workers and female workers, difficult for Tennessee lightweight materials manufacturers. Nearly 20% of workers in lightweighting-related occupations are 55 years old or older and will be retiring in the next 20 years.

Even with increased employer demand for workers in lightweight manufacturing, young workers, as well as the parents, counselors, and educators informing them, are not giving occupations in this industry a second thought. Of the 7,337 jobs related to lightweighting posted by Tennessee employers in March and April 2015, 33% advertised a salary over $50,000 and almost half were for skilled trades jobs. Despite high wage potential and strong employer demand, recruiting new workers has been a challenging task. More creative campaigns need to be deployed in order to highlight lightweight jobs, compensation, and career pathways for young Tennessee workers.

THE SOLUTION

Social media, self-made videos, and internet marketing are the way of the future and the best way to reach out to youth. LIFT partners in Tennessee are leveraging these methods to help rebuild the talent pipeline for manufacturing, meeting future workers on their own turf. The LIFT partners will organize a program for students to self-advertise lightweight manufacturing work and career opportunities. The aim of the student video contest is to engage parents, students, counselors, educators, and employers in conversations promoting careers in advanced manufacturing to enhance the image of manufacturing careers for tomorrow's workforce. This project will increase enrollments in advanced manufacturing Career and Technical Education (CTE) courses and post-secondary programs and, in time, grow the advanced manufacturing workforce of the future in Tennessee.

ABOUT THE PROJECT

The Tennessee Student Video project will be an adaptation of a similar program conceived by the Manufacturers Resource Center out of Lehigh Valley, Pennsylvania. Student teams in Lehigh Valley partnered with local manufacturing companies to create a video answering, "what's so cool about manufacturing?" Videos were then posted online for public viewing and voting to determine which team best represented the career opportunities available in advanced manufacturing.

Lehigh Valley saw significant engagement with the videos – over 123,000 votes were cast in three days. More importantly, this conversation-starter on manufacturing careers helped increase enrollment in community college manufacturing programs by 30% the following semester. The Tennessee Student Video Contest has similar aims at closing advanced manufacturing talent gaps through sparking public conversation and promoting training programs.

PROJECT LEAD

Tennessee Chamber of Commerce & Industry

PARTNERS

Dream It Do It Pennsylvania

Dream It Do It Tennessee

Tennessee Chamber of Commerce & Industry

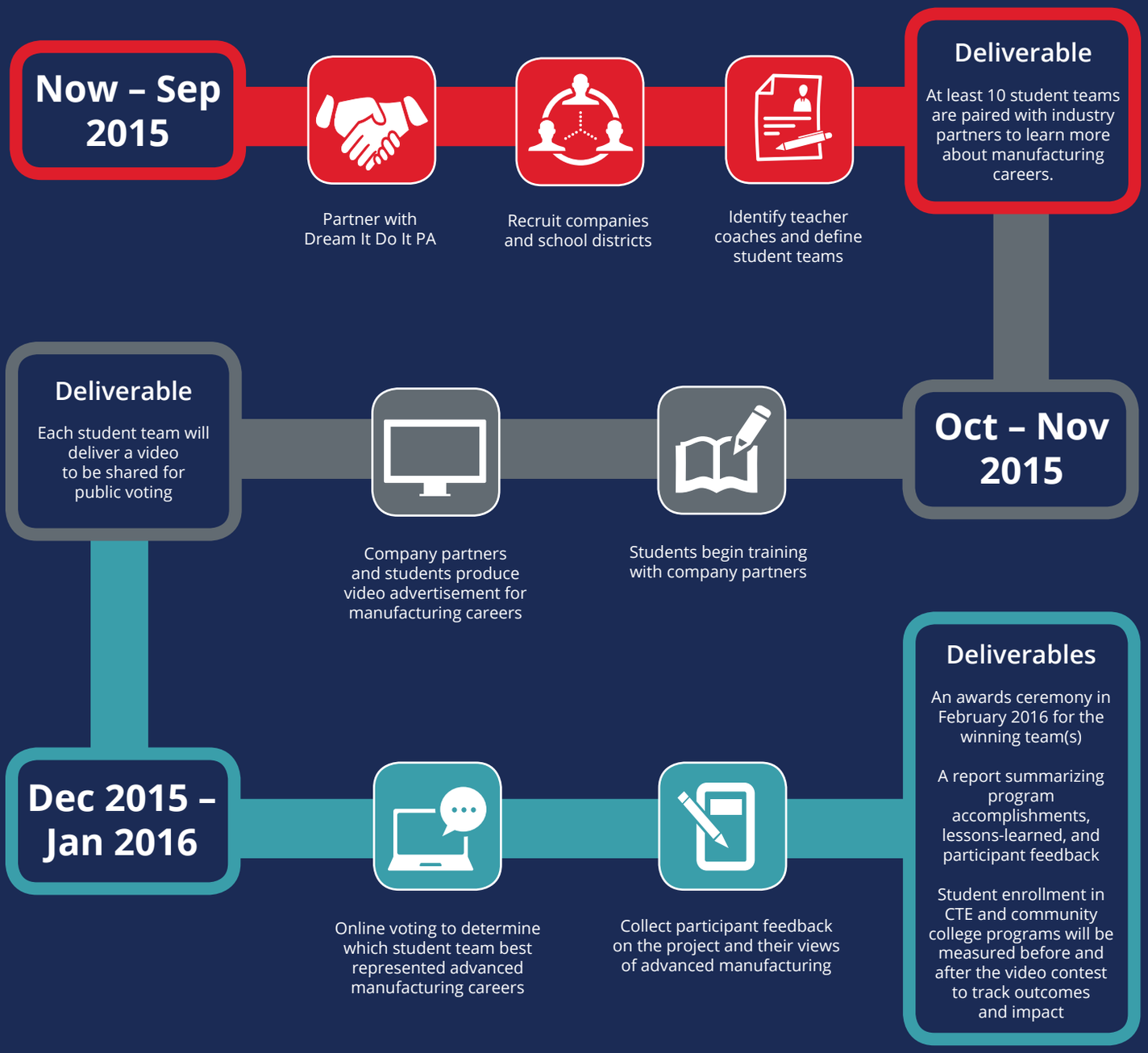
Tennessee Manufacturers Association

Shelby County School Districts

University of Tennessee Center for Industrial Services

Greater Memphis Alliance for a Competitive Workforce (GMACW)

PROJECT PHASES



GEOGRAPHIC FOOTPRINT

The Tennessee Student Video Contest will begin in the Memphis, TN area, with hopes to expand contests into each of the state's nine economic and workforce development regions. The vision is that the winning team from each region would compete in a statewide contest.

EXPECTED OUTCOMES

Through a partnership with the Dream It Do It PA team, the Tennessee LIFT partners are hopeful that the Student Video Contest will inspire employers in need of skilled workers and students who had not previously considered career pathways in manufacturing. The Tennessee team expects to see similar outcomes as in Pennsylvania, measured by student and employer participation in video production, public engagement through voting, and increased enrollment in technical and manufacturing college programs.

For more information on the Tennessee Student Video Competition project in Memphis, please contact GMACW at 901-614-1099 or alliance@gmacw.com. For all other LIFT education and workforce development initiatives contact LIFT Workforce and Education Director, Emily DeRocco at ederocco@lift.technology.

For more information about the education & workforce development initiative visit www.lift.technology

lift LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Adult Career Pathways: Increasing Access to Manufacturing Training in Kentucky

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

During the first four months of 2015, Kentucky employers posted 9,289 online job ads for manufacturing workers in occupations related to lightweighting. While encouraging young talent to enter the field is important for the future, current employer demand must be fulfilled now. Adult education, training, and upskilling are critical to ensure that Kentucky's employers can access the talent they need for success.

THE SOLUTION

The Kentucky Federation for Advanced Manufacturing Education (KY FAME) is a partnership of regional manufacturers whose purpose is to implement a dual-track, apprenticeship-style training that will create a pipeline of highly skilled workers. In Greater Louisville - the area of the state with the most significant manufacturing sector – KY FAME has been enthusiastically embraced by key employers. Employers, workforce developers, and educators agree that KY FAME is a critical strategy for building a pipeline of talented students preparing for middle skills manufacturing jobs. The first FAME class graduated in 2010 and was a result of a partnership between Toyota and Bluegrass Community & Technical College. Today, KY FAME is formally incorporated as a statewide organization with four chapters across the state with plans for growth to 10 chapters by the end of 2015.

There is, however, a limitation in that FAME is not available to adult job seekers and current workers with the potential to excel in advanced manufacturing. At full capacity, the KY FAME model alone will not meet the demand for highly skilled employees in advanced manufacturing and must be expanded to be available to adult learners to ensure employers have the talent they need for success.

Building on the success of FAME, LIFT will be partnering with Jefferson Community & Technical College (JCTC) to add an adult education, training, and upskilling model to make this program more robust and address current talent needs with local employers. Adults in the program will spend two full days per week in the classroom at a Kentucky Community & Technical College location and spend 24 hours per week at a manufacturing facility. Workers earn competitive wages, spend time in the workplace and classroom and complete their apprenticeship with both academic training and hands-on manufacturing experience.

PROJECT LEAD

Jefferson Community & Technical College

PARTNERS

Kentucky Community & Technical College System

Kentucky Cabinet for Economic Development

Kentucky Manufacturing Career Center

Atlas Machine & Supply

Ford Motor Co.

GE Appliances

Lantec

Nth Works

Raytheon

Reynolds Metals

Shelby Industries

Westport Axle

Yamamoto

Zoeller

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Deploying pathways from k-12 through community colleges to university four-year degree programs, with more on and off ramps to employment

Expand work-and-learn opportunities

Linking & leveraging resources and related initiatives on the ground today

Offering on-the-job training solutions for industry

EXPECTED OUTCOMES

More workers

Increased number of adults entering manufacturing fields and/or moving up the career ladder from entry-level positions

Stronger partnerships

Stronger partnerships between employers and JCTC to ensure all training is employer-focused

Replicable/scalable program

A program plan that can be replicated across the U.S. to offer adults more opportunities to enter manufacturing fields

PROJECT DESCRIPTION

FAME 2.0

Jefferson Community & Technical College (JCTC) and local manufacturers have developed a multi-level strategy to quickly expand the number of skilled employees in the region. This expansion, called the FAME alternative pathways model, will develop a pipeline of trained entry-level workers and at the same time implement an accelerated, modularized, skills-based program for incumbent workers. The pipeline of entry level workers will draw on the pool of adult job seekers at the Kentucky Manufacturing Career Center. The incumbent worker career path will enable current employees to access higher paying jobs in their company and provide access to higher-skilled training for newly hired entry-level employees. Included in the curriculum of this alternative pathway are training courses on lightweight-specific skills such as machining and welding. Program participants will receive both high quality academic training along with hands-on manufacturing experience, spending two days per week in the classroom and three working at a manufacturing facility. This model will ensure that program participants are able to make competitive wages while training and that graduates are ready for the workforce that employers need.

The JCTC Advanced Manufacturing program will have four main components:

1

BRIDGE TO EMPLOYMENT

This component will be housed at the Kentucky Manufacturing Career Center [KMCC] and create advanced pathways out of the KMCC for students with demonstrated aptitude. The training will consist of the National Career Readiness Certificate (NCRC), the Certified Production Technician (CPT) Program, Mechatronics, Introduction to Lean, Problem Solving/Critical Thinking, Team Building and Workplace Behaviors.

Objectives include:

- Creating stackable credentials for entry level advanced manufacturing courses
- Accepting these credentials as credit toward the Associate and Applied Science degree
- Acquiring space and equipment at the KMCC that will allow JCTC to offer training on a continuous basis

2

BRIDGE TO EMPLOYMENT

This component creates advanced pathways for entry-level, incumbent employees and other non-FAME high school graduates. JCTC will offer ongoing higher skills training to companies and to students seeking an alternative to the regular academic schedule. The core courses proposed in this component will equip the students with the skills they need to move up an established career ladder. Multi-company groups may be developed so that companies having one or two employees can take advantage of technical classes that might not be available because of the small number of students. College credit awarded for these courses will apply to any of the manufacturing programs offered at JCTC.

3

CREDIT FOR PRIOR LEARNING ASSESSMENT

AMTEC assessments have been industry approved and judged valid and reliable through a BETA testing process. JCTC will administer these assessments to incumbent workers and students who wish to test out of a specific skill set offered in a particular module.

Steps toward implementation for this component are:

- Establishing the acceptance of assessment results as evidence of skill mastery
- Designing a process for applying the appropriate credit to the student's academic record
- Scheduling assessments at the convenience of the student and/or company
- Scheduling an instructor to provide the skills demonstration portion of the assessment

4

STUDENT SUCCESS STRATEGIES

JCTC will hire a Success Coach who will provide ongoing support to students enrolled in the advanced manufacturing training programs. Activities such as assistance with admission and registration, career exploration, goal setting, intrusive interventions and case management services will be offered to all students, but will focus on students in the entry-level component.

Activities include:

- Providing information, assistance, and support for program participants or prospective students
- Establishing a career plan for each student
- Meeting regularly with students to mentor and advise and resolve barriers to student success
- Providing proactive coaching for students and identify academic and support services as needed

For more information please see lift.technology or contact LIFT Education & Workforce Director, Emily DeRocco at ederocco@lift.technology.

Jefferson Community & Technical College

KYFAME Kentucky Federation for Advanced Manufacturing Education Greater Louisville Chapter

BUILDING 21st CENTURY MANUFACTURING TALENT

Ohio Manufacturing Careers Council: Driving Talent to Manufacturing Careers

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Manufacturing is at the heart of Ohio's economy with an annual output of $87.2 billion. Ohio has 1,250 machine shops manufacturing aviation parts, 348 Automotive Tier-1 suppliers, and more than 730,000 workers in the 140 various occupations related to lightweighting. Despite these impressive numbers, the combination of new, advanced technologies in manufacturing, an aging workforce, and increased job demand has put a strain on the state's ability to provide manufacturing employers with the skilled talent they desperately need. Job postings for lightweighting occupations in Ohio have risen more than 60% in the first half of 2015. There were over 45,000 online job ads in Ohio for lightweighting-related occupations in May and June 2015.

THE SOLUTION

In order to meet the needs of manufacturing employers in Ohio, more students and adult workers need to learn about the opportunities in the growing fields, including lightweighting. Through the help of LIFT, an Ohio Manufacturing Careers Council will be established. In order to create exposure to career pathways that will facilitate a pipeline of workers, Ohio manufacturers will replicate a successful demand-driven strategy to:

- identify in-demand occupations in conjunction with the Governor's Office of Workforce Transformation.
- map career pathways.
- promote those pathways to people throughout the state of Ohio.

The story of the opportunities in Ohio manufacturing will be exposed to audiences of youth, returning veterans, and career changers. By connecting manufacturing employers with educational leaders and ambassadors, awareness about the tremendous career opportunities in occupations related to lightweighting will grow. As a result, the supply of skilled workers for these jobs will increase to meet the employer demand in the state of Ohio.

PARTNERS

Industry-Led Initiative

This initiative will be led by industry and will include manufacturers from across the State of Ohio.

Key Partners Outside of Industry

Other key partners stand ready to support manufacturers' priorities and include the Governor's Office of Workforce Transformation, the Ohio Department of Higher Education, and Ohio TechNet, a collaboration of community colleges.

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Deploying pathways from k-12 through community colleges to university four-year degree programs, with more on and off ramps to employment

Attracting more young people to manufacturing careers

Understanding demand and supply data

EXPECTED OUTCOMES

Heightened awareness of lightweighting jobs and occupations at all levels and a stronger pipeline of

- young people
- returning veterans
- career changers entering into manufacturing programs and careers

Demand-driven structure to guide manufacturing workforce priorities:

- Statewide Manufacturing Careers Council representing employer demand
- Statewide Manufacturing Workforce Alliance that includes education, workforce, and other strategic partners representing worker supply

PROJECT DESCRIPTION

Manufacturing employers, including LIFT member companies, will create the Ohio Manufacturing Careers Council. This council will replicate a successful demand-driven strategy to identify in-demand occupations in conjunction with the Governor's Office of Workforce Transformation, map career pathways, and promote those pathways to young people throughout the state of Ohio.

With the assistance of manufacturing CEOs and educational leaders, the council will develop a marketing strategy—including an online "matchmaking portal"—to promote these career pathways to target groups including youth and returning veterans. The council will first convene in Fall 2015 and marketing will begin in Winter/Spring 2016.

Ohio Manufacturing Careers Council Kickoff Meeting, September 2015

- Identify high-level manufacturing executives across the state—with a particular emphasis on LIFT member companies—to create the Ohio Manufacturing Careers Council
- Gather and present demand data to the Council for review and vetting; incorporate additions and feedback provided by industry, including trends and implications of new lightweighting and other technologies

Potential Implementation Actions for the Ohio Manufacturers Council

CAREER PATHWAY DEVELOPMENT:

Define 20 statewide and 35 regional manufacturing career pathways, including occupational outlooks and required skills and education

- Hold focus groups with manufacturers to verify career pathways by occupational families
- Identify and map education and training programs throughout the state that support these manufacturing career pathways
- Analyze and identify the current education supply for these pathways
- Develop tailored regional career pathways maps for the two Industry Workforce Alliance Pilots and five of the DOL TAACCCT-funded programs with crossover to the 20 occupations identified under this project
-

PROMOTING CAREER PATHWAYS:

Create a toolkit complete with informational and promotional materials for each of the identified manufacturing pathways

- Organize a statewide Manufacturing Career Pathways Ambassador initiative that identifies individuals working in manufacturing careers who are willing to speak to various groups about their own pathways
- Develop a roster of Manufacturing Career Pathways Ambassadors with sufficient representation to reach every middle school, high school, career and technical center, community college, university, and local Workforce Investment Board
- Launch a functional website that highlights opportunities in manufacturing (highlighting lightweighting and other growing manufacturing sectors), presents career pathways information, links to relevant education and training programs, links to OhioMeansJobs, and a "matchmaking" portal where organizations or individuals may request services from an Ambassador
- Partner with the Ohio Department of Education, Board of Regents, Ohio Department of Job and Family Services, local Workforce Investment Boards, and K-12 district superintendents to incorporate career pathways maps into the counselor preparation program; ensure that all institutions receive information about the website, Ambassador program, and toolkit
- Develop a grass roots marketing campaign to increase awareness of manufacturing careers among Ohioans.

Implementation projected will likely be modeled after another successful Ohio industry strategy: the Insurance Industry Resource Council (IIRC). The Governor's Office of Workforce Transformation has engaged the IIRC to provide LIFT with a real-life example of this work in action across Ohio's Insurance industry. CEOs from Governor Kasich's insurance industry task force quickly came to a similar road block: a dire need to create a message about careers to draw the workforce to their doors. The insurance CEOs developed and are executing a state-wide strategy to market their career pathways and will share their challenges and successes.

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

BUILDING 21st CENTURY MANUFACTURING TALENT

Industrial Technology, Growing the Workforce

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Today's manufacturing enterprises demand a highly skilled Industrial Technology Maintenance workforce to support business processes and operational improvements that occur through new technologies that focus on automation, light weighting, and plant productivity and efficiency.

Demand for workers with industrial technology maintenance skills is growing quickly. In 2014, there were 39,599 job postings for workers with these skills in the LIFT region and 283,295 nationally. Not only is demand high for workers right now but demand will grow in the future as the current workforce ages. In the LIFT Region, 26.3% of workers are over the age of 55 and another 31.1% are between 45 and 54. With about 75,000 industrial technology workers over 55, the talent pipeline is more important than ever. For many industrial technology jobs the number of students completing certificates and degrees in related fields is not enough to fill current employer demand.

Across the U.S. there are seven certificate and degree categories which likely include some subject matter related to industrial technology maintenance. But, enrollment in these programs has been declining and, as shown by current employer job postings, demand outpaces supply. There is ample opportunity for new programs, more training, and increased outreach to potential workers about this high-skill, high-demand field.

THE SOLUTION

To respond to this significant workforce need, the National Institute for Metalworking Skills (NIMS), the authority on quality skills standards and credentials for precision manufacturing, Ivy Tech Community College in Indiana, and Lightweight Innovations for Tomorrow (LIFT), are partnering to build a high quality Industrial Technology Maintenance workforce by expanding industry-based certifications and training programs across the region.

PARTNERS

NIMS

The National Institute for Metalworking Skills (NIMS) is the developer of quality competency-based skills standards and credentials for jobs in manufacturing and related industries. Through these efforts, NIMS helps build and maintain a globally competitive workforce. www.nimsready.org/

LIFT

Lightweight Innovations for Tomorrow (LIFT) is part of the National Network for Manufacturing Innovation and serves as the nation's essential bridge between basic research and final product commercialization for lightweight metals. The Institute's world-class facilities and technology development capabilities provide the "right" solutions for the nation's defense and commercial transportation sectors to promote American competitiveness, energy efficiency, defense readiness, and economic growth. www.lift.technology

Ivy Tech Community College

Ivy Tech Community College is Indiana's largest public postsecondary institution and the nation's largest singly accredited statewide community college system serving nearly 200,000 students annually. Ivy Tech has campuses throughout Indiana. It serves as the state's engine of workforce development, offering affordable degree programs and training that are aligned with the needs of its communities. In addition, its courses and programs transfer to other colleges and universities in Indiana. It is accredited by the Higher Learning Commission and is a member of the North Central Association. http://www.ivytech.edu

PROJECT PHASES

PHASE 1

How
NIMS worked with the Ivy Tech Community College System of the State of Indiana and over 125 industry, education, and workforce development leaders to create the first in a series of industry recognized Industrial Maintenance skills and competency standards.

Deliverable
National standards created to be used by educators and industry leadership to enhance training programs.

PHASE 2

How
Standards become recognized in industry, education, and workforce organizations as a means to benchmark worker skills and training.

Deliverable
More workers are measured against national recognized skills and standards.

PHASE 3

How
In partnership with LIFT and Ivy Tech, NIMS will use the standards to develop and bring to market industry credentials that certify these skills and competencies.

Initial credential roll-out in a five state region including Tennessee, Kentucky, Indiana, Ohio and Michigan.

Final Deliverable
National credential programs created where individuals will be able to earn these credentials to qualify and be prepared for good-paying jobs in Industrial Technology Maintenance.

WHAT IS INDUSTRIAL TECHNOLOGY MAINTENANCE?

Industrial Technology Maintenance is made up of high-tech jobs that include maintaining, troubleshooting and improving complex machines and industrial systems, such as conveying systems, multi-axis machines, robotic welding arms, and hydraulic lifts.

In the I-75 corridor, Industrial Machinery Mechanics earn a median hourly wage of $23.09 and typically require a postsecondary non-degree award.

However, even with competitive wages, there are a minimal number of qualified candidates to adequately fill these open employment opportunities.

EXPECTED OUTCOMES

More workers entering the Industrial Technology Maintenance field of work and utilizing the credentialing programs for training. Enhanced employer recognition of the standards and credentials making it easier to hire workers with the right skills and abilities.

To download the NIMS Industrial Technology Maintenance standards please visit http://nimsready.org/industrial-technology-maintenance/.

For more information about the education & workforce development initiative visit www.lift.technology

lift LIGHTWEIGHT INNOVATIONS

NIMS®

IVY TECH COMMUNITY COLLEGE

BUILDING 21st CENTURY MANUFACTURING TALENT

LIFT Assembly Line: Virtual Reality Lightweight Manufacturing at LIFT HQ

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Lightweight metals and lightweighting technologies are most often talked about in R&D settings, on the manufacturing floor, and in the lab. Students do not often have the chance to learn about these materials and new technologies that are becoming more and more important in advanced manufacturing, particularly in the defense and commercial transportation sectors. Without early experiences in advanced manufacturing or with new technologies, many students will not choose to go into high-demand manufacturing careers as engineers or other skilled high-tech workers.

This is especially a problem for high-tech manufacturers in the sectors poised to use new lightweight metals, composite materials, and related technologies. Without innovative techniques to reach students on their level, the industry may be at a loss for skilled talent in the future.

THE SOLUTION

Using its world-class virtual reality lab, Tennessee Tech University has created a virtual assembly line game focused on lightweighting in the automotive sector. Students and visitors at LIFT HQ will be able to build their own vehicle, choosing among different components to create the ultimate lightweight machine. Students and other users will learn about different materials and how they contribute to the overall performance, e.g., speed and energy consumption, of a lightweight vehicle. This virtual reality game is only the beginning of a new frontier in advanced manufacturing training.

PROJECT LEAD

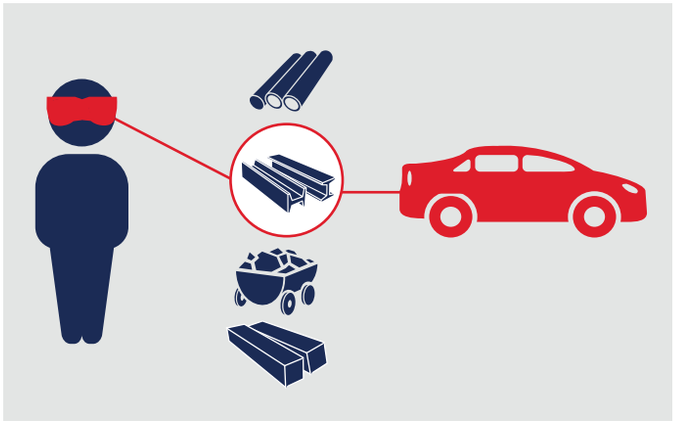
Tennessee Tech University

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Attracting more young people to manufacturing careers

PROJECT DESCRIPTION

At a computer station, students will be transported from LIFT HQ onto the manufacturing floor to build a custom vehicle. Students will work along an assembly line, selecting parts on a conveyer belt, to create a lightweight automobile. At each conveyer belt station along the assembly line, students will have to choose between four different materials, with a goal of selecting the lightweight option. The overall goal of the game is to create the ideal lightweight vehicle, with points assigned based on the vehicle weight and distance traveled.



The LIFT Assembly Line launched as part of the Manufacturing Day 2015 activities in Detroit, Michigan. Thirty students from a local Detroit high school began their Manufacturing Day celebration and talent tour by stopping in at LIFT to test out the new virtual reality game and talk with engineers about their careers in manufacturing. These students put their lightweighting knowledge to the test to create customized vehicles using the technology created by Tennessee Tech University.

LIFT visitors will be able to test the new technology while at the headquarters in Detroit. Industry partners along with workforce and education partners are invited to try the game. The virtual reality lab is not just a game for LIFT; it puts LIFT at the leading edge of advanced manufacturing education, training, and development with industrial application opportunities. It is truly a 21st century technology for developing 21st century talent.

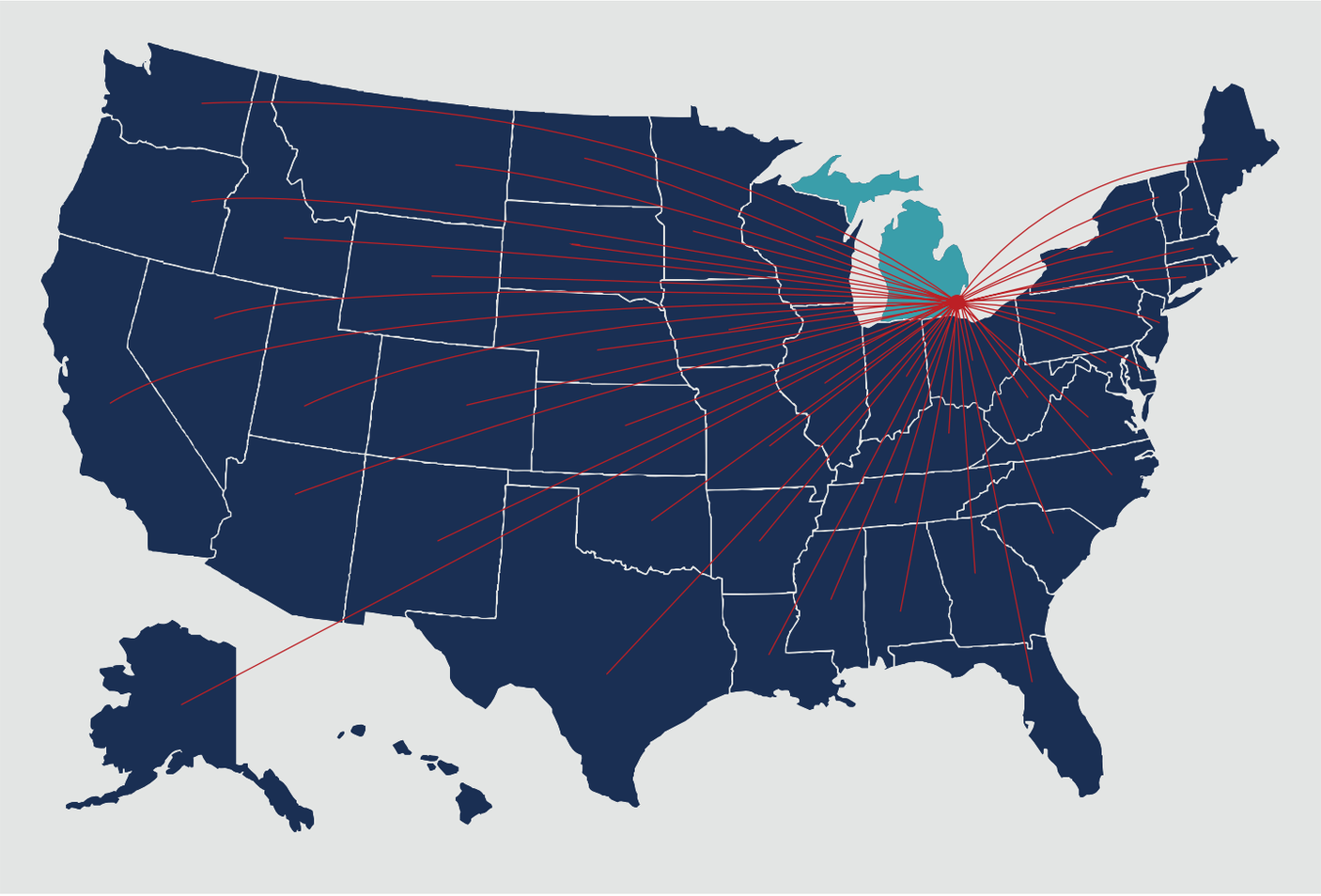
EXPECTED OUTCOMES

Thousands of students, teachers, industry partners, and other LIFT visitors will be introduced to lightweighting through the LIFT Assembly Line game. This initiative's creative use of technology will no doubt bring lightweighting ideals into the minds of future advanced manufacturing workers and attract new talent to the field.

NATIONWIDE IMPACT

The LIFT Assembly Line game will be available for all LIFT partners and visitors to use. It will serve as one of the first of many virtual reality-based teaching tools to bring advanced manufacturing to students around the world. Virtual reality technology brings LIFT to the forefront of manufacturing education and manufacturing processes. The ability to transport a student onto a factory floor without having to travel brings manufacturing to life for students who may not otherwise have the experience.

Virtual systems have great potential to not only increase student awareness and interest in manufacturing but also dramatically alter the way industry trains its own workforce. Companies can adopt these technologies to demonstrate new products and integrated manufacturing techniques for workers in any location. New assembly systems can be created and tested virtually before machinery is physically built. The game is just the beginning of a future where virtual learning, training, and R&D are the norm.



For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

RIGHT SKILLS RIGHT NOW

Accelerated Machinist Training for Veterans in Indiana

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

After serving the country, veterans face the often difficult task of transitioning to civilian life and obtaining full-time employment with family sustaining wages. According to the 2015 Veteran Economic Opportunity Report, approximately one out of two (53%) separating Post-9/11 veterans will face a period of unemployment. Furthermore, the average duration of unemployment for veterans has increased from 18 to 22 weeks in the last six years. In Indiana, nearly 500,000 veterans need to find full-time work as they transition out of the military.

Meanwhile, Indiana's manufacturers posted 45,500 open positions from July 2014 to June 2015. These manufacturers need hard-working, highly-skilled workers to fill their talent gaps. Ensuring the state's veterans can access accelerated training to gain the skills in demand for good jobs in advanced manufacturing is a critical solution for both Indiana's manufacturers and the men and women who served.

THE SOLUTION

Vincennes University (VU) offers the accelerated Right Skills NOW CNC Machinist training program, designed to help veterans transition to civilian employment as skilled employees with upward mobility potential. The accelerated CNC Machinist Right Skills NOW program of study features industry-recognized NIMS credentials based on skills needed for a career in advanced manufacturing. The program is VA-approved so veterans can apply their benefits towards tuition, supplies, and for some living expenses.

The Right Skills NOW program is a great fit for veterans because they are able to quickly gain hands-on experience, enhance their skills and enter full-time employment. Combined with training, the maturity and life experience of veterans provide a solid foundation for succeeding and advancing on the job, important factors for Indiana's employers. Partner employers benefit from access to trained workers whose military service has engrained work ethic, commitment, and loyalty.

PROJECT LEAD

Vincennes University

PARTNERS

Gene Haas Foundation

Veterans Administration (VA)

Indiana National Guard

From Industry

Frank Ladner

Jasper Engines

Haas Automation

HFO Midwest

Sandvik

Mastercam

Reinshaw

Quality Mill Supply

Clodfelter Engineering

SGS

Zeiss

5th-Axis Fixtures

Frowa

Immerse2Learn

Fastenal

Chick

Techniks

Mitutoyo

Rego-Fix

From NNMI

Lightweight Innovations for Tomorrow (LIFT)

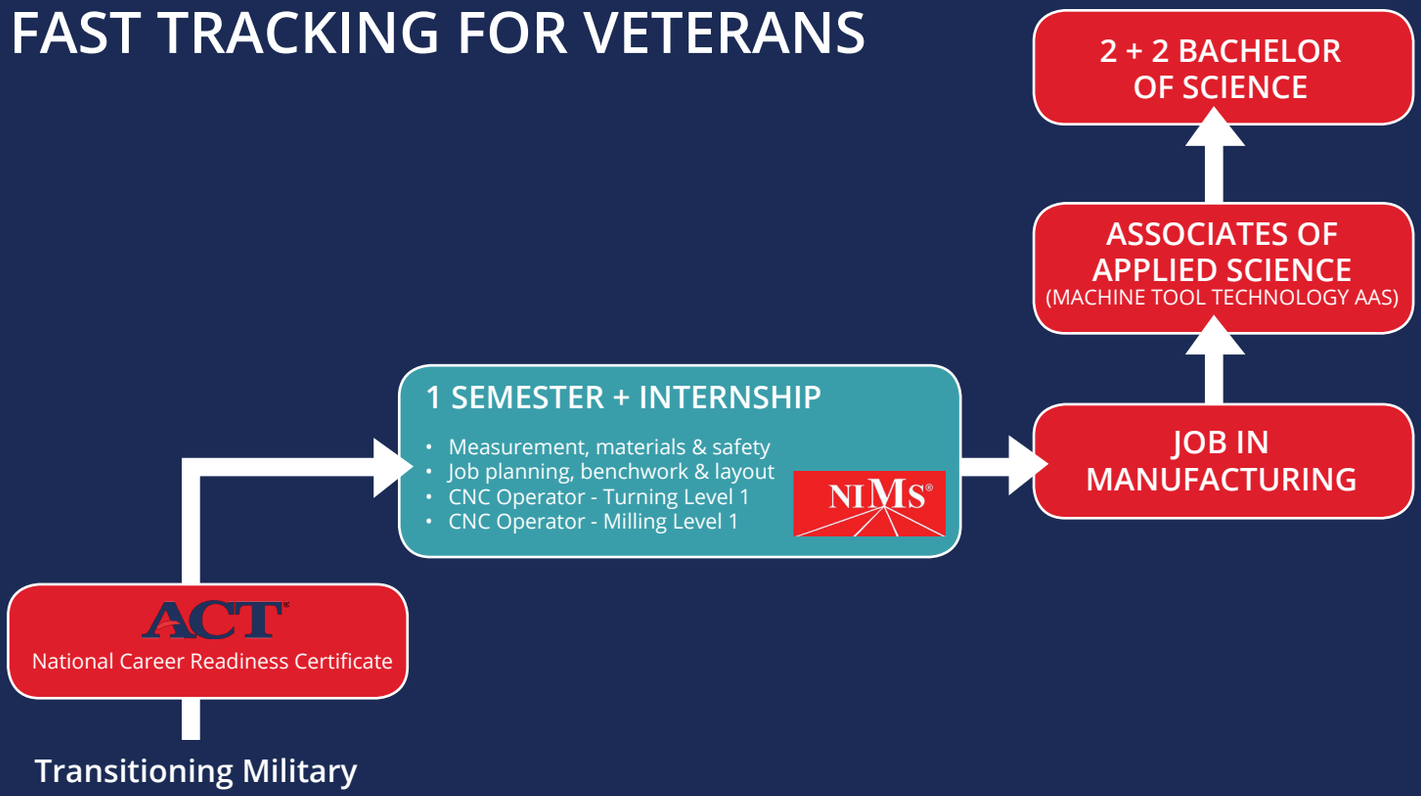
Institute for Advanced Composites Manufacturing Innovation (IACMI)

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Connecting separating military and veterans with Fast Track skills development and manufacturing careers within the lightweight metals manufacturing pathway

Linking & leveraging resources and related initiatives on the ground today

FAST TRACKING FOR VETERANS



PROJECT DESCRIPTION

The Right Skills NOW CNC Machinist training at Vincennes focuses on training military veterans. Many factors contribute to the success of the Right Skills NOW program, including:

- Employer engagement at the onset – connecting the veterans with a job before the training;
- Accelerated training (16 weeks with hundreds of hours of hands-on learning);
- Industry recognized NIMS credentials awarded;
- High demand skills taught on high quality, state-of-the-art equipment (16 full size Haas CNC machines, 12 Haas control simulators, 15 seats of Mastercam, etc.); and
- Entry into a good paying career with potential for upward mobility.

Right Skills NOW program candidates are interviewed by a partner employer from their geographical area prior to the training. Partner employers select participants to "sponsor" for the training. Attendance and grades are reported to the employers monthly over the 16 weeks of training. Upon completion, graduates are placed immediately into CNC operator and machine setup and operation positions with one of the sponsoring employers.

Veterans participating in the Right Skills NOW program will train at the newly built Gene Haas Training Center, just 25 miles from downtown Indianapolis. This state-of-the-art, 23,000 square foot center will leverage resources to more than double the number of veterans trained for advanced manufacturing jobs.

GEOGRAPHIC FOOTPRINT

Veterans from throughout Indiana will be able to participate in the training program which will be held in Central Indiana. The City of Lebanon, where the training will be provided, is located in Boone County, one of the eight counties surrounding the City of Indianapolis.

EXPECTED OUTCOMES

With funding from LIFT, the Right Skills NOW CNC Machinist program will be able to support an additional 70 veterans gaining valuable manufacturing skills. Veterans experiencing a gap between funds available to support themselves and their families and to participate in the accelerated training will receive a stipend of up to $3,000 to bridge the gap.

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

NIMS VINCENNES UNIVERSITY lift LIGHTWEIGHT INNOVATIONS

High School evGrandPrix

Engaging Students in STEM Education for Manufacturing

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Effective pathways for students into manufacturing-focused STEM careers are critical to the future vitality of the U.S. manufacturing industry. Without early experiences in advanced manufacturing or with new technologies, many students will not choose to go into high-demand manufacturing careers as engineers or other skilled high-tech workers. These career pathways also need to engage both students who will pursue a university degree as well as students who will move into the manufacturing industry with an Associate's Degree or from an apprenticeship or other technical training program. The current career technical education and career awareness/training systems are not well aligned to provide students with enough early opportunities to learn and become excited about manufacturing careers. Increased opportunities for students to learn about their potential in high-tech manufacturing fields is essential for future workforce success.

THE SOLUTION

The Purdue University High School evGrandPrix (HSevGrandPrix) project will leverage the excitement of designing, building, testing, and racing electric powered go-karts at the Indianapolis 500 to create an engaging high school STEM-for-Manufacturing education program. The program will generate a path into postsecondary study and training and encourage the next generation of engineers and manufacturing technicians. The HSevGrandPrix will give students the opportunity to work in a team to manufacture a go-kart requiring the academic mathematics/science content of engineering design as well as the hands-on machining/electronics needed to move that design to a working go-kart. The HSevGrandPrix program will promote the success of all young people engaged in the process, not only those pursuing a university degree.

PROJECT LEAD

Purdue University

PARTNERS

IvyTech

Vincennes University

Lincoln Tech

Indiana School Districts

United States Auto Club

IndyCar

Indianapolis Motor Speedway

Dallara

Andretti Motorsports

Indiana Department of Education

Conexus

Employ Indy

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

This project aligns to several of LIFT's eleven strategic focus areas for workforce development and education. Specifically, the HSevGrandPrix project will have a direct impact on three of our strategic focus areas:

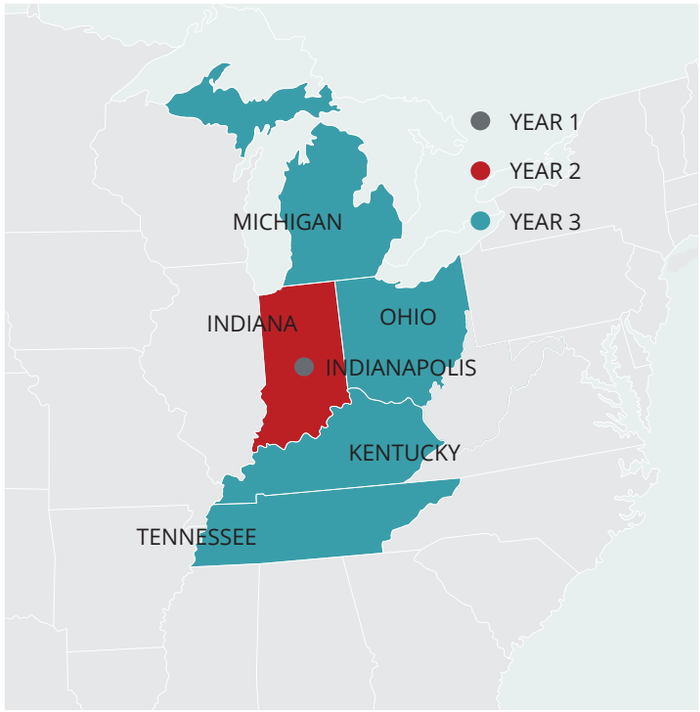
Ensure students gain STEM foundational skills

Attract more young people to manufacturing careers

Teach the teachers

GEOGRAPHIC FOOTPRINT

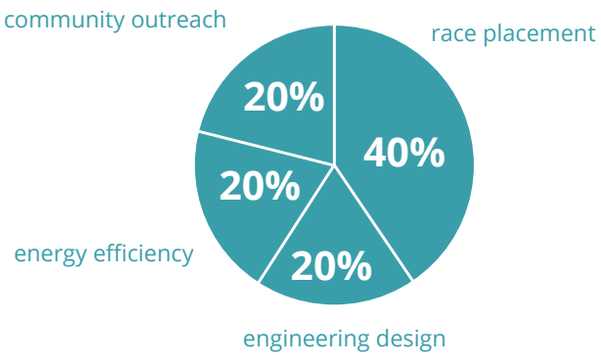
The HSevGrandPrix program will start in Indiana with an Indianapolis focus in Year 1 and an expansion across the state in Year 2. Although Year 1 will have an Indianapolis focus, it will also engage one or two rural schools in order to understand how the program can scale into rural high schools where students with considerable hands-on skills often naturally lean toward a manufacturing career. Because of the partnership with USAC, the program will work towards expanding into neighboring Midwestern states like Michigan, Ohio, Kentucky and Tennessee in Years 2 & 3.



Project Description

Purdue University has partnered with the United States Auto Club (USAC) to develop an electric powered go-kart competition for high school students at the Indianapolis Motor Speedway (IMS) as part of Indy500 activities. The high school event is modelled after the International Collegiate evGrandPrix which is a combined educational and go-kart racing event held the last five years at IMS. The high school event will use lead acid batteries versus the higher energy (and more costly) lithium-ion batteries that power the collegiate event.

The HSevGrandPrix is not primarily about the go-kart race, but rather the engineering, science, organizational management, and marketing/ advertising needed to design, build, test, and race the go-karts. Event scoring is:



The students have to raise a fraction of the go-kart costs themselves, so the project also involves marketing and advertising – skills that engage non-tech-related students in the project. Also, there is a need for project management that involves students interested in a business-focused career path, also essential for manufacturing. The direct relationship of this project to LIFT includes but is not limited to:

- Development and incorporation of a hands-on, inquiry based educational project related to the strength of materials, as one of the exploratory projects that can be deconstructed from the go-kart;
- Development of this hands-on project into fully scaffolded curriculum modules ready for use by high school and community college faculty;
- Sponsorship of two of the initial high school go-karts, which will be appropriately branded to LIFT;
- Attracting more young people to educational pathways to Advanced Manufacturing careers, both technical and engineering, and providing a media-rich environment to recognize academic achievement in STEM fields;
- Acknowledgement of LIFT support for the evGrandPrix at the Indianapolis Motor Speedway; and
- Connections with LIFT member companies to participate in the evGrandPrix teams and events.

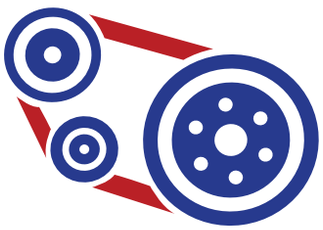
EXPECTED OUTCOMES

The LIFT-Purdue HSevGrandPrix partnership will:

Introduce students to manufacturing in an engaging manner so that more young people will consider manufacturing as a viable career option.

Encourage students to continue education in manufacturing via a BS/BA program, an Associate's Degree in manufacturing or by directly entering into an industry-sponsored apprenticeship or other training program.

Provide hands-on projects that illustrate science/math principles in the classroom and then show how these concepts connect in the construction of electric go-karts.



Show a clear connection between STEM competencies and the skills needed for a productive career in advanced manufacturing.

Show how lightweighting is an important component of vehicular design, using the IndyCar technology as the demonstration vehicle.

Provide a high profile venue at the Indy500 that will both celebrate the educational success of our students and excite additional students/schools to enter the HSevGrandPrix educational program and thereby position themselves for future careers in advanced manufacturing.

PURDUE UNIVERSITY

USAC UNITED STATES AUTO CLUB

lift LIGHTWEIGHT INNOVATIONS

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

QUOTE

“The transformation of STEM education will require an expansive partnership that includes post-secondary institutions, local school districts, industry, community volunteers and local, state and national government leaders. The LIFT sponsorship of the High School Go-Kart Education Program is an important component of this expanding partnership.

JAMES CARUTHERS

GERALD AND SARAH SKIDMORE PROFESSOR AT THE SCHOOL OF CHEMICAL ENGINEERING, PURDUE UNIVERSITY.

BUILDING 21st CENTURY MANUFACTURING TALENT

Ohio Means Internships & Co-ops 2.5 Program

An Education & Workforce Development Initiative for LIFT … Lightweight Innovations for Tomorrow

July 1, 2015 – December 16, 2016

THE PROBLEM

Manufacturing is the largest sector of Ohio's economy at 18% GDP, producing more than $52 billion in products sent to 216 countries. Most manufacturing firms in Ohio are small businesses. Approximately 97% of Ohio manufacturing firms employ less than 500 workers, including almost 50% of firms with 1-4 employees. At the same time, demand for workers in manufacturing is at record levels. Manufacturing employers posted over 275,000 online ads for workers in Ohio during 2014, and 2015 is set to surpass this record. The need for skilled workers in advanced and lightweight manufacturing is expected to grow exponentially.

The skills necessary for many workers in the field take years to develop and, with rapidly shifting technologies, many workers' skills will be outdated by the time they are mastered in the classroom. How can Ohio fill the pipeline of trained workers now to ensure that the manufacturing sector remains strong?

THE SOLUTION

In response to the need for more on-the-job and work-based learning, the Ohio Department of Higher Education funded the LIFT Ohio Means Internships & Co-ops 2.5 Program (LIFT OMIC). OMIC is a partnership between The Ohio State University (OSU) and its academic and industry partners, to build a co-located internship program that trains students for in-demand lightweight manufacturing technologies. The goal is to bolster a workforce proficient in the application of advanced lightweight metal alloys, manufacturing technologies, and design methods important to advanced manufacturing. LIFT and OSU have assembled a strong team to develop this novel educational approach to manufacturing education involving real-world industry projects with close involvement by academic faculty and students.

Initially, the program's goal is to engage 80 interns and conduct 30 co-op internships.

PARTNERS

Lead

Ohio Department of Higher Education

Academic partners

The Ohio State University, Columbus State Community College, Tolles Career and TechnicalCenter, C-TEC Career & Technology Education Centers of Licking County, Tri-Rivers Career Center, Marion Technical College, Metro High School, Columbus School for Girls

Industry and technology partners

Honda and Whirlpool, JobsOhio, Ohio Manufacturers' Association, and Edison Welding Institute

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Deploying pathways from k-12 through community colleges to university four-year degree programs, with more on and off ramps to employment

Attracting more young people to manufacturing careers

Expanding work and learn opportunities

EXPECTED OUTCOMES

Teams of co-located interns may provide valuable perspectives to industry through cross-institutional training. The LIFT OMIC co-located internship program intends to address a central concern of employers – closing the skills gap between the classroom and the workplace.

PROJECT DESCRIPTION

- Focused on in-demand manufacturing career pathways
- Solve industry-identified problems through individual or team projects
- 80 total internships
- 30 co-op internships
- Students will:

Undergo high-level capstone training, utilizing resources at both sites with industry and academic mentors. At a minimum, the student or student teams, faculty mentor, and company representative must meet at the beginning and end of the semester to work on project goals, timelines, resources and deliverables.

Have access to school facilities and equipment to use on industry-defined and driven projects.

Work individually or in teams (single or multi-institution including students from Ohio Technical Centers, community colleges, and research universities).

Receive scholarships toward tuition and fees as well as an hourly salary.

May receive assigned online educational resources by the company on industry-specific skills, such as LEAN, SixSigma Black Belt curricula, and soft skills, such as communication, problem-solving, and project management.

Receive academic credit or a transcript notation for their effort over the academic term.

Details on the LIFT OMIC program is at http://omi.osu.edu/omic. Industry members or students may contact Kathryn Kelley at omic@osu.edu or kelley.81@osu.edu.

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

BENEFITS TO PARTICIPANTS

Students, faculty, and industry will come together for the LIFT OMIC co-op and internship program. The program benefits all involved to create well-trained, ready, cohorts of highly-skilled workers for Ohio manufacturing firms.

Students will:

- Gain hands-on training working in real-world industry projects
- Earn competitive hourly wages from participating companies
- Open opportunities to future employment
- Earn a $1,000 scholarship at project end
- Receive academic credit or transcript notation at completion

Faculty will:

- Work closely with industry representatives to help students gain experiential learning
- Collaborate with cross-institutional teams on sustainable best practices in advanced manufacturing, furthering curriculum development

Participating companies will:

- Directly access talented students
- Work with faculty mentors that offer project expertise
- Choose training modules for students that ensure the future workforce has industry-specific skills such as Lean, Six Sigma, and others

lift LIGHTWEIGHT INNOVATIONS

lift LearningBlade® Growing interest and sharpening skills for STEM.

BUILDING 21st CENTURY MANUFACTURING TALENT

Metals Manufacturing Mission: Learning Blade® deployment in Kentucky

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

LEARNING BLADE IN KENTUCKY

With investment from LIFT, Thinking Media created a new online curriculum within the Learning Blade® platform focused on lightweight metals, manufacturing technologies, and careers. The new Mission is part of the curriculum available to all Learning Blade® users nationally. In partnership with KYDataSeam and the Kentucky Department of Education, Office of Career & Technical Education, LIFT is sponsoring the new Learning Blade® program implementation in 30 middle schools across the Commonwealth of Kentucky with the goal of statewide reach in the coming years.

Kentucky companies have increasing needs for manufacturing workers as they grow jobs and current workers age out of the workforce. Reaching future workers during middle school is essential to build a foundation of knowledge and skills that will launch students into the manufacturing careers of the future. Learning Blade®'s program provides experiences in many different career settings to show students all that is possible for them.

Lessons included in the program that will reach students throughout Kentucky highlight jobs in:

- Welding
- Mechanical & industrial engineering
- Industrial design & drafting
- Machining
- Mechatronics
- Hybrid vehicles
- Manufacturing & materials technology

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Attract more young people to manufacturing careers

Ensure students gain STEM foundational skills

Reconnecting disconnected youth to high quality, middle skills jobs

PARTNERS

Kentucky Department of Education, Office of Career & Technical Education

KYDataSeam

Thinking Media -the creators of Learning Blade® and the creators of ACT's KeyTrain® system

GEOGRAPHIC FOOTPRINT

Tied to statewide rollout in the Commonwealth of Kentucky, 30 schools have committed to the program in the following counties:

SCHOOL	DISTRICT
Caldwell County Middle School	Caldwell County
Clay County Middle School	Clay County
Beaumont Middle School	Fayette County
Bryan Station Middle School	Fayette County
Carter G. Woodson Academy of Excellence	Fayette County
Crawford Middle School	Fayette County
EJ Hayes Middle School	Fayette County
Fayette County Middle School	Fayette County
Jessie Clark Middle School	Fayette County
Leestown Middle School	Fayette County
Lexington Traditional Magnet School	Fayette County
Martin Luther King Jr. Academy for Excellence	Fayette County
Morton Middle School	Fayette County
SCAPA at Bluegrass	Fayette County
Tates Creek Middle School	Fayette County
The Learning Center at Linlee	Fayette County
Winburn Middle School	Fayette County
Academy at Shawnee	Jefferson County
Central High School	Jefferson County
Hancock County Middle School	Hancock County
B. Michael Caudill Middle School	Madison County
Clark-Moores Middle	Madison County
Farristown Middle School	Madison County
Foley Middle School	Madison County
Madison Middle School	Madison County
Estes Elementary	Daviess County
Owensboro High School	Daviess County
Owensboro Middle School North	Daviess County
Owensboro Middle School South	Daviess County
Webster County Middle School	Webster County

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

QUOTE

“Using technology to deliver real-world experiences is the future of teaching. Using our digital platform to bring STEM career awareness to students and provide them with an opportunity to become part of the future manufacturing workforce is our goal.”

SHEILA BOYINGTON

PRESIDENT, THINKING MEDIA.

BUILDING 21st CENTURY MANUFACTURING TALENT

Work and Learn in Kentucky:
Computerized Machine Training at Bluegrass Community & Technical College

An Education & Workforce Development Initiative for LIFT...
Lightweight Innovations for Tomorrow

THE PROBLEM

The lack of a recruiting talent pipeline represents a major obstacle for employers in manufacturing in Kentucky and nationwide. Part of this problem is misconceptions about manufacturing jobs and careers. Few individuals understand that advanced manufacturing is high-tech, innovative, creative, and an economic sector that offers good jobs and career opportunities. This is particularly true as new manufacturing innovation institutes like LIFT bring new technologies, materials, and processes to the manufacturing industry.

Employer demand for computer-controlled machinists has increased at an annual rate of 67% since 2010 in Kentucky. Yet, the supply of students earning relevant credentials or pursuing training has not been increasing at the same rate. A rapidly aging workforce exacerbates the issue and as a result advanced manufacturing employers in Kentucky struggle to find talent they desperately need for open positions.

THE SOLUTION

The Computerized Manufacturing and Machining (CMM) program at Bluegrass Community and Technical College (BCTC) provides students with the opportunity to prepare for careers related to lightweight manufacturing through a combination of theoretical and hands-on training. At two different locations in central Kentucky (Lexington and Danville), students can earn up to four certificates, two diplomas, and an Associate of Applied Science degree. The CMM program has a proven record of accomplishment, as evidenced by high rates of student retention, job placement, and employer satisfaction with program graduates. Due to technological advances and increased demand for qualified workers, however, the substantial skills gap still exists and more workers need to be trained in successful programs like CMM.

Despite the program's success, the number of ready workers still does not match the number of available machining positions in the region. Inaccurate and sometimes negative perceptions about the industry and career opportunities is one major reason this is so. Simply offering a high quality training program is not enough. With LIFT's support, BCTC will develop a comprehensive initiative that engages potential CMM technicians, exposes them to job opportunities and careers in real manufacturing companies and provides integrated work and learn opportunities.

The inability to afford tuition is another significant barrier to filling the CMM pipeline with ready workers. While some support services and financial assistance are in place to assist these individuals, more is needed to support students through to completion. This project will address this concern using a series of tuition waivers – the first of their kind in Kentucky. Tuition waivers will be available to high school students with financial needs, high-performing high school students and Veterans.

PROJECT LEAD

Bluegrass Community and Technical College

PARTNERS

Academic Partners

High Schools:

- Tates Creek
- Paul Laurence Dunbar
- Henry Clay
- Lafayette
- Bryan Station
- Boyle County
- Danville Independent
- Garrard County
- Mercer County
- Anderson County
- Scott County
- Harrison County
- East Jessamine
- West Jessamine

lift LIGHTWEIGHT INNOVATIONS

ABOUT THE PROJECT

Strategy 1: Targeted Recruitment

Student field trips to regional manufacturing companies

- Companies in Defense and commercial transportation sectors
- Students will observe employees in actual work environments

Establish a strong media presence in local high schools and Area Technology Centers (ATCs)

- Production of a recruitment video highlighting
  - industry needs
  - new technologies
  - live machining footage
  - design using CAM software
- Edge Factor videos provided by LIFT and BCTC

Social Media outreach

- Student posts about experiences in manufacturing companies
- BCTC website
- Recruitment video promotion via Twitter and other social media
- Graduate testimonials

Strategy 2: Student Support and Pipeline Development

Tuition waivers to support students through completion and employment

- High Performing High School Students
- Competitive High School Students with Financial Need
- Veterans

Strategy 3: Creating an Integrated Work and Learn Model

Modeled on the highly successful KYFAME manufacturing work & learn program

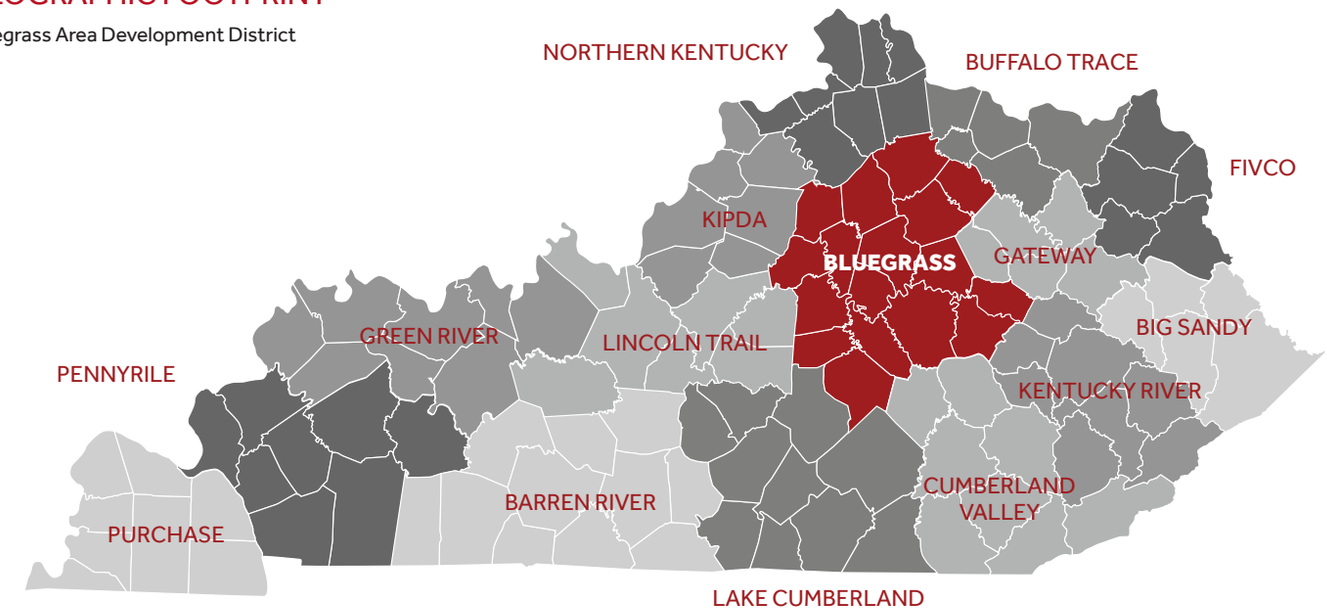
Led by an advisory group comprised of experienced leaders from local manufacturing companies

Includes work-based learning opportunities for CMM students identified by the advisory group

Features a co-op phase in which students split time between classes and working for local manufacturers

GEOGRAPHIC FOOTPRINT

Bluegrass Area Development District



REPLICABLE INNOVATIONS

- Integrated work & learn opportunities for CMM students
- Tuition waivers
- Comprehensive student recruitment and engagement materials
- Employer-led Program Advisory Group

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

- Understanding workforce demand-supply gaps
- Attracting students and workers to educational pathways and careers in manufacturing
- Ensuring students gain STEM foundational skills for success in manufacturing careers
- Helping disconnected youth and adults prepare for high quality, middle skill jobs
- Fast track military personnel and veterans to skills development for manufacturing careers

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

QUOTE

“Our goal is to bring together a network of students, educators and employers to inspire new collaborations and create pathways for today’s youth to the advanced manufacturing opportunities within Kentucky and beyond.”

AUGUSTA JULIAN
BLUEGRASS COMMUNITY AND TECHNICAL COLLEGE PRESIDENT

Pathways to Jobs in Detroit: Connecting Disconnected Youth & Adults to Manufacturing Careers

An Education & Workforce Development Initiative for LIFT ... Lightweight Innovations for Tomorrow

THE PROBLEM

Opportunities in advanced manufacturing in the metro-Detroit region abound. Job postings in Michigan for skilled trades workers, engineers, and other manufacturing workers reached all-time highs in 2015 with over 118,886 jobs posted. While many in-demand jobs in manufacturing require at least a bachelor's degree, 35% call for community college or specialized post-secondary training that can jumpstart a career in manufacturing. Training for these jobs has a fast turnaround, and program participants can move into employment sooner. Nonetheless, the number of qualified job seekers in the region is floundering. Too few individuals, both youth and adults, are prepared for the world of work in manufacturing not only because they lack necessary technical skills, but also workplace readiness skills are missing for many. As a result, LIFT partners at Goodwill Industries of Greater Detroit, Focus: HOPE, and TechShop Detroit have created successful programs to upskill and prepare many of the city's disconnected youth and adults to prepare them for in-demand manufacturing careers. Yet, these organizations have found it difficult to reach enough people successfully through their current outreach programs, referrals, open houses and social media campaigns.

With wide disconnect between employer needs, workforce readiness, training program availability, and program participation, a new method to get the word out about training opportunities is necessary. The time is right to create a more comprehensive outreach plan in metro Detroit and many other cities where the population's abilities do not match industry needs.

THE SOLUTION

With support from LIFT, Goodwill Industries of Greater Detroit, Focus: HOPE, and TechShop Detroit have created a plan to reconnect disconnected youth and adults in the metro Detroit area through strategic outreach and a preparatory pathway that leads to long term manufacturing training and career programs. Mobile outreach rallies will be held to bring the excitement and career possibilities within manufacturing to disconnected youth and adults. Once engaged through these outreach efforts, individuals will be connected to training programs that will focus on teaching the skills necessary for success in the workplace, including personal, people, and workplace skills along with applied knowledge. The goal is for the program to become nationally recognized by partners across the National Network of Manufacturing Institutes (NNMIs) and be deployed throughout metro areas across the United States.

PROJECT LEADS

Focus: HOPE
Goodwill Detroit
TechShop Detroit

PARTNERS

Industry Partners

- Ford Motor Company
- Dow Chemical
- FCA | Fiat Chrysler Automobiles
- Johnson Controls
- COMAU LLC
- American Axle

Academic Partners

High Schools:

- Blanch Kelso
- Detroit Public Schools
- Henry Ford Academy
- Henry Ford High School

Higher Education:

- Henry Ford College
- Macomb Community College
- Wayne Community College
- Oakland Community College
- Lawrence Technological University
- Eastern Michigan University
- University of Michigan
- Wayne State University

ABOUT THE PROJECT

Outreach: Mobile Rally Events

ENGAGING MORE INDIVIDUALS

Will spread awareness about LIFT and lightweighting-related manufacturing careers using available programming through TechShop created mobile platform.

CARNIVAL-STYLE RALLIES

Will feature a fully equipped mobile tech truck that houses beginning robotics, electronics and computer software that can be applied in lightweight manufacturing applications.

TRADITIONAL RALLIES

Will be timed with the start of training programs in hopes to engage more individuals with the programs at Goodwill Industries of Greater Detroit and Focus: HOPE.

Enhance Workplace Readiness and Technical Skills

Goodwill Industries of Greater Detroit

Will enhance their current programs: Work Readiness and The Youth Training and Employment Program. Programs will add computer literacy, problem solving, and basic math and reading skills.

- Work Readiness training will focus on job readiness training, a career portfolio, onsite work experience, job placement assistance and financial literacy training.
- The Youth Training and Employment program will host youth aged 15-21 for 16-weeks of paid employment training focused on important customer service skills, onsite work training, career assistance, resume building workshops and personal skills development.

Focus: HOPE
Education • Opportunity • Community

Will enhance its Earn and Learn program and long running Machinist Training Program. Enhancements include a new production worker training class for 20 students and increased access to the Machinist Training Program for 90 students with a new Ready Set Go component to help students prepare for machinist training.

- Earn and Learn provides youth aged 18-24 and formerly incarcerated unemployed adults with access to employment and training. The program helps individuals obtain work skills, set and achieve education goals, and gain work experience.
- The Machinist Training Program is a manufacturing training readiness class that prepares workers for manufacturing jobs.

TechShop
BUILD YOUR DREAMS HERE

Will provide educational day camps during the student programs held at Goodwill Industries of Greater Detroit and Focus: HOPE increasing participants' connections to manufacturing. TechShop will host students for tech-oriented play activities and expose students to multiple facets of manufacturing innovation including manufacturing skills, computer programming, and different ways of ideation, creative problem solving and design thinking.

Expand Training for Youth and Adults

NINETY STUDENTS

Will be added to Goodwill Industries of Greater Detroit programs during the first year of this partnership. The students engaged will focus on:

- Work readiness
- Common employability skills
- Math & reading proficiency

GEOGRAPHIC FOOTPRINT

The pilot program will be released in metro Detroit with plans for national application. In Michigan, and nationally, the emphasis will be on cities with large populations of disconnected youth and adults where workplace readiness skills are often the greatest barriers to employment. After the initial launch of the Mobile Rally platform, the partnership plans to expand in the following areas:

About the Training Leads

Goodwill Industries of Greater Detroit

For over 94 years, Goodwill Industries of Greater Detroit has led the region's ongoing battle against unemployment. Goodwill Industries of Greater Detroit estimates it has served near 1 million clients and placed almost 90,000 individuals into jobs over its history. Metro Detroiters have benefitted from the nonprofit organization's employment training, education support and job placements programs. Goodwill's team delivers services, products and employment coaching support to more than 900 local employers of all sizes each year. Trainees receive classroom education, vocational instruction, workplace behavior coaching, financial literacy, placement assistance and ongoing career support. For employers, this assures positions are filled by skilled, mature and confident workers motivated to succeed.

Focus: HOPE

For over 45 years, Focus: HOPE, a non-profit civil and human rights organization in Detroit MI, has been a leader in regional workforce development by providing education and training opportunities that have led to solid careers in advanced manufacturing, manufacturing engineering and technology, and information technologies – both at middle and higher skill levels. Focus: HOPE's education and training programs have continued to bridge the needs of Michigan industries for a skilled workforce by expanding access for urban youth and other citizens to economic opportunity and good jobs. The education and training programs incorporate hands on experiences that bolster adult learning and provide graduates knowledgeable of current industry practices.

Focus: HOPE's Center for Advanced Technologies (CAT) and Machinist Training Institute (MTI) have been the core of success. Focus: HOPE runs several other programs to provide the necessary support and develop skills for disconnected youth, adults and returning citizens in the region so they are able to advance through the MTI and CAT programs and be successful. For example, Earn and Learn and Ready Set Go are two specific developmental programs at Focus: HOPE that will participate in this project.

TechShop Detroit

TechShop Detroit is a playground for creativity hosting areas for part fabrication, prototyping, hacker space and learning center. TechShop Detroit provides access to over $1 million worth of professional equipment and software. Our expert staff is always present to ensure members and students have a safe, meaningful and rewarding experience. Most importantly, at TechShop Detroit, shop users can explore in a collaborative and creative environment. Each of our facilities includes laser cutters, plastics and electronics labs, a machine shop, wood shop, metal working shop, textiles department, welding stations, and a 60K water jet cutter. Students and day users have open access to design software, featuring Autodesk Design Suite. Huge project areas with large work tables are available for completing projects and collaborating with colleagues.

EXPECTED OUTCOMES

950+ disconnected youth and adults engaged through Mobile Rallies

110+ new students added through program enhancements

90+ new students added through program expansions

80% Expected graduation rate from sponsored programs

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Reconnecting disconnected youth and adults to pathways to manufacturing careers

Linking and leveraging existing resources.

Goodwill Industries of Greater Detroit

Focus: HOPE Education • Opportunity • Community

TechShop BUILD YOUR DREAMS HERE

lift LIGHTWEIGHT INNOVATIONS

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

QUOTE

“With support from LIFT, Detroit partner organizations have developed and enhanced training programs that will help prepare the workforce necessary to fill the existing skills gap for area manufacturers while also providing pathways to good jobs for regional youth and adults.”

EMILY STOVER DEROCCO
DIRECTOR OF EDUCATION AND WORKFORCE DEVELOPMENT

BUILDING 21st CENTURY MANUFACTURING TALENT

Foundations for Manufacturing Careers: Worker Readiness in Ohio

An Education & Workforce Development Initiative for LIFT... Lightweight Innovations for Tomorrow

THE PROBLEM

Employer demand in Ohio for lightweighting-related workers has nearly doubled since the end of 2014. Entry-level positions, needed by manufacturers to increase growth and production, form a substantial portion of the available jobs in Ohio. The state expects to see a seven percent increase in total jobs added for production workers through 2022 with nearly 8,000 annual job openings. Despite the increased demand, too few individuals are gaining the skills they need—foundational employability or technical skills—in order to begin working for Ohio manufacturers. This critical skills gap needs to be addressed so that Ohio employers can have the skilled and educated workforce their advanced manufacturing enterprises require.

THE SOLUTION

In collaboration with partners from education and industry, Ohio TechNet will lead the charge in addressing the critical gap at the very entry level of manufacturing career pathways in Ohio. This includes pathways to high-demand manufacturing occupations in the transportation sector. Foundations for Manufacturing Careers will address not only the skills needed to operate today's manufacturing equipment, but also the greatest entry-level need of manufacturing employers—employability skills—by providing Ohioans with a path to enter into and move along a career pathway toward high-demand occupations. Individuals will enter the pathways in one of two ways:

1. Manufacturing Readiness Program
2. Foundations for Manufacturing Career Course

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Helping disconnected youth and adults prepare for high quality, middle skill jobs

Linking and leveraging resources

Deploying educational pathways from high school, through community colleges, to universities

PROJECT LEAD

Lorain County Community College on behalf of the Ohio TechNet Community College Consortium

PARTNERS

From Education

- The Ohio Department of Higher Education
- Ohio Governor's Office of Workforce Transformation
- Ohio TechNet Community College Consortium
- Lorain County Community College
- Cincinnati State Technical and Community College
- Trumbull Career and Technical Center
- Mahoning County Career and Technical Center
- Columbiana County Career and Technical Center
- WorkAdvance partners (community-based organizations)
- ABLE [Adult Basic Education] programs in Butler, Columbiana, Hamilton, Lorain, Mahoning, and Trumbull Counties

From Industry:

- Ohio Manufacturing Careers Council
- The Mahoning Valley Manufacturers Coalition

ABOUT THE PROJECT

Manufacturing Readiness Program

1. Expand upon existing models to package classroom instruction, career coaching and wraparound support services.

2. Fully prepare and support participants with the academic, personal, people, and workplace skills necessary for success.

Phase I
Toolkit Development and Partner Engagement

Create a toolkit in order to guide replication, establish a detailed project plan, and engage partners for program expansion

Phase II
Implementation, Refinement, and Regional Expansion

Present, replicate, and expand the Manufacturing Readiness Program in eight partner institutions

Phase III
Statewide Adoption and Sustainability

Convene stakeholders in order to embed the Manufacturing Readiness Program into existing funding streams and practices

Foundations for Manufacturing Career Course

Develop a common Foundations for Manufacturing Careers course aligned to credentials for adoption across all community colleges in Ohio.

Phase I
Research, Analysis, and Initial Drafting

Design and draft a comprehensive course description following research and discussion from Ohio TechNet consortium meetings, employers, and college educators

Phase II
Course Design

Develop a comprehensive master course syllabus for the Manufacturing Foundations course

Phase III
Course Explanation

Coordinate discussions to promote adoption of the course throughout the University System of Ohio

Expected Outcomes

- Implementation of a standardized Manufacturing curriculum endorsed by industry to be delivered at community colleges statewide
- Replication of the comprehensive Manufacturing Readiness model throughout Ohio
- Strengthened pipeline of individuals entering into manufacturing programs and careers
- Increased collaboration among stakeholders, from educators to employers to workforce boards
- The development of a team focused on demand issues for the Ohio Manufacturing Careers Council, thereby identifying and addressing talent gaps in the manufacturing talent pipeline

GEOGRAPHIC FOOTPRINT

The Manufacturing Readiness model will be implemented in Trumbull, Mahoning, and Columbiana Counties in the Youngstown region; Lorain County; and Butler and Hamilton Counties in the initial pilots. The Manufacturing Foundations course will involve the Ohio TechNet institutions initially.

QUOTE

“Engaging students in a meaningful work-based learning experience will accelerate the development of the workforce needed for the future growth in lightweighting and advanced manufacturing.”

ETHAN KARP

PRESIDENT AND CEO, MAGNET

BUILDING 21st CENTURY MANUFACTURING TALENT

Growing a Skilled Manufacturing Workforce: Work-Based Learning in Ohio

An Education & Workforce Development Initiative for LIFT... Lightweight Innovations for Tomorrow

THE PROBLEM

Employer demand in Ohio for lightweighting-related workers has nearly doubled since the end of 2014. The state expects to see a seven percent increase in total jobs added for production workers through 2022 with nearly 8,000 annual job openings. Yet, the supply of students earning relevant credentials or pursuing training has not been increasing at the same rate. A rapidly aging workforce exacerbates the issue and as a result, advanced manufacturing employers in Ohio struggle to find talent they desperately need for open positions. Skill shortages in advanced manufacturing, particularly in lightweight materials, will continue to grow unless countered by greater awareness and training designed to fit employer needs. Furthermore, manufacturers often cite the lack of hands-on experience as a limitation of individuals coming straight out of education and training programs. In fact, this has become one of the grand challenges raised by manufacturers across the country.

THE SOLUTION

To address this challenge, this project will create more relevant work-based learning opportunities for students to apply their newly acquired skills on the job, connecting theory-based classroom instruction with the world of work. Research on student skill mastery indicates the impact of applied learning opportunities on student success and their career development. Through a work-based learning experience, students should expect not only to apply the theory and skills learned in the classroom but also to develop higher-level, critical thinking skills, problem solving and decision-making in the complex work environment. Through the Manufacturing Extension Partnerships (MEP) in Ohio, this initiative offers the potential to assist in the development of the skilled worker pipeline needed in lightweighting and advanced manufacturing in Ohio. Employer partners will identify curriculum enhancement activities focused on application of lightweighting technologies in their companies.

METRICS OF SUCCESS

At least 75 high school students participating in summer work-based learning internship experiences.

75% of participants rate the experience as positive

80% of students earn at least one industry certification

25% of students earn college credit

50% of students retained by employers following work-based learning experience

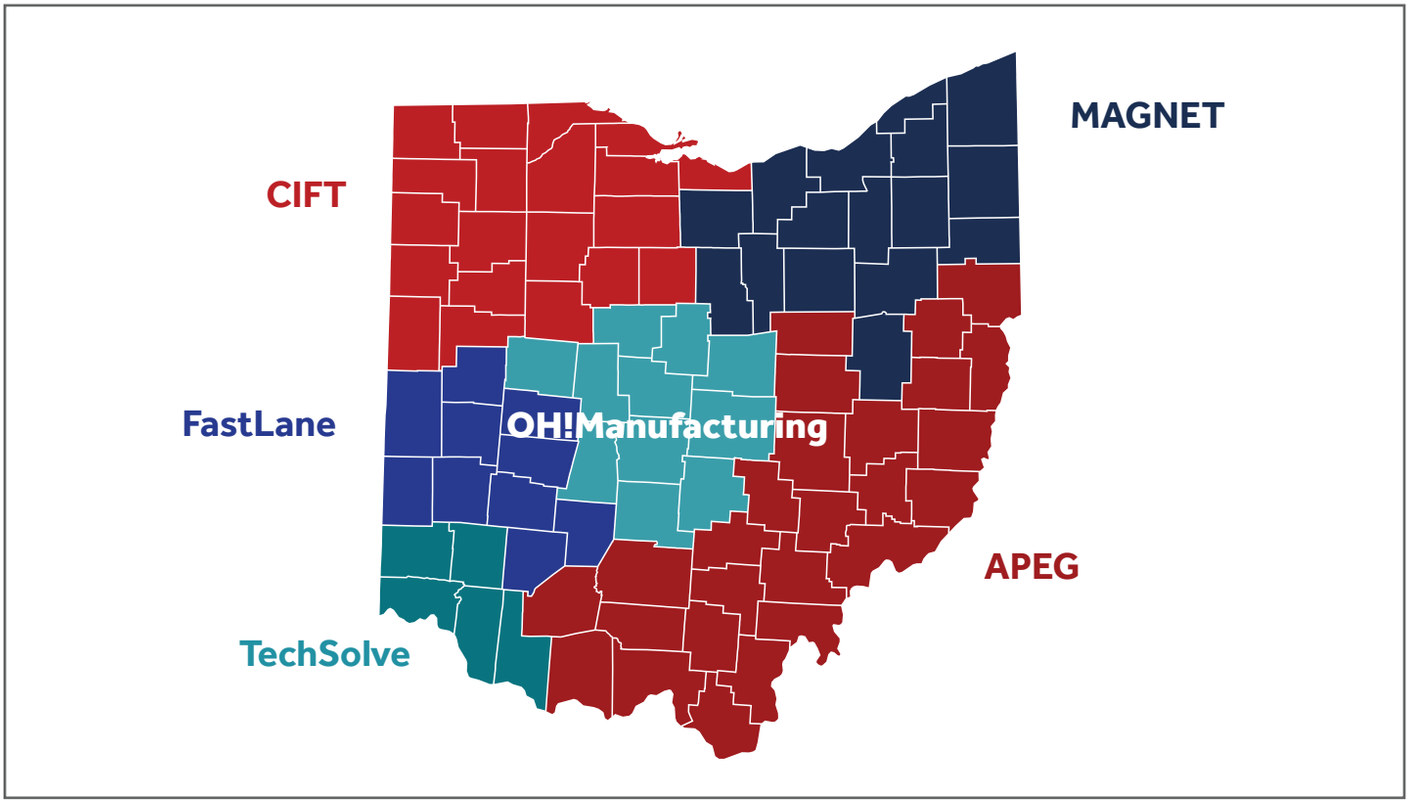
EXPECTED OUTCOMES

- Creation of an advanced manufacturing career pathway promoted by college credit and industry certification opportunities
- Piloting of work and learn opportunities by at least six schools
- Promotion and commitment from Ohio manufacturing employers to participate and provide work-based learning internship experiences
- Implementation of the pathway in three OhioMEP Affiliate regions
- Demonstration of the value in a work-based learning internship approach to developing the skilled and educated workforce needed to implement lightweighting technologies

lift LIGHTWEIGHT INNOVATIONS

MAGNET Manufacturing Advocacy & Growth Network AN OHIO MEP AFFILIATE

GEOGRAPHIC FOOTPRINT



ABOUT THE PROJECT

In collaboration with partners from education and industry, MAGNET: The Manufacturing Advocacy and Growth Network (MAGNET) will lead this project in providing secondary students with work-based learning opportunities in Ohio. MAGNET has developed and piloted a work-based learning project that includes paid internship experiences for high school students interested in careers in advanced manufacturing. More than 60 11th grade students have participated in this program and nearly three-fourths retained employment following completion of their internship.

Through LIFT, the new initiative will build on the successful work-based learning model designed by MAGNET by strengthening the model and expanding it into two other MEP regions across Ohio. The LIFT-sponsored programming will include:

- Emphasizing career pathways for students interested in pursuing a career in advanced manufacturing
- Offering college credit for the work experience
- Earning industry certifications
- Launching student on pathways to associate's and bachelor's degrees

ALIGNMENT TO STRATEGIC FOCUS AREAS

Deploying educational pathways from high school, through community colleges, to universities

Expanding work and learn opportunities

Ensuring more students gain STEM foundational skills

PROJECT LEAD

MAGNET: the Manufacturing Advocacy & Growth Network – An Ohio Manufacturing Extension Partnership (OHMEP) Affiliate

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

LIFT LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

High School Machining Program in Kentucky

An Education & Workforce Development Initiative for LIFT... Lightweight Innovations for Tomorrow

THE PROBLEM

During 2015 advanced manufacturing employers posted 32,718 open jobs in Kentucky. Approximately 24% of these postings were for skilled trade positions specializing in machining and industrial technology. Kentucky, and the U.S. as a whole, are experiencing declining numbers of qualified candidates for these jobs. In 2014, only 5,000 students in Kentucky completed certificate or degree programs related to machining and industrial technology and many of these students have not had the opportunity for on-the-job experience provided by an apprenticeship or internship program, making them less employable. In Louisville, General Electric (GE) hires close to 500 production employees annually yet about 300 of those leave within their first year of employment because they were not adequately prepared.

Opportunities for technical training for students are important. However, several equally important aspects to being prepared for work are often overlooked. By providing opportunities for on-the-job experience with an emphasis on critical employability skills, along with the technical training, individuals are truly prepared to be successful in the workplace. All of these skills and attributes - the technical and the non-technical - are necessary for employers like GE to stay competitive. Too few high school-level programs prepare students for the world of work in any field, much less manufacturing.

THE SOLUTION

To address the need for quality programming at the high school-level in Greater Louisville, local high schools, manufacturers, and government leaders are collaborating to create dynamic new programs that will launch students into successful careers in high demand from local employers. With an investment from LIFT and generous support from GE, Ford's Louisville Assembly Plant, and local Ford UAW members, an innovative regional high school advanced manufacturing career pathway program will be developed. Upon completion, the students will have successfully navigated a four-course career major in manufacturing, participated in a work-based learning experience with a local employer and earned the National Career Readiness Certification (NCRC) and Manufacturing Skills Standards Council (MSSC) Certified Production Technician (CPT) certification.

High school is the essential time to ensure that the future workforce can learn not only the technical skills needed for career success but also the employability skills that many of today's workers lack. Manufacturers are looking to local high school populations as a pipeline for production employees. The new program, which combines MSSC-CPT training with the NCRC and direct involvement by industry, will ensure that employers have a highly qualified pipeline of workers sooner.

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

PROJECT LEAD

Jefferson County Public Schools - Doss High School

FROM INDUSTRY

- GE Appliances
- Ford - Louisville Assembly Plant
- Local Ford UAW Members

PARTNERS

- Jefferson County Public Schools – Doss High School
- Bullitt County Public Schools – Bullitt County Area Technology Center
- KentuckianaWorks - Kentucky Manufacturing Career Center
- Amatrol

ABOUT THE PROJECT

MSSC-CPT is a certification already identified by 90+ local industries as representing the skills and knowledge needed by front-line production technicians. Combining the MSSC-CPT with NCRC and including a work-based learning experience to the program creates a formula for successful career preparation and the opportunity for lucrative manufacturing careers.

Direct involvement by industry ensures that students learn the specific technical and employability skills required by advanced manufacturing employers. With rapid advancement of technology, students in the program will have access to the most cutting-edge knowledge to prepare them for future manufacturing careers. Students will be immersed in programming and work-based opportunities and receive industry-recognized credentials to launch their careers right out of high school.

Upon completion of the program, students receive:

1. MSSC-CPT certification
2. NCRC certification
3. Completion of four transferable manufacturing courses to continue to post-secondary training
4. Immediate employment opportunities with industry partners

GEOGRAPHIC FOOTPRINT

Greater Louisville Area: Jefferson and Bullitt Counties

REPLICABLE INNOVATIONS

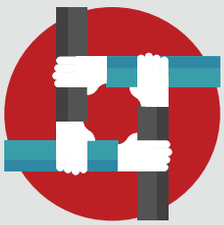
This model of NCRC programming integrated with industry-recognized technical training and work-based learning in a high school setting to prepare students for careers immediately upon high school completion is replicable across the U.S.

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Attracting students and workers to educational pathways and careers in manufacturing

Deploying educational pathways from high school, through community colleges, to universities

Beginning in August 2016, high school students involved in the program will have access to:

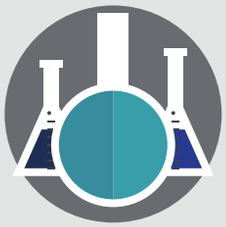


Hands on training

Work-based learning with employers

Online courses

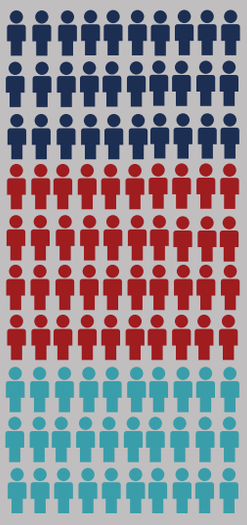
Lightweight materials training



Laboratory facilities

NCRC employability skills training and assessments

MEASURES OF SUCCESS



100 high school students enrolled in the program each year

40 students completing the program each year receiving either full-time employment or continuing to related post-secondary training

30 adult learners engaged in the program and connected to local employers

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

lift LIGHTWEIGHT INNOVATIONS

LIGHTWEIGHT INNOVATIONS | **BUILDING 21st CENTURY MANUFACTURING TALENT**

Work-and-learn in Indiana: Career Exploration in Lightweight Metals Manufacturing

An Education & Workforce Development Initiative for LIFT ... Lightweight Innovations for Tomorrow

THE PROBLEM

A leaky talent pipeline represents a major obstacle for manufacturers in Indiana and nationwide. With misconceptions about manufacturing jobs, students are often unaware of the exciting career opportunities in manufacturing – particularly lightweight metals manufacturing. As a consequence, few students understand the new age of advanced manufacturing filled with high-tech, innovative, and creative technologies offering stable, high-paying jobs.

Between 2014 and 2015, demand for workers in occupations related to lightweight metals manufacturing nearly doubled, with companies in Indiana posting over 50,000 related jobs in 2015. The rapidly aging workforce in many of these in-demand manufacturing occupations exacerbates the supply-demand gap. The growing demand from employers requires a more concerted effort toward filling the pipeline.

To combat this, work-and-learn strategies such as internships, co-ops, apprenticeships, and others have been a staple in Indiana in the past. However, manufacturing work-and-learn strategies targeted toward the emerging Hoosier workforce have had limited success and sustainability due to myths about age restrictions, liabilities, and impacts on productivity. With these myths prevalently held by employers and educators in Indiana, students were engaged in work-and-learn experiences that only superficially exposed them to manufacturing careers such as plant tours, job shadowing, or other short-term work experiences.

THE SOLUTION

Conexus Indiana, an initiative to capitalize on emerging opportunities in advanced manufacturing and logistics, developed *Conexus Interns*, a cutting-edge model in which select students compete for internships in manufacturing companies throughout the state. Launched in 2015, *Conexus Interns* dispels myths about what is possible through work-and-learn models and encourages young Hoosiers to consider long-term careers in manufacturing. These interns gain real-world experience and the opportunity to explore careers with manufacturing companies. In addition, the internships provide manufacturers with an extended look at an emerging pool of talent.

PROJECT LEAD

Conexus Indiana

EXPECTED OUTCOMES

100 100 students participate in internships with lightweight manufacturers in 2016 and 2017 as LIFT Interns

300 300+ students exposed to lightweight metal technologies and career opportunities in lightweight manufacturing during the *Conexus Interns* Summit

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

- Expanding work-and-learn opportunities for students
- Attracting more young individuals to manufacturing careers
- Offering on-the-job training solutions for industry partners

SCHEDULE TO INITIATE

June 2016

Student interns begin work

***Conexus Interns* Summit**

ABOUT THE PROJECT

In the *Conexus Interns* model, high school students participate in a six week paid internship with manufacturers across Indiana. Conducted over the summer months, interns also participate in an overnight intern summit at Purdue University. Once accepted into the pool of qualified applicants, students are then selected by Indiana manufacturers with help from *Conexus*.

In its first summer, the *Conexus Interns* program had 84 high school students participating in internships with manufacturers in central Indiana. Ninety percent of participants reported that their experience was valuable. In addition, 40 percent of students reported they plan to pursue careers in advanced manufacturing because of their internship. With LIFT support, the program will expand throughout the state to an additional 100 students and will target these additional positions toward work-and-learn opportunities specifically with lightweight manufacturing companies. These added positions will be designated as LIFT Interns.

In addition to providing work-and-learn opportunities to 100 LIFT Interns, *Conexus* will dedicate efforts to information sharing and collaboration with the State Workforce Innovation Council and the ACT Foundation as they convene leaders throughout Indiana to develop an overarching work-and-learn framework and thought leadership in Indiana.

PARTNERS

38 Indiana companies specializing in automotive, aerospace, and other lightweight metal applications

From Industry

- Allison Transmission
- BAE
- Batesville Products
- Batesville Tool & Die
- Blasdel Enterprises
- Bulk Truck & Transport Service, Inc.
- Busche
- CalTherm
- Dana Holding Corporation
- Elgin Fastener Group
- GKN Sinter Metals
- Greenville Technology, Inc.
- Haynes International
- Hitachi Powdered Metals
- Hoosier Pattern, Inc.
- IMMI
- Jasper Engine & Transmission
- Kessington, LLC
- Koch Enterprises
- Littler Diecast Corporation
- Magna Powertrain
- Marion Manufacturing
- MSP Aviation
- Mursix Corporation
- Ottenweller Company.
- Precise Mold & Plate
- Raybestos
- Riverside MFG, LLC
- Rolls-Royce
- Subaru of Indiana Automotive
- STARK Industries/JWS Machine
- Super ATV LLC
- Tech Castings LLC
- Tru-Flex LLC
- TS Tech Indiana, LLC
- Ultra Electronics, USSI
- Valeo
- Wabash National

From Education

- Purdue University
- Ivy Tech Community College
- Vincennes University
- Indiana high schools

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lift LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Teacher Training in Tennessee: Materials Science Bootcamps

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

The mismatch in the supply and demand for workers in advanced manufacturing presents a constant struggle for employers searching for qualified workers in Tennessee and nationwide. Specifically in the Volunteer State, online job ads for workers in occupations related to lightweight metals manufacturing more than doubled between 2014 and 2015, with over 46,000 related job ads posted in 2015 alone. The rapidly aging manufacturing workforce exacerbates the supply-demand gap. LIFT's research expects that nearly 20 percent of workers in lightweight metals manufacturing occupations will retire in the next 10 years.

Manufacturing technology is changing very fast and today's manufacturing careers are very different than yesterday's. It is a challenge for teachers to keep up with those technological changes. . As a consequence, few students understand the new age of advanced manufacturing filled with high-tech, innovative, and creative technologies offering stable, high-paying jobs. Today's youth will remain uninformed and the supply-demand gap will only worsen without an organized effort to aid teachers not just in realizing the wide array of prospects within the transforming manufacturing sector, but also in bringing new activities and curriculum to the classroom that energize and engage students about manufacturing and materials science.

THE SOLUTION

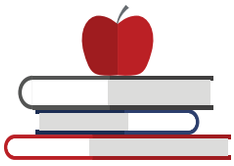
With support from LIFT, the Tennessee State LIFT Education & Workforce Development Team will leverage significant state investment from Tennessee's Labor Education Alignment Program (LEAP) to build upon the success of the Summer 2015 ASM-LIFT Materials Camp program. The Materials Camp program provides science, technology, engineering, and math (STEM) focused training to high school and middle school teachers to better promote STEM education and career pathways awareness. These programs have shown materials science as an excellent tool to bring together academic and vocational instructors with a common goal of inspiring students about STEM disciplines and careers.

The teachers who participate in the bootcamps will return to their classrooms to share their newly found knowledge about materials science and help encourage students to pursue careers in the field.

ABOUT THE PROJECT

Building on past success

2 LIFT-ASM Bootcamps



50 Tennessee Teachers

5,000 Students

In 2015, two LIFT-ASM Bootcamps enabled 50 Tennessee teachers to learn more about materials science and how to pass this new knowledge to their students. As a result of that teacher training, over 5,000 students learned more about materials science. Furthermore, ASM reported that camp evaluations exceeded all metric expectations.

To further expand upon the successes of 2015, three bootcamps will take place in Tennessee in August 2016.

A new Materials Science Bootcamp in West Tennessee

A camp in Southern Middle Tennessee with new teachers

An "advanced" camp in Northern Middle Tennessee for teachers who participated in 2015 camps

Each camp will provide a significant professional development opportunity for teachers to incorporate new advanced manufacturing curriculum into their classrooms in the 2016-2017 school year by exposing them to valuable lessons in physical science and chemistry, from an engineering perspective. The information can be used as a basis for teaching their own Materials Science course or infusing the concepts into existing science courses to increase relevancy and

For more information please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

student motivation. LIFT–branded instructional material will be provided, including YouTube training modules that can be used by both Master Teachers and teachers who are part of the camps. These open-source documents will cover:

- Value of Lightweighting (focus on math and using units)
- Essential Properties of Materials (focus on density, stiffness and strength)
- Strengthening Mechanisms in Metals
- Demonstrations in Strengthening
- Demonstrations in Aluminum Strengthening

PARTNERS

- South Central Tennessee Workforce Alliance
- ASM Foundation
- Austin Peay State University
- Columbia State Community College
- LEAP - Closing Gaps Through Partnerships
- Middle Tennessee Advanced Manufacturing Skills Panel
- Northfield Workforce Development & Conference Center
- Southwest Tennessee Community College
- Tennessee College of Applied Technology – Pulaski, TN
- Tennessee STEM Innovation Network

BOOTCAMP LOCATIONS

1. Northfield Workforce Development & Conference Center (Spring Hill, TN)
2. Austin Peay State University (Clarksville, TN) – Advanced Bootcamp
3. Southwest Tennessee Community College (Memphis, TN)

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Ensure students gain STEM foundational skills

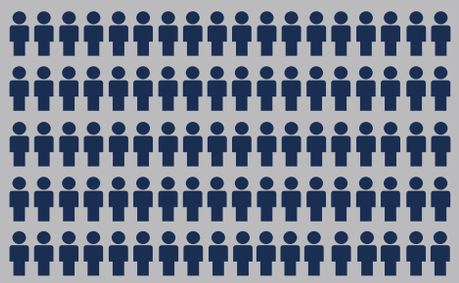
Attract more young people to manufacturing careers

Teach the teachers

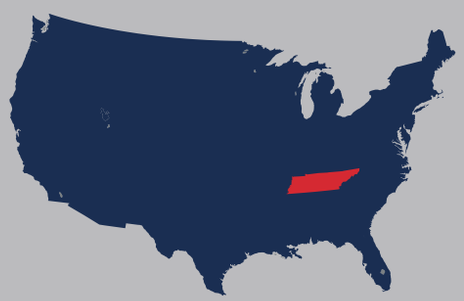
Expand work-and-learn opportunities

2016 SUMMER BOOTCAMP EXPECTATIONS

Three bootcamps—One advanced camp for teachers who attended last year



90 teachers
(an increase of 80 percent from 2015)



Thousands of students impacted in West, Southern Middle, and Northern Middle Tennessee

98% of respondents feel prepared to implement new labs/demos learned at camp

98% feel they gained new ideas and approaches to instruction

98% indicated they will use material science technology concepts in their classroom

Program meets or exceeds 98% benchmark on participant evaluations

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

BUILDING 21st CENTURY MANUFACTURING TALENT

Leading a MakerMinded Vision

Connecting the next generation of manufacturers and business leaders to the skills and experiences they need to be successful and to the companies that need their talents

MAKERMINDED.COM
OPENING MINDS TO ADVANCED MANUFACTURING

PROBLEM ONE: Innovation Demands Talent

Employer demand for skilled workers is rapidly increasing, yet current workers are not prepared to fill these jobs and students are not pursuing the STEM education and training that would prepare them for a career in manufacturing.

For the U.S. to become the world leader in advanced manufacturing – particularly lightweight metals manufacturing – an educated and skilled workforce is necessary to use the new manufacturing technologies and processes being developed.

PROBLEM TWO: Students Leaving Stem Behind

In eighth grade, students start considering careers, and these considerations become clearer through high school. By the time they are seniors, however, only 16 percent are proficient in mathematics and interested in a STEM-related (Science, Technology, Engineering, Math) career. Students are less engaged in STEM training, with fewer selecting college majors in STEM fields, making it even more difficult to encourage a career in advanced manufacturing once they reach high school and college age.

Roughly 28 percent of Bachelor's degree students enter a STEM field at some point during their postsecondary education. Nearly half of those students, however, leave STEM by either changing majors or leaving college completely, creating an even larger gap in the trained workforce.

The small share of students entering STEM fields displays the lack of preparation for those careers. For manufacturers, this "disconnect" between students gaining the foundational STEM skills and the educated, skilled, and ready workforce our manufacturers need must be a national priority.

PROBLEM THREE: Jobs Are Being Left Unfilled

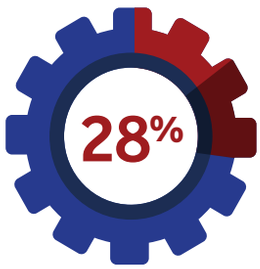
Over the next decade, nearly 3.5 million manufacturing jobs in the United States likely need to be filled. Pending retirements coupled with a declining flow of new workers and an increasing need for talent have created a large skills gap resulting in estimates predicting that two million of those jobs will remain unfilled.

Employers seeking advanced manufacturing workers in the 5-state LIFT region posted over 91,000 online job ads during Q1 2016, up 26 percent from the 73,000 postings in the first quarter of 2015. In Tennessee alone, employer demand was reflected in 41 percent more job postings over the same time period. Building the pipeline of talent necessary to fill these jobs demands more solutions to prepare students and new workers with necessary STEM knowledge and skills.

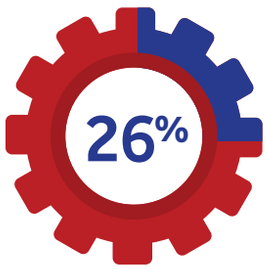
MORE AWARENESS AND ACCESS ARE NEEDED

Numerous world-class initiatives are addressing the serious and growing disconnect between America's youth and the STEM knowledge and skills required to succeed in the new and exciting Advanced Manufacturing jobs. The challenge is awareness and access, with too few students, parents, and educators learning and sharing information about the programs and how to better engage young people in activities that connect them to the world of STEM. LIFT and its partners believe a recently developed initiative will help address this challenge.

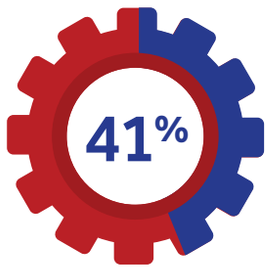
of senior year high school students are proficient in mathematics and interested in STEM



of Bachelor's degree students enter a STEM field at some point during their postsecondary education, but nearly half leave



increase of online advanced manufacturing job postings in the first quarter of 2016 compared to the first quarter of 2015



increase of advanced manufacturing employer job demand in Tennessee alone

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

lift LIGHTWEIGHT INNOVATIONS

THE SOLUTION

CHANGING MINDSETS AND INCENTIVIZING STUDENTS AND SCHOOLS TO TAKE ACTION IN STEM EDUCATION – FIRST IN TENNESSEE, THEN NATIONWIDE

The MakerMinded web portal, designed by Tennessee Tech University, brings together actionable information, the power of competition and campaign communications to saturate the learning infrastructure with a manufacturing mindset to bridge the gap between activities and programs that engage and educate youth and the students who can take advantage of them. The solution delivers a diverse portfolio of successful STEM awareness and education activities to schools and students in a simple, accessible platform including both national and local-level STEM and manufacturing career exploration activities, project-based learning, formal educational resources, and other experiential learning opportunities.

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HOW IT WORKS

The portfolio provides students with alternative options to gain foundational STEM/manufacturing skills emphasizing work-based, project-based and problem-based learning. Other key components include using cutting-edge technology, relevant "real-world" content, and industry partnerships that provide mentorship, subject matter expertise, and other learning experiences.

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SAMPLE ACTIVITIES IN THE MAKERMINDED PORTFOLIO

A few examples of the programs and activities that are part of the MakerMinded Portfolio include:

- FIRST Robotics
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- Destination ImagiNation

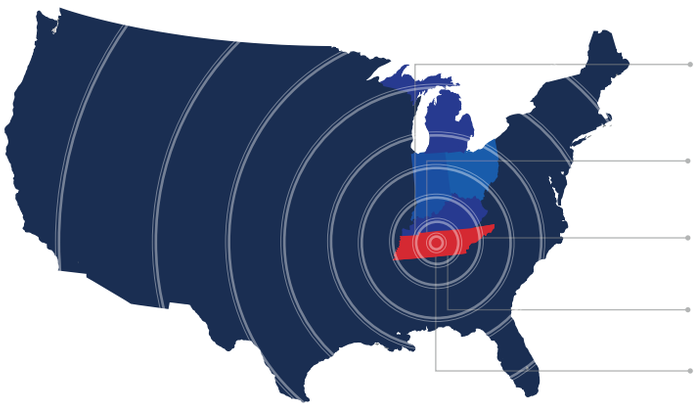
ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing

Linking & leveraging resources and related initiatives on the ground today

EXPECTED OUTCOMES



- Changed perceptions and broadened understanding among students regarding manufacturing
- More students engaged in STEM/manufacturing learning experiences
- An increase in students pursuing further STEM education and training
- Students develop foundational technical skills
- Increased number of under-represented populations exposed to manufacturing and STEM fields

Potential to reach over 3,800 middle and high schools and 5.9 million students across the 5-state LIFT region.

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LIFT LIGHTWEIGHT INNOVATIONS

ABOUT THE PROJECT

MakerMinded will have a national scope with roll-out first in Tennessee to set the standard for future expansion.

Tennessee STEM Innovation Network

BATTELLE Education

Tennessee Tech UNIVERSITY

The Tennessee STEM Innovation Network will drive the Tennessee state roll-out process, including:

- Customizing the portfolio programs for local employers and organizations
- Leading the statewide communications & marketing efforts for program implementation
- Tracking progress for each school and the state
- Sponsoring and co-hosting a recognition event

The Tennessee Tech University team will manage the MakerMinded platform and Tennessee-specific portal, including:

- Developing and hosting the custom web portal for Tennessee's program
- Managing the leader board and reports
- Ensuring consistent platform functionality

LAUNCH AND EVALUATION IN TENNESSEE

Fall 2016

Roll-out coinciding with the school year kick-off

- Roll out across Tennessee with 100 middle and high schools signed-up and active on the platform
- Initially leveraging Tennessee STEM Innovation Network's STEM Platform Schools and schools partnered with their Regional STEM Innovation Hubs

Fall 2017

Fall 2017 – Year one results report

o Metrics to be collected:

- Schools activated and engaged in the MakerMinded platform
- Activities/programs completed by students (at school, county, and state-levels)
- Percentage of students who indicate interest in pursuing further STEM/manufacturing education and careers (through participation surveys)
- Real-time feedback of students' experiences with programs and activities
- Reported completion point variance in schools, to determine areas of strength and weakness
- Manufacturing industry awareness and interest as demonstrated in STEM surveys pre- vs. post-implementation
- Number of rural and iZone schools that participate in the program

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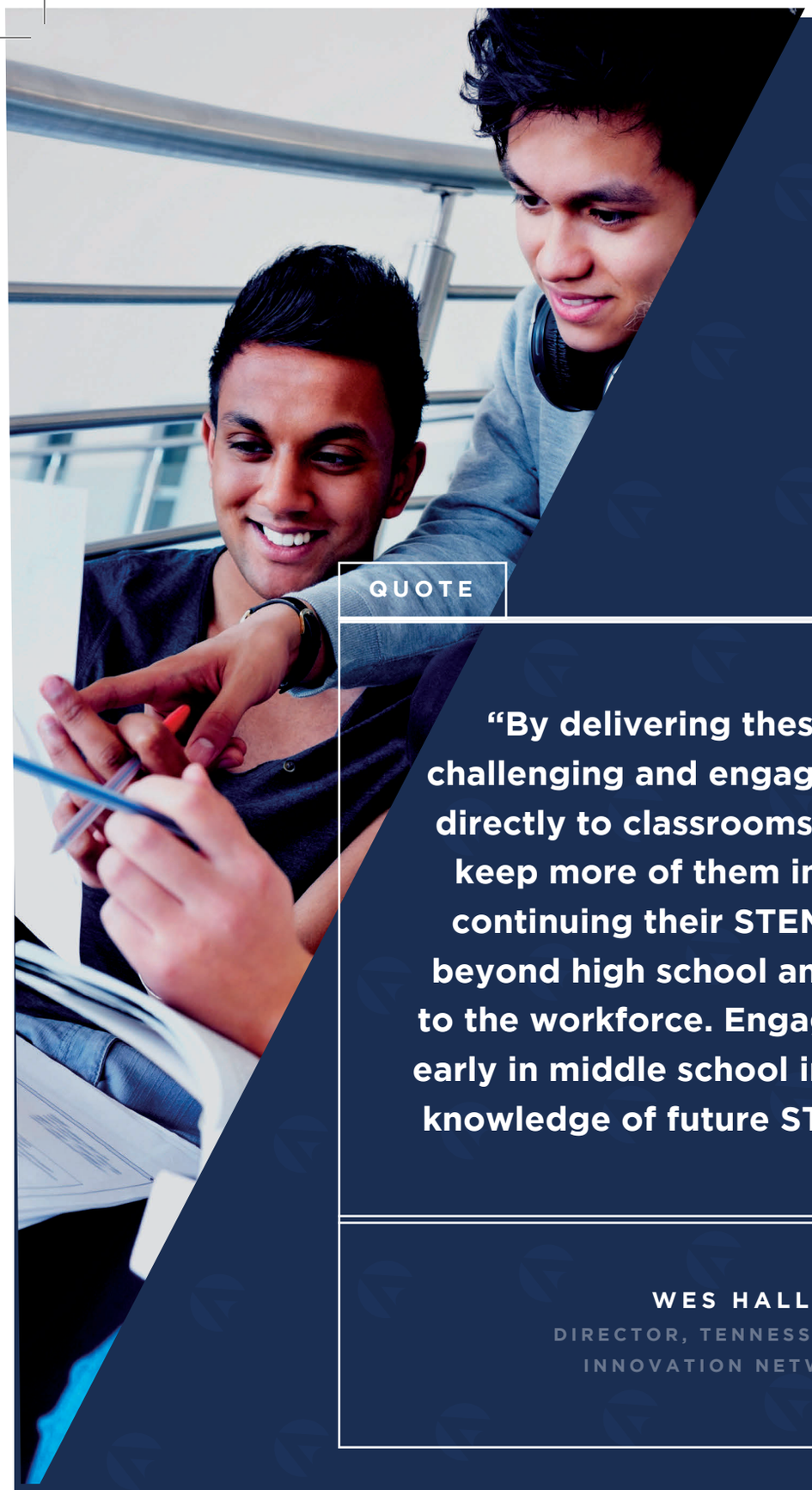


QUOTE

“By delivering these fun, yet challenging and engaging activities directly to classrooms, we hope to keep more of them interested in continuing their STEM education beyond high school and eventually to the workforce. Engaging students early in middle school increases their knowledge of future STEM careers.”

WES HALL
DIRECTOR, TENNESSEE STEM INNOVATION NETWORK

BUILDING 21st CENTURY MANUFACTURING TALENT

Raising the Bar: Enhancing the ASM Teachers Materials Curriculum

An Education & Workforce Development Initiative for LIFT... Lightweight Innovations for Tomorrow

THE PROBLEM: LACK OF MATERIALS SCIENCE EDUCATION IN THE CLASSROOM

The foundation for all advanced manufacturing jobs is materials science education. Without it, students lack a fundamental awareness of the properties of materials and the science, technology, engineering, and mathematics [STEM] knowledge relating materials to advanced manufacturing.

Unfortunately, in many schools, fundamental STEM building blocks are either nonexistent or lack meaningful and up-to-date information. In too many cases, concepts are presented without connecting them to real world applications, leaving students to wonder "so what?" instead of "how could I?"

To help bring manufacturing back onshore and position the U.S. as the global leader in lightweight materials manufacturing, worker training must begin with ensuring that fundamentals are taught in the classroom.

INTRODUCTION TO ASM-LIFT TEACHER MATERIALS CAMPS

In 2015, LIFT partnered with the ASM Materials Education Foundation to develop lightweight metals and materials core curriculum modules to include in ASM's Materials Camps to empower middle school and high school teachers to better promote STEM career pathways, specifically regarding lightweight metals manufacturing. LIFT also began supporting the expansion of camps to new locations. The camps have been exceptionally successful in helping teachers develop an understanding of lightweight metals manufacturing concepts that could be incorporated into their classrooms.

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Ensure students gain STEM foundational skills

Attract more young people to manufacturing careers

Teach the teachers

lift LIGHTWEIGHT INNOVATIONS

For more information, please see lift.technology or contact LIFT Education & Workforce Director, Emily DeRocco at ederocco@lift.technology.

BUILDING ON PAST SUCCESS

This year, LIFT and ASM will expand the program to reach beyond the teacher camps and bring more materials science education directly into the classroom via development of world-class curriculum and lab teaching materials including:

- Five short videos and examples from industry members introducing lightweight metals engineering challenges and innovative solutions, such as how to minimize mass while meeting crash test standards. The examples will help students directly relate to real life challenges and examples of the creative materials, processes, and design alternatives devised by industry.
- A classroom module program with lab activities that introduces materials and process engineering fundamentals necessary to work on problems posed by the classroom videos and/or the capstone project's problem.
- A capstone project suitable for integration with a high school level materials engineering curriculum.

With these additions available in the class, students will **learn** foundational STEM skills, work to **solve** engineering problems in a practical and hands-on manner, and through the high school capstone project **be better prepared** for the senior design project requirement of most university engineering curricula.

This LIFT-ASM partnership will give teachers access to low cost supplies and real world examples for more rapid deployment of materials science information. This initiative can be aligned with today's curriculum requirements of the Next Generation Science Standards (NGSS) and Common Core Standards, as well as LIFT's focus areas.

EXPANDING THE CURRICULUM

Enhancing the 2015 program in 2016:

- Value of lightweighting (focus on math and using units)
- Essential properties of materials (focus on density, stiffness, and strength)
- Hands-on demonstrations of strengthening mechanisms in metals, polymers, and glasses including cold working, solid state phase transformations (heat treating), cross linking, and changing chemistry to raise the glass transition temperature.
- Mass reduction strategies through a capstone project integrating materials selection, component design, and processing.

QUOTE

“The partnership we have with LIFT is critical to teaching students not only about lightweighting, but also about the future of advanced manufacturing as a whole.”

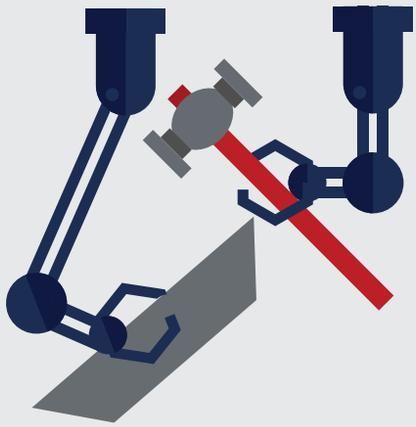
NICHOL CAMPANA

DIRECTOR OF DEVELOPMENT & OPERATIONS,
ASM MATERIALS EDUCATION FOUNDATION

BUILDING 21ST CENTURY MANUFACTURING TALENT

The LIFT Prize in Robotic Blacksmithing: Igniting Student Interest in Manufacturing Skills and Innovation

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow



THE PROBLEM: MANUFACTURING TECHNOLOGY ADVANCING, WORKFORCE SUPPLY STAGNATING

Manufacturing has undergone a revolution around additive manufacturing, 3-D printers, and CNC machines. This keystone industry is more automated, requiring workers to have advanced technical and mathematical skills to program, run, and maintain complex machinery necessary for 21st century production. New manufacturing processes are emerging through LIFT and its partners such as agile processing which provides the opportunity to improve material properties, reducing waste and producing repeatable shapes while minimizing tooling and cost.

While this manufacturing renaissance is underway, fewer students are engaging in career pathways related to manufacturing, and employers are struggling to find the talent to replace their aging workforce. Currently, more than 21% of the advanced manufacturing workforce in LIFT's partner states is over age 55 and ready to retire soon. On top of this, employers in the LIFT partner states posted nearly 340,000 jobs during 2015 alone, but only 103,000 individuals completed degrees and certifications preparing them for these lucrative jobs. Postings continue to increase while sources of talent remain static. Demand is growing. Supply is stagnant.

COMPETITION: A NEW FRONTIER OF STUDENT ENGAGEMENT

To encourage students to develop the skills they need to become innovators and future manufacturing leaders, LIFT, through its Agile and Low-Cost Processing Pillar, has teamed with the Center for Design and Manufacturing Excellence (CDME) at The Ohio State University to initiate the LIFT Prize in Robotic Blacksmithing, a student competition using agile processing principles. The competition combines outreach to students, engagement with emerging cutting-edge technologies, employers working directly with students, prizes, and national recognition for the winning teams.

This competition merges the ancient skills of the blacksmith with the digital age of robotics to create new material forming capabilities called "Robotic Blacksmithing" for making useable object shapes. Like additive manufacturing and Computer Numeral Control (CNC) machining, Robotic Blacksmithing creates new methods for manufacturing, improving material properties, reducing waste, and agile manufacturing of complex and repeatable shapes with minimal tooling at low cost.

WHAT IS ROBOTIC BLACKSMITHING?

Instead of a blacksmith manipulating and forming materials by hammering, bending, twisting, or pulling, a robot is programmed to perform these movements and manipulations using a set of agile forming tools with greater efficiency and agility, and using far lighter and less expensive tools than might be used in traditional forging.

There are great opportunities for innovation in this new field to develop material forming models in a numerical or experimental modeling environment, and then translate these models into a robot environment to design and manufacture useful shapes. In the future, it is envisioned that Robotic Blacksmithing programming tools will be available to makers everywhere who seek to shape materials into objects. This technology can go beyond simple subtractive or additive manufacturing because the material can be improved by working it with deformation and heat, and sensors can record the process and assure properties. Most exciting, because the processes re-shape material, there is virtually no waste and a wide variety of materials can be processed to very high strength with other engineered properties.

Job Demand Outweighing Workforce Supply

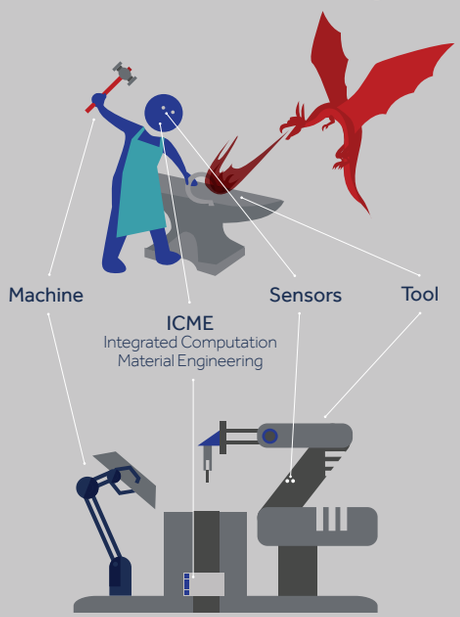
340,000

jobs were posted during 2015 but only...

103,000

individuals completed degrees and certifications preparing them for the same lucrative jobs

The Evolution of Robotic Blacksmithing



CONTINUING THE DIGITAL MANUFACTURING REVOLUTION

Robotic Blacksmithing follows on the heels of two revolutions in digital manufacturing have truly changed our world. The first was CNC, in which cutting tools process materials (plate, bar, and other wrought shapes) into more complex shapes. Instead of carving by hand, CNC machines use very large and fast metal removal tools, programmed with a digital 3-D model to subtract material from the block to create desired object features. The second manufacturing revolution was around additive manufacturing and 3-D printers, which add successive volumes of material by computer control to create complex shapes that are described by an electronic (digital) data source, such as a 3-D model. Our menu of processes and materials for additive manufacturing is expanding rapidly right now.

ELIGIBILITY

The program is open to any student team attending a U.S. high school, technical college, community college, college or university, and partnerships with regional or national companies are encouraged.

EXPECTED OUTCOMES

Students will benefit from this competition by:

- Developing and demonstrating a third robotically-controlled way of making things
- Inspiring innovation and new skills
- Showing the linkage between doing and innovation
- Showing innovation, skills, spirit and pride by competing to develop a wholly new technology

PROJECT LEAD

The Center for Design and Manufacturing Excellence at The Ohio State University

ALIGNMENT TO STRATEGIC FOCUS AREAS

Deploying educational pathways from high school, through community colleges, to universities

Ensuring more students gain STEM foundational skills

Creating enhancements to engineering curriculum using lightweighting

THE OHIO STATE UNIVERSITY

lift LIGHTWEIGHT INNOVATIONS

For more information, please see lift.technology or www.roboticblacksmithing.com.

For questions about LIFT Education & Workforce initiatives, contact Director Emily DeRocco at ederocco@lift.technology.

For technical questions on the LIFT Prize in Robotic Blacksmithing, please contact Glenn Daehn at daehn.1@osu.edu.

ABOUT THE COMPETITION

Full rules for this competition will be released in mid-September 2016, with the first prize being offered about the end of 2016. Groups may begin forming teams, partnering with industry and planning now.

The competition will be organized in a phased approach with three phases increasing in difficulty:

First Phase

CNC Shaping of Plasticine /Clay

In the first phase, student teams will develop and program a single system to develop three common shapes that will be specified with the competition rules.

Student teams will be evaluated based on the following criteria:

- Component quality
- Process time
- Public documentation of the journey and of approach

Second Phase

Shaping of Soft Metal

Third Phase

CNC Shaping with Thermomechanical Processing

Prizes

$50,000

Winning teams will receive recognition and include total cash awards of at least $50,000.

Rules

Expected to be posted in September 2016

BUILDING 21ST CENTURY MANUFACTURING TALENT

On Track: Hands-On Applied Learning to Fill the Manufacturing Workforce Pipeline in Kentucky

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM: MANUFACTURING TECHNOLOGY ADVANCING, WORKFORCE SUPPLY STAGNATING

Demand for advanced manufacturing employees in Kentucky continues to grow. According to the LIFT quarterly labor market report, employer demand for jobs related to advanced lightweight metals manufacturing increased by 38% from Q1 2015 to 7,764 jobs posted in Q1 2016. In-demand lightweighting-related workers include engineers, designers, skilled trades workers, human safety specialists, and logistics and procurement workers.

A recent report commissioned by the Bowling Green (KY) Area Chamber of Commerce predicts that the Southcentral Kentucky region alone will have 4,500 job openings in manufacturing, transportation, distribution, and logistics in 2016, and that employer demand for these skill sets will double by 2020. Currently available talent is not sufficient to fill these open positions.

With the sustained high level of employer demand for lightweight advanced manufacturing-related workers in Kentucky, and Southcentral Kentucky in particular, the region must actively work to recruit and train the talent pipeline necessary to fill vacant positions.

THE SOLUTION

In an effort to engage more of the region's students in educational opportunities related to the lightweight metals manufacturing sector - important because of the growing regional aluminum industry cluster - the Bowling Green Area Chamber of Commerce coordinated the On-Track Initiative with Southcentral Kentucky Community and Technical College (SKYCTC), Warren County Area Technical Center (Warren ATC) and industry partners.

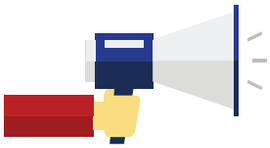
On Track students compete against each other to design and rebuild a vehicle using the science, technology, engineering, and mathematics (STEM) principles integral in today's lightweight manufacturing industry. The hands-on program engages students from a variety of study focus areas to overhaul the cars to be

efficient **lightweight** **cost-effective**

Students enrolled in automotive, welding, machine tool, and collision repair technical courses have the opportunity to directly apply their new skills. Students studying physics, biology, engineering, business, and math play a role in the design work necessary for the project. The program culminates with an opportunity for the students to put their design and skills to the test at the annual Holley LS Fest, featuring drag racing, drifting, and autocross events.

2016-2017 SCHOOL YEAR EXPECTED OUTCOMES

Engage **500+** students



Recruit participants from broad areas of study to expose students to lightweight manufacturing

Target younger student populations through elementary, middle, and high school tours to generate interest in automotive careers and begin to gear students toward a lightweight manufacturing career pathway

Establish program financial stability with contributions from partners and the auction of the rebuilt vehicles after the Holley LS Fest

GEOGRAPHIC FOOTPRINT

Southcentral Kentucky (Greater Bowling Green Area)

ALIGHMENT TO LIFT STRATEGIC FOCUS AREAS

Deploying educational pathways from high school, through community colleges, to universities

Creating demand driven workforce development

Attracting students and workers to educational pathways and careers in manufacturing

Project Lead

BowlingGreenArea Chamber of Commerce

Partners

Bowling Green Area Economic Development Authority

Bowling Green Independent Schools

General Motors

Western Kentucky University

ONTRACK Driving education through motorsports.

Southcentral Kentucky Community & Technical College HIGHER EDUCATION BEGINS HERE

Warren County Regional Jobs Park THE KEY TO YOUR FUTURE

WARREN COUNTY PUBLIC SCHOOLS WHERE CHILDREN PREPARE FOR SUCCESS

Bowling Green City Schools

Holley

SouthCentralKentucky Central For Business. Southern For Living.

For questions about LIFT Education & Workforce initiatives, contact Director Emily DeRocco at ederocco@lift.technology.

lift LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Leading a MakerMinded Vision in Kentucky

Connecting the next generation of manufacturers and business leaders to the skills and experiences they need to be successful and to the companies that need their talents

makerminded
OPENING MINDS TO ADVANCED MANUFACTURING

PROBLEM ONE: Innovation Demands Talent

Employer demand for skilled workers is rapidly increasing, yet current workers are not prepared to fill these jobs and students are not pursuing the STEM education and training that would prepare them for a career in manufacturing.

For the U.S. to become the world leader in advanced manufacturing – particularly lightweight metals manufacturing – an educated and skilled workforce is necessary to use the new manufacturing technologies and processes being developed.

PROBLEM TWO: Students Leaving STEM Behind

In eighth grade, students start considering careers, and these considerations become clearer through high school. By the time they are seniors, however, only 16 percent are proficient in mathematics and interested in a STEM-related (Science, Technology, Engineering, Math) career. Students are less engaged in STEM training, with fewer selecting college majors in STEM fields, making it even more difficult to encourage a career in advanced manufacturing once they reach high school and college age.

Roughly 28 percent of Bachelor's degree students enter a STEM field at some point during their postsecondary education. Nearly half of those students, however, leave STEM by either changing majors or leaving college completely, creating an even larger gap in the trained workforce.

The small share of students entering STEM fields displays the lack of preparation for those careers. For manufacturers, this "disconnect" between students gaining the foundational STEM skills and the educated, skilled, and ready workforce our manufacturers need must be a national priority.

PROBLEM THREE: Jobs Are Being Left Unfilled

Over the next decade, nearly 3.5 million manufacturing jobs in the United States likely need to be filled. Pending retirements coupled with a declining flow of new workers and an increasing need for talent have created a large skills gap resulting in estimates predicting that two million of those jobs will remain unfilled.

Employers seeking advanced manufacturing workers in the 5-state LIFT region posted over 84,000 online job ads during Q2 2016, including nearly 8,000 jobs posted in Kentucky alone, up nearly 11 percent from the end of 2015. Building the pipeline of talent necessary to fill these jobs demands more solutions to prepare students and new workers with necessary STEM knowledge and skills.

MORE AWARENESS AND ACCESS ARE NEEDED

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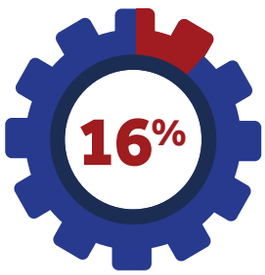

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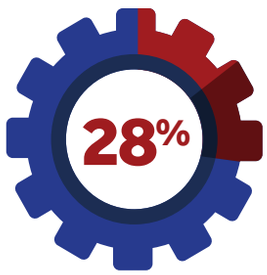

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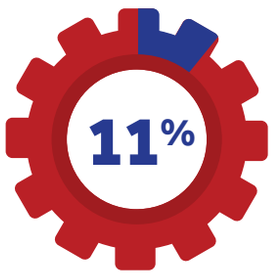

increase of advanced manufacturing employer job demand in Kentucky alone since Q4 2015

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lift LIGHTWEIGHT INNOVATION

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- SkillsUSA
- Science Olympiad
- Destination ImagiNation
- Manufacturing Plant Tours
- Local STEM Career Days
- MATHCOUNTS
- LIFT Virtual Reality Simulation
- Science and Engineering Fairs

ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Attracting students and workers to educational pathways and careers in manufacturing

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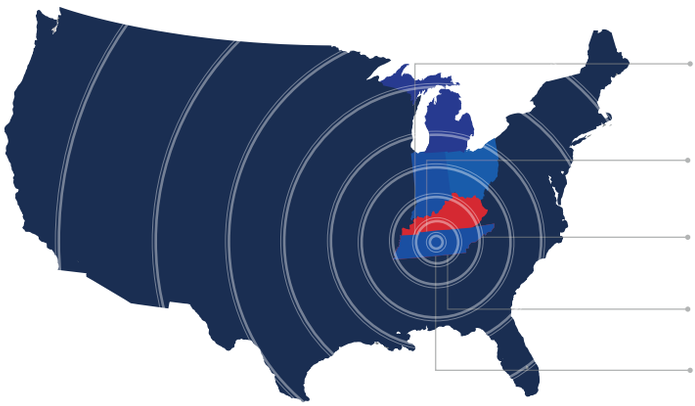
Linking & leveraging resources and related initiatives on the ground today

EXPECTED OUTCOMES



- Changed perceptions and broadened understanding among students regarding manufacturing
- More students engaged in STEM/manufacturing learning experiences
- An increase in students pursuing further STEM education and training
- More opportunities for students to develop foundational technical skills
- Increased number of under-represented populations exposed to manufacturing and STEM fields

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lift LIGHTWEIGHT INNOVATIONS

ABOUT THE PROJECT

MakerMinded will have a national scope with a continuing roll-out, starting in Tennessee and now in Kentucky.

KENTUCKY ASSOCIATION OF MANUFACTURERS

makerminded
OPENING MINDS TO ADVANCED MANUFACTURING

iCUBE
IMAGINE + INSPIRE + INNOVATE

The Kentucky Association of Manufacturers will drive the Kentucky state roll-out process, including:

- Customizing the portfolio programs for local employers and organizations
- Leading the statewide communications & marketing efforts for program implementation
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- Managing the leader board and reports
- Ensuring consistent platform functionality

LAUNCH AND EVALUATION IN KENTUCKY

Jan 2017

Roll-out and implementation

- Roll out across Kentucky with 50 schools for first half of the school year
- Working with the Kentucky Department of Education for widespread awareness and use of MakerMinded

Fall 2017

Fall 2017 – Year one results report

Metrics to be collected:

- Schools activated and engaged in the MakerMinded platform
- Activities/programs completed by students (at school, county, and state-levels)
- Percentage of students who indicate interest in pursuing further STEM/manufacturing education and careers (through participation surveys)
- Real-time feedback of students' experiences with programs and activities
- Reported completion point variance in schools, to determine areas of strength and weakness
- Manufacturing industry awareness and interest as demonstrated in STEM surveys pre- vs. post-implementation
- Number of rural and at-risk schools that participate in the program

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

QUOTE

“MakerMinded is helping to inspire and prepare the next generation of manufacturing leaders and ensure Kentucky continues to be a great place to innovate and make things.”

GREG HIGDON

PRESIDENT AND CEO,
KENTUCKY MANUFACTURERS ASSOCIATION

BUILDING 21ST CENTURY MANUFACTURING TALENT

Modern Manufacturing Work-Study Program: Building Ohio's Advanced Manufacturing Talent Pipeline in an Accelerated High School-to-College-to-Jobs Pathway

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Manufacturing represents a critical component of Ohio's economy. The sector accounts for over $80 billion, or one-sixth of the state's total GDP. Only six other states have a higher share of their GDP focused on manufacturing. The divide between the need for workers and students earning relevant degrees and training has strained manufacturing employers nationwide. In central Ohio, automotive manufacturers struggle to find technicians.

With the rapidly evolving technologies prevalent in today's manufacturing, technicians need higher level skills and many need an Associate's degree or industry certification and relevant experience to be fully prepared to enter the workforce. Ohio employers posted over 4,000 online ads for manufacturing technicians in 2015. Meanwhile, less than a thousand students earned technician degrees from accredited colleges in the Buckeye state. In Marysville, Ohio, Honda North America Services LLC has a critical need for manufacturing technicians. The firm expects a need to hire and train an average of 400 new technicians annually.

The rising costs of education further compound the issue; tuition for a two-year degree from a public college costs about $7,000, on average. That does not include other expenses, like books, transportation, and living arrangements. In addition, not enough high school students receive appropriate STEM-related education to enter math and science-intensive studies immediately. The supply-demand gap in technicians can be alleviated by allowing students to earn high school and college credit concurrently and engaging with manufacturers to create work-study programs.

THE SOLUTION

To address the need for quality technicians for automotive manufacturers in Ohio, Columbus State Community College has collaborated with local employers and high schools to establish the Modern Manufacturing Work-Study Program. With an investment from LIFT and an awarded grant from the National Science Foundation, the program will become a reality in Marysville, Ohio.

In partnership with Marysville STEM Early College High School and local manufacturers, in particular Honda North America Services, students will earn the necessary education and training required in today's advanced manufacturing technician roles. By dual enrolling while still in high school, students will have the opportunity to cut in half the time necessary to earn an Associate's degree, thereby saving 50% on tuition costs. Furthermore, early access to college credits will allow students to move directly into the work-study at Honda or other regional manufacturers as year two students.

PROJECT LEAD

Columbus State Community College

PARTNERS

Honda North America Services LLC

Other regional manufacturing employers

Marysville STEM Early College High School (via Marysville Schools)

Miami University Middletown Department of Engineering Technology

Miami University Middletown Applied Research Center (Project Evaluator)

GEOGRAPHIC FOOTPRINT

The Modern Manufacturing Work-Study Program will focus on high school students enrolled in the Marysville STEM Early College High School in Marysville, Ohio. The project emphasizes attracting under-served populations, such as female, African-American, and students from geographically rural areas. The Work-Study Program design is replicable in other regional economies and with other industry-education partnerships.

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Expanding work and learn opportunities for students

Creating enhancements to engineering curriculum using lightweighting technologies

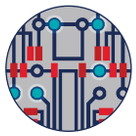
Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing careers

ABOUT THE PROJECT

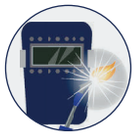
Through the work-study program, students will expand their knowledge of lightweighting concepts as they work at Honda or another regional manufacturer for three days per week and take colleges courses two days per week. Upon completing the program, students will graduate with an Associate of Applied Science in Electro-Mechanical Engineering Technology, and can anticipate becoming employed full-time at Honda or another regional manufacturer. Graduating students will also have the option of enrolling in a Bachelor of Engineering Technology through Miami University.

Graduating technicians will have the following skillsets critical to lightweight manufacturing:



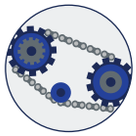
Electrical (AC and DC)

Hydraulics



Welding

Programmable logical controllers



Mechanical drive systems

Safety and troubleshooting

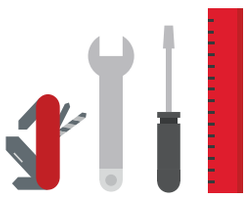
Pneumatics

Light weighting

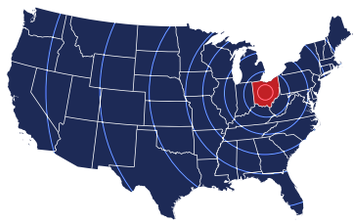
With supplemental LIFT funding, Columbus State will operationalize a required hands-on manufacturing laboratory at the Marysville STEM Early College High School. The new manufacturing laboratory will include simulators, installation, wiring, and assorted smaller supplies.

DELIVERABLES

150+ students enrolled in the program over the next five years



Improved technical skills of graduates and greater pool of applicants for technician openings



Replicable model for greater implementation around the state and nationwide

For questions about LIFT Education & Workforce initiatives, contact Director Emily DeRocco at ederocco@lift.technology.

LIFT LIGHTWEIGHT INNOVATIONS

BUILDING 21ST CENTURY MANUFACTURING TALENT

Aligning Manufacturing USA Technology and Talent Development:
Strengthening University-Industry Partnerships to Build a Technology-Savvy Manufacturing Workforce

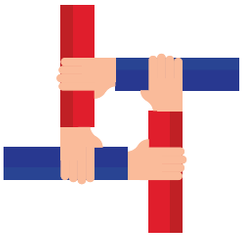
An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Manufacturing is becoming more cutting-edge every day, and workers are expected to have advanced math skills and scientific prowess to join the workforce and continue driving innovation. Historically, much of the manufacturing workforce has been developed in two education silos: the technician, assembly, and skilled trades through apprenticeships and skilled training programs in vocational education and community colleges; and the engineers in university programs of study. Now, the infusion of technology across all manufacturing sectors and at all levels of design and production requires the workforce to have higher level skills and a significant set of competencies related to new technologies, materials, and processes.

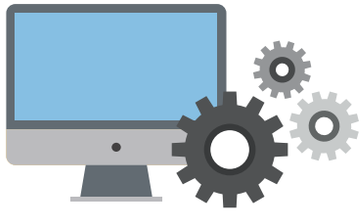
Over 31 percent of the more than 343,000 advanced manufacturing jobs posted between October 2015 and September 2016, required applicants to have, at minimum, a Bachelor's degree. Yet, many degree programs are not created with industry in mind. As the advanced manufacturing industry evolves, so do employer needs. Strong partnerships are needed between post-secondary education and industry. If community and technical colleges and universities are not incorporating the evolving needs of industry into their curriculum and training opportunities, their students will not be prepared for the world of innovation in advanced manufacturing.

THE SOLUTION



Building a Team of Education Experts

LIFT, as a member of Manufacturing USA, will work to align technology and talent development by empaneling an Expert Educator Team from universities and community colleges to help identify the knowledge, skills and abilities workers at all levels will need in order to deploy the technologies, materials, and processes created at LIFT.



Aligning Technology Development Plans with Training Competencies

LIFT's Expert Education Team will strengthen the connection between emerging technologies and educational programs of study by identifying for faculty the competencies related to using these technologies in the design or production environment, to better prepare students to enter the workforce after graduation.

Providing Industry-Driven, Technology-Aligned Work-and-Learn Curricula

LIFT will Increase access to opportunities for students to engage in work-based learning activities by making work-and-learn a part of the university and community college curricula to produce graduates more capable and confident in using new manufacturing technologies and processes.

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Expanding work and learn opportunities for students

Understanding workforce demand-supply gaps

Ensuring students gain STEM foundational skills for success in manufacturing careers

Creating enhancements to engineering curriculum using lightweighting technologies

Offering on-the-job training solutions for industry partners

Linking and leveraging resources and related initiatives on the ground today

THE PLAN

LIFT, APLU and NCMS will convene an Expert Educator Team (EET) with participants from LIFT and APLU member universities to work with LIFT's industry members to:

1. **Identify workforce competencies and develop strategies aligned with LIFT technology development plans and industry goals**
2. **Disseminate the core competencies to university and community and technical college partners for curriculum content enhancement and development and student attraction into the field**
3. **Identify work-and-learn strategies specific to LIFT technology pillars in support of industry member needs and enhance their availability to students**
4. **Expand work-and-learn opportunities to be part of curriculum at partner universities**

   Examples include:
   - Internships and Externships
   - Problem-Based Learning
   - Capstone Courses and Projects
   - Undergraduate Research

These activities will result in:

Foresight of technology advances to come for materials and processes

Engagement of students in work-and-learn opportunities as part of their education pathway

Integration of new technology, work-and-learn, and industry needs into higher education curriculum

PROJECT LEAD

The Association of Public and Land-grant Universities (APLU)

The Association of Public and Land-grant Universities (APLU) is a research, policy, and advocacy organization dedicated to strengthening and advancing the work of public universities. With a membership of 236 public research universities, land-grant institutions, state university systems, and affiliated organizations, APLU's agenda is built on the three pillars of increasing degree completion and academic success, advancing scientific research, and expanding engagement.

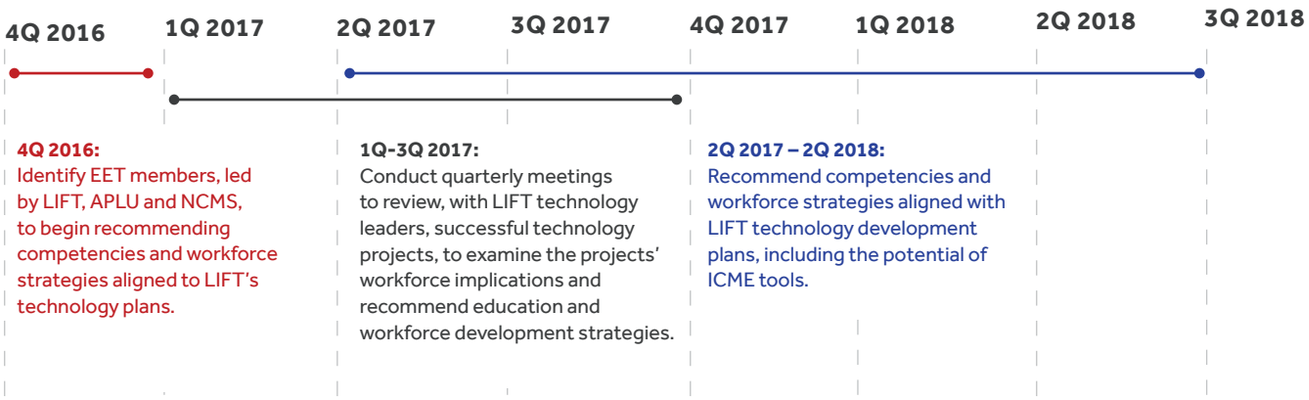
PARTNERS

The National Center for Manufacturing Sciences (NCMS)

The National Center for Manufacturing Sciences (NCMS) is the largest cross industry collaborative research & development consortium in North America, and is dedicated to driving innovation in commercial, defense, robotics and environmentally sustainable manufacturing.

PROJECT TIMELINES

Aligning Education & Workforce Strategies With LIFT's Technology Advancements

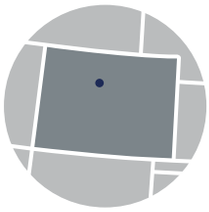


Developing Technology-Aligned, Work-and-Learn Education Strategies

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

GEOGRAPHIC FOOTPRINT

APLU members in the LIFT 5-state region and **LIFT's research partners. A * designates institution as both an APLU member and a LIFT research partner.**



Colorado

- Colorado School of Mines*

Illinois

- Northwestern University

Indiana

- Ball State University
- Indiana University
- Indiana University-Purdue University Indianapolis
- Purdue University*
- University of Notre Dame

Kentucky

- Kentucky State University
- University of Kentucky*
- University of Louisville

Maryland

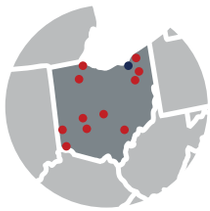
- Johns Hopkins University

Massachusetts

- Massachusetts Institute of Technology*
- Worcester Polytechnic University

Michigan

- Michigan State University*
- Michigan Technological University*
- Oakland University
- University of Michigan*
- Wayne State University*
- Western Michigan University



Ohio

- Bowling Green State University
- Case Western Reserve University
- Central State University
- Cleveland State University
- Kent State University
- Miami University
- Ohio University
- The Ohio State University*
- The University of Akron
- The University of Toledo
- University of Cincinnati
- Wright State University

Pennsylvania

- Pennsylvania State University*

Tennessee

- Middle Tennessee State University
- Tennessee State University
- The University of Memphis
- The University of Tennessee, Knoxville*

Texas

- University of North Texas*
- University of Texas at Austin*

BUILDING 21st CENTURY MANUFACTURING TALENT

State Manufacturers Associations Collaboration Initiative: Tennessee Joins LIFT Partnership for Talent Development, Small and Medium Enterprise Outreach, Membership Services and Development

An Education & Workforce Development Initiative for LIFT... Lightweight Innovations for Tomorrow

THE PROBLEM: Solving Big Issues Requires a Broader Team of Experts Across the Region

As both demand and employment in lightweighting-related advanced manufacturing jobs grow across the five-state LIFT region, including Michigan, Indiana, Ohio, Kentucky and Tennessee, LIFT is continuing to develop initiatives to better address gaps between workforce supply and employer demand.

While LIFT's membership and state-based education and workforce development teams have provided insight into each state's business environment, available talent, and skills gaps, a broader team of experts, with deep roots in each state and covering a wide spectrum of manufacturing industries and capabilities, is needed to fully address the growing workforce needs in our region.

PARTNERS

- The Ohio Manufacturers Association (OMA)
- The Kentucky Association of Manufacturers (KAM)
- The Indiana Manufacturers Association (IMA)
- The Tennessee Chamber of Commerce & Industry

EXPECTED ROLES OF THE STATE MANUFACTURERS ASSOCIATION PARTNERS

Tennessee will join the existing LIFT partnerships with SMAs in Ohio, Kentucky, and Indiana to expand our understanding of the needs of the manufacturing industry beyond those three states and into the Volunteer State. The growing partnerships will showcase the benefits manufacturers find in LIFT and the other Manufacturing USA Institutes.

lift LIGHTWEIGHT INNOVATIONS

State Manufacturing Association partners and LIFT will work together in the following ways:

Share information from LIFT and other Manufacturing USA institutes with manufacturers

Serve as a forum for manufacturers to provide LIFT leadership the perspective of manufacturing employers

Partner on targeted and effective Education and Workforce initiatives

Increase engagement of small and medium enterprises

Continually identify potential new LIFT partners in respective states

THE SOLUTION: Teaming Up With Additional State Manufacturers Associations

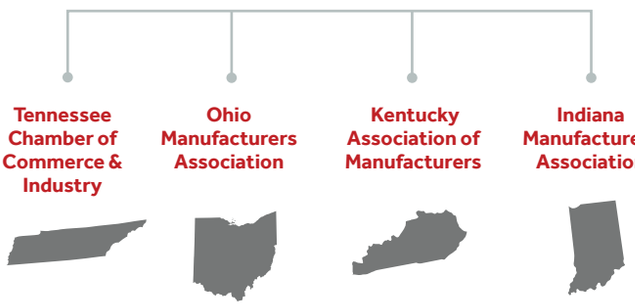
The role of state manufacturers associations (SMAs) in talent development is expanding, and LIFT has now partnered with its fourth SMA -- the Tennessee Chamber of Commerce & Industry -- to help them grow in that space and deepen LIFT's relationships with Tennessee's manufacturers and educators.

LIFT's partnerships with SMAs now include the Ohio Manufacturers Association, the Kentucky Association of Manufacturers, the Indiana Manufacturers Association and the Tennessee Chamber of Commerce and Industry, bringing a combined 430 year legacy of manufacturing success. These groups reach thousands of manufacturers in their states and have served as the single, most representative voice of manufacturers to create manufacturing-friendly state policies in their state capitals and workforce programming in their communities.

SMAs are an important voice in the current LIFT state teams and will help serve as a connector between the institute and each state's key policymakers. With a strong legacy of helping manufacturers across the region, these four organizations have worked to strengthen the industry by supporting public policies, promoting awareness and providing education about the industry.

By adding the Tennessee Chamber of Commerce and Industry to the existing partnerships, members of both LIFT and the SMAs will be able to leverage the assets and expertise of all partners – from manufacturing innovation projects, to education and workforce development programs, to support of pro-manufacturing policies in the state capitals.

430 years of experience



3,750 member companies collaborating across four states

ABOUT THE PARTNERS

Founded in 1912, the Tennessee Chamber of Commerce & Industry also serves as the Tennessee Manufacturing Association. With statewide partnerships with business and local chambers, the Chamber works in the halls of the Legislature on behalf of business and also with companies and educators throughout the Volunteer State to build a world-class workforce.

The Ohio Manufacturers Association's (OMA) membership of 1,400 companies reflects the type, size and distribution of manufacturing across Ohio in all manufacturing verticals, including transportation equipment, plastics, fabricated metal, machinery, and chemical. OMA facilitates Ohio manufacturers working together—and learning from one another—in key management disciplines of energy, environment, government affairs, human resources, safety & workers' compensation, tax & finance, workforce, and matters of manufacturing leadership.

Established in 1911, the Kentucky Association of Manufacturers is Kentucky's most effective advocate for manufacturers. KAM's mission is to protect and create a manufacturing-friendly environment in Kentucky. In addition to advocating, KAM connects, educates and provides cost-saving programs and products to members. For more information, go to: www.KAM.us.com.

Formed in 1901, the Indiana Manufacturers Association (IMA) is the second oldest manufacturers association in the country and the only trade association in Indiana that exclusively focuses on manufacturing. The IMA is dedicated to advocating for a business climate that creates, protects and promotes quality manufacturing jobs in Indiana. Indiana is one of the top manufacturing states in America in wealth and jobs created, sustained and supported. More than 50 percent of all employment in Indiana has some connection to manufacturing.

ALIGNMENT TO STRATEGIC FOCUS AREAS

- Address the gaps in workforce competencies needed by manufacturers
- Expand work and learn opportunities for students
- Offer on-the-job training solutions for industry partners
- Link and leverage resources on the ground today
- Expand knowledge about and credibility of both LIFT and the National Network of Manufacturing Institutes broadly

For more information, please see lift.technology or contact LIFT Education & Workforce Director, Emily DeRocco at ederocco@lift.technology.

BUILDING 21ST CENTURY MANUFACTURING TALENT

Upskilling Incumbent Workers:
Professional Certification in Lightweight Additive Manufacturing

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Ohio is ranked sixth in the nation for manufacturing employment concentration and the state's manufacturing industry contributes $80.7 billion to the national economy. With over 700,000 workers employed in the field, manufacturing is integral to Ohio's success. Despite the strength of the industry, fewer individuals are entering the manufacturing field. In 2015, only 29,816 individuals completed training and degrees relevant to advanced manufacturing jobs while employers posted 83,742 available jobs in the state. Many efforts are underway to increase interest in advanced manufacturing among the future workforce. However, employers need workers to fill positions quickly. One way for manufacturers to get the talent they need for immediate success is to train their current workers in the new skills necessary for production.

THE SOLUTION

The Siegal Lifelong Learning Program (SLLP) at Case Western Reserve University (CWRU) in Ohio was founded in 2012 with the mission to develop robust educational activities for working professionals. In collaboration with LIFT and other industry partners, SLLP will develop specialized programming for working professionals to increase their knowledge of lightweight metals and other advanced manufacturing technologies. This approach serves an unmet need for many employers and will be a high-quality, university-led program for upskilling incumbent workers to fill job demands.

PROJECT LEAD

Case Western Reserve University Siegal office of Continuing Professional Studies

PARTNERS

EWI
Ohio Aerospace Institute (OAI)
MAGNET
The Timken Company
Parker Hannifin
Materion

ABOUT THE PROJECT

SLLP Office of Continuing Professional Studies will create open enrollment courses in technical topics with input from project partners EWI, Ohio Aerospace Institute (OAI), and MAGNET to ensure that course materials align with industry needs across Ohio.

EWI — **Develops, tests, and implements advanced manufacturing technologies**

EWI is the leading engineering and technology organization in North America dedicated to developing, testing, and implementing advanced manufacturing technologies for industry.

OAI — **Enhances our partners' aerospace competitiveness**

OAI's mission is to enhance our partners' aerospace competitiveness through research and technology development, workforce preparedness, and engagement with global networks for innovation and advocacy.

MAGNET — **Supports, educates, and champions Northeast Ohio manufacturing**

MAGNET: The Manufacturing Advocacy and Growth Network is part of the Ohio Manufacturing Extension Partnership (MEP), which supports, educates, and champions Northeast Ohio manufacturing with the goal of transforming the regional economy into a powerful, global player.

IMPACT

- Additional training options for incumbent workers in Ohio
- Increased enrollment in CWRU graduate programs related to advanced manufacturing
- An increase in the skillset of workers employed by manufacturers in the state

lift® LIGHTWEIGHT INNOVATIONS

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Creating enhancements to engineering curriculum using lightweighting technologies

Linking and leveraging resources and related initiatives on the ground today

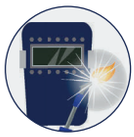
Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing careers

Program graduates will receive higher education training in:

Advanced materials, including metals

Lightweighting



Welding

Advanced manufacturing techniques identified by employer partners

The project may offer two unique features for future graduates:

Full-time employment at Parker, Materion, or another regional manufacturer

For additional information about Case Western Reserve Siegal Office of Continuing Professional Studies, please contact Monica Dumitriu at mxd2@case.edu.

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

lift® LIGHTWEIGHT INNOVATIONS

BUILDING 21ST CENTURY MANUFACTURING TALENT

Teaching Factory: Building a sustainable model for collaborative education in STEM technologies

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

Hands-on training grows more important each day for manufacturing workers. Not only do companies need highly skilled and trained individuals but also the equipment necessary for training has become complex and expensive enough that many educational institutions cannot house equipment at their facilities. Stand-alone and separate institutions, while they have the technical expertise to teach the workforce, cannot purchase all of the equipment necessary for training. Without access to the proper materials and machinery, students are not as prepared for the world of work in manufacturing and employers are less able to find the workers they need. Companies and educational institutions across the nation face this problem.

ABOUT THE PROJECT

Students engaged in the program will:

1. Earn stackable, portable, credentials that can culminate in a certificate or a degree
2. Have the opportunity to gain full-time employment at one of the many manufacturers in the collaboration

THE SOLUTION

To address this growing problem for educators and manufacturers across the country, Youngstown State University Research Foundation is leading the development of the Mahoning Valley Innovation & Commercialization Center, (MVICC), a collaborative infrastructure for training workers on technical equipment. This model will serve as the first of its kind in manufacturing, creating the "Teaching Factory" by replicating the concept of teaching hospitals across the U.S. The Teaching Factory will use shared equipment, facilities, and training, all focused on the greater purpose of creating the talent of tomorrow and further developing incumbent workers today. MVICC will serve as a hub to connect students to cutting-edge equipment and training. Partners from all levels of education will collaborate and combine assets to create a "living career pathway." Partners include:

- Universities
- Community Colleges
- Career and Technical Centers
- High School STEM Academies

MVICC program features will include:

- Shared laboratory for hands-on experience and real-world application
- Electronics
- Machining
- Additive manufacturing
- Industry-standard equipment
- Robotics
- Industrial maintenance
- Advanced materials
- STEM education
- Welding
- Mechatronics
- Lightweight metals

Sustainable and Replicable Model

MVICC's structure of collaboration is sustainable as new assets will be shared among partners to ensure that as many students as possible have access. Many institutions receive one-time investments of capital for equipment investment but the funding is not sustained as technology changes. By sharing equipment, more organizations can fully utilize equipment and help to alleviate the issue of long-term funding for technology advancement.

MVICC will also be adopting a Teaching Factory model, similar to that of a teaching hospital. Students are able to get hands-on experience while customers are being served. Students at MVICC will create products to generate revenue that offsets their cost of training.

Partners will engage the Ohio Department of Higher Education to identify other collaborative bodies that may be working on a similar concept. The group will also collaborate with the Ohio Federal Research Network to ensure that the training programs created fill the needs of NASA and the Air Force Research Laboratory. This scalable and proven model can be replicated by other national manufacturing innovation institutes and manufacturing collaborations across the nation.

PROJECT LEAD

Youngstown State University Research Foundation

Mahoning Valley Manufacturers Coalition - Representing more than 50 of the region's most influential manufacturers

PARTNERS

Eastern Gateway Community College

Choffin Career & Technical Center

Columbiana County Career & Technical Center

Mahoning County Career & Technical Center

Trumbull Career & Technical Center

STEM Academy

Youngstown City Schools

City of Youngstown

Youngstown Business Incubator

Youngstown State University

ALIGHMENT TO LIFT STRATEGIC FOCUS AREAS

Linking and leveraging resources and related initiatives on the ground today

Ensuring students gain STEM foundational skills for success in manufacturing careers

Creating enhancements to engineering curriculum using lightweighting technologies

Attracting more young people to manufacturing careers

Attracting more young people to manufacturing careers

For questions about LIFT Education & Workforce initiatives, contact Director Emily DeRocco at ederocco@lift.technology.

LIFT LIGHTWEIGHT INNOVATIONS

BUILDING 21ST CENTURY MANUFACTURING TALENT

Online Training Modules for LIFT Members

An Education & Workforce Development Initiative for LIFT...
Lightweight Innovations for Tomorrow

THE PROBLEM

The LIFT region, including Michigan, Ohio, Indiana, Kentucky, and Tennessee, is facing a skills gap that is expected to widen by more than 50% in the coming decade. Employers in the region posted 336,166 jobs during 2016 related to advanced manufacturing, and many of these jobs go unfilled due to lack of training for incumbent workers and too few new qualified workers joining the field. In 2015, only 110,247 individuals in the LIFT region completed relevant training for advanced manufacturing jobs. Comparing employer needs to relevant training "completers," the region currently faces three open jobs per newly trained individual. One way that companies can ameliorate this talent gap is to train their current workforce on new and emerging technologies. Training for new technologies is often expensive and difficult to coordinate, especially for small and medium-sized companies. Easy-to-access, affordable, high-quality training does not exist for many new technologies related to lightweighting. This further expands the already wide talent gap for companies seeking to upskill their current workers.

THE SOLUTION

To address this challenge, LIFT is sponsoring the creation of new online training modules related to lightweighting, in collaboration with EWI and 180Skills, with educational resources available to all LIFT member companies. This collaboration will allow LIFT members to access high-quality training for new lightweighting technologies without excessive cost or the need for workers to travel. Utilizing virtual training developed through LIFT, EWI, and 180Skills, LIFT members will be able to upskill their incumbent and new workers on new technologies, immediately reducing the talent gap they are facing.

- EWI is a recognized leader in training for new lightweighting technologies and provides frequent training classes, both onsite and at customer facilities for advanced welding and inspection technologies related to lightweighting.
- 180Skills develops interactive online technical education content making advanced manufacturing training available to companies of all sizes in all locations across the nation.

DELIVERABLES

Online training modules for LIFT members:

Nondestructive Evaluation for Lightweighting Materials

7

student contact hours

Fundamentals of Arc Welding for Lightweighting Materials

4.3

student contact hours

ABOUT THE PROJECT

EWI will develop key content for several training modules in collaboration with 180Skills.

These include:

MODULE 1:
Nondestructive Evaluation

Topics covered include:

- Visual Testing
- Liquid Penetrant Testing
- Magnetic Particle Testing
- Eddy Current Testing
- Ultrasonic Testing
- Radiography

Courses include basic principles, equipment functionality, and an introduction to advanced methods of Phased Array Ultrasonic Testing and Computer Tomography.

MODULE 2:
Basic Fundamentals of Arc Welding for Lightweighting Applications

PROJECT LEAD

EWI

EWI is a leading engineering and technology organization in North America dedicated to developing, testing, and implementing advanced manufacturing technologies for industry. EWI provides applied research, manufacturing support, and strategic services to leaders in the aerospace, automotive, consumer products, electronics, medical, energy & chemical, government, and heavy manufacturing industries.

PARTNERS

180 Skills

180 Skills is an online career and technical education experience with a library of over 650 courses and 1,100 hours of education, to enable career seekers to gain the skills they need to attain meaningful employment in the least amount of time.

LIFT members

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Creating enhancements to engineering curriculum using lightweighting technologies

Offering on-the-job training solutions for industry partners

Linking and leveraging resources and related initiatives on the ground today

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

BUILDING 21ST CENTURY MANUFACTURING TALENT

Building the Talent Pipeline for Lightweight Manufacturing

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

As lightweight additive manufacturing continues to grow across the country, employers are concerned that the skills gap in the workforce is growing at the same or at an even greater rate. Additive manufacturing, particularly as it relates to lightweight applications, requires the use of highly complex geometry and algorithms which provide the high strength-to-weight ratios required, while utilizing the production flexibility provided by additive manufacturing.

The gap between what can be imagined, what can be actually produced and how much weight can be removed through lightweight additive manufacturing is closing in. According to the 2016 Wohler's Report, 15 percent of the 278,000 additive manufacturing machines purchased the previous year were industrial machines.

There is little doubt that additive manufacturing, with its capability to produce highly complex geometry, will play a significant role in the next generation of lightweight parts for aerospace, automobiles and many other industries.

However, in order for U.S. manufacturers to remain competitive in the global economy, the workforce will not only need to possess expertise in operating additive manufacturing machines, but also in designing new geometries that take advantage of lightweighting techniques.

THE SOLUTION

Cincinnati State Technical and Community College and its recently formed Technical Advisory Committee (TAC) will develop an open-source curriculum to provide incumbent workers and new students with knowledge and hands-on experience in two tracks:

Track 1: Utilizing additive manufacturing equipment and techniques to produce precision objects across a wider field.

Track 2: Leveraging the evolving array of digital tools that allow students to become additive manufacturing designers, modelers and simulators – activities which previously required graduate level engineering education.

A MANUFACTURING USA COLLABORATION

America Makes

America Makes in Youngstown, Ohio, is another Manufacturing USA institute which is focused on accelerating the adoption of additive manufacturing technologies in the United States manufacturing sector and increasing domestic manufacturing competitiveness.

The strong alignment between LIFT and America Makes in lightweighting and additive manufacturing [AM] provides the technical expertise of many industry members and academic partners of the two institutes to this initiative.

PROJECT LEAD

Cincinnati State Technical and Community College

PARTNERS

Southwest Ohio Aerospace Region (SOAR)
AeroHUB

TAC Members:
University of Cincinnati Research Institute
Procter & Gamble
Able Tool
Belcan
General Nano
Dayton Area Defense Contractors
EWI
Imaginistics
KineticVision
Mazak Corp.
Rhinestahl Corp.
Red Tiger Investments,

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Creating enhancements to engineering curriculum using lightweighting technologies

Linking and leveraging resources and related initiatives on the ground today

Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing careers

ABOUT THE PROJECT

The curriculum developed will have the following benefits:

Open Source and Customizable

The curriculum will be fully open source. Sharing this curriculum is fundamental, and the partners welcome the development of a continuous-improvement community around this effort to help ensure its relevance to a wide audience and its sustainability from the ground up. The curriculum will also be developed in a way that it could be customized to meet specific employer needs, further enhancing its relevance.

Training the Trainers

Even with an open source curriculum, additive manufacturing is a new area of instruction for most faculty. A mentoring program will be established to provide faculty with training in delivering the curriculum, first at Cincinnati State, and once refined, expanded to the five states in the LIFT region. The two-semester mentoring program will allow new faculty to shadow an experienced instructor for one semester either in person or by video and then teach the course with coaching for one semester.

Part of a Flexible Career Pathway

Careful thought has been given as to how to structure a manufacturing career pathway that makes it possible for students to secure high demand jobs in AM and advanced manufacturing at multiple levels. The curriculum will be designed to fit into the career pathway allowing maximum flexibility for students with different experience levels, and allowing students to step from college to job to college and back - all the while "stacking" credentials into a degree.

Sustainability

Funding from LIFT will be instrumental for startup of the project, including curriculum development and marketing, which the sponsors anticipate will drive open enrollment and market-based sustainability. In addition, plans include the following to ensure project sustainability following LIFT funding:

- The project will seek support from the Cincinnati State Technical Advisory Committee (TAC) to secure funding for subsidizing tuition and equipment.
- Partners for a Competitive Workforce, a regional umbrella organization for workforce development, has committed to seeking funding to help sustain the project after LIFT funding.
- The project will also leverage public funds to provide post-startup support for the program.

DELIVERABLES

Year 1

Curriculum

- **Track 1:** Additive Manufacturing Development and Delivery

Mentoring

- Develop mentoring program

Year 2

Curriculum

- **Track 1:** Additive manufacturing delivery and optimization
- **Track 2:** Modeling and Simulation development

Mentoring

- Internal and external mentoring

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

lift® LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Taking Teacher Externships to Scale in Kentucky: Experiential Learning About Manufacturing and Lightweighting Career Opportunities

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

As advanced manufacturing technology and processes evolve and are implemented by industry, many teachers and instructors are unaware of the new technologies and potential career pathways now available in the manufacturing economy. Teachers' lack of awareness results in students not having exposure to 21st century, high-tech advanced manufacturing. Instructors and teachers remain critical facilitators to develop and cultivate connections between academic and technical skills, and how those skills translate to jobs and occupations in their future. When students are introduced to career pathways in high school, or earlier, they begin to understand how their course work translates to success in the careers they choose after graduation.

Without a stronger link between learning and work, the manufacturing skills gap continues to grow despite the demand for skilled workers. Nearly 20% of lightweighting workers are over the age of 55 and will be retiring in the next 20 years. And, across Kentucky, employer demand, as defined by online job postings, has grown consistently since 2010. In the 4th quarter of 2016, demand was at one of the highest points over the past four years with employers posting about 7800 jobs related to lightweighting. It is critical that students today understand the opportunities presented by a career in manufacturing tomorrow.

THE SOLUTION

Building on Past Success

In 2015, LIFT partnered with the Kentucky Community & Technical College System and the Northern Kentucky Industry Council to establish a manufacturing externship experience for teachers, emphasizing employers who utilize or are transitioning to lightweight technologies and materials. The participating teachers were able to share their new knowledge of and appreciation for advanced manufacturing with their students to encourage more of them to pursue advanced manufacturing careers post-graduation. Teachers took real-world manufacturing experiences, translated them to classroom learning and ultimately impacted tomorrow's manufacturing workforce.

Scaling Up Statewide

In the summer of 2017, LIFT is partnering with Kentucky FAME to scale the pilot to a statewide and sustainable initiative. The program will provide up to 135 teachers across the nine Kentucky FAME chapters with on-the-job training with local manufacturers, customized for their particular region and school system.

PROJECT LEAD

Kentucky FAME – A statewide partnership of manufacturers whose mission is to be a conduit between industry and education.

The nine KY FAME chapters include:

- Bluegrass
- Cumberlands
- Louisville
- Owensboro
- Lincoln Trail
- Northern Kentucky
- South Central Kentucky
- West Kentucky
- Northeast Kentucky

PARTNERS

- Kentucky Association of Manufacturers
- Foundation for Kentucky Industry
- School Systems in Each Kentucky FAME Chapter
- Kentucky Community and Technical College System
- University of Kentucky College of Education

ABOUT THE PROJECT

The goal of the teacher/instructor externship experience is to connect classroom learning to authentic activities and encourage teachers to use that connection in their classroom instruction. Specifically, this project begins developing instructor understanding of emerging technologies such as those related to lightweighting and the opportunities and challenges these technologies pose for students.

The externship experience provides business partners and teams of teachers an opportunity to learn how technical and academic course content is used in a real-world manufacturing setting. Teams of teachers – importantly consisting of both technical and academic instructors – spend up to five days in partnership with an area manufacturing business, learning about job and career opportunities and requirements, how classroom learning is applied in the workplace, and how to apply the manufacturing experience back into the classroom. Business partners assist teachers in understanding these realities and teachers then connect manufacturing practices to the content standards they are required to teach students in their respective courses.

Each regional area, across Kentucky FAME's nine chapters, will customize its program with their local manufacturers and school systems, and a statewide program coordinator will ensure the program is implemented consistently across the state to meet objectives.

A standard five-day program would include:

Day 1
Orientation to the week ahead

Orientation

- Goals and outcomes.
- Making the most of your experience.
- Engaging business partners.
- Creating projects.

Meet and Greet

- Business partner orientation and safety protocol.

Day 2–4
On the Job

Custom Experience

Each partner employer will develop a customized itinerary and experience for their teacher/instructor partners.

Day 5
Action Plans

A.M.

Teachers spend morning reviewing information collected and developing an Action Plan for the coming school year.

P.M.

Business partners join the teachers to hear the Action Plans and discuss next steps.

For more information about the education & workforce development initiative visit www.lift.technology and contact LIFT Workforce & Education Director, Emily DeRocco at ederocco@lift.technology

lift® LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Leading a MakerMinded Vision in Ohio

Connecting the next generation of manufacturers and business leaders to the skills and experiences they need to be successful and to the companies that need their talents

makerminded
Powered by lift

PROBLEM ONE: Innovation Demands Talent

Employer demand for skilled workers is rapidly increasing, yet current workers are not prepared to fill these jobs and students are not pursuing the STEM education and training that would prepare them for a career in manufacturing.

For the U.S. to become the world leader in advanced manufacturing – particularly lightweight metals manufacturing – an educated and skilled workforce is necessary to use the new manufacturing technologies and processes being developed.

PROBLEM TWO: Students Leaving STEM Behind

In eighth grade, students start considering careers, and these considerations become clearer through high school. By the time they are seniors, however, only 16 percent are proficient in mathematics and interested in a STEM-related (Science, Technology, Engineering, Math) career. Students are less engaged in STEM training, with fewer selecting college majors in STEM fields, making it even more difficult to encourage a career in advanced manufacturing once they reach high school and college age.

Roughly 28 percent of Bachelor's degree students enter a STEM field at some point during their postsecondary education. Nearly half of those students, however, leave STEM by either changing majors or leaving college completely, creating an even larger gap in the trained workforce.

The small share of students entering STEM fields displays the lack of preparation for those careers. For manufacturers, this "disconnect" between students gaining the foundational STEM skills and the educated, skilled, and ready workforce our manufacturers need must be a national priority.

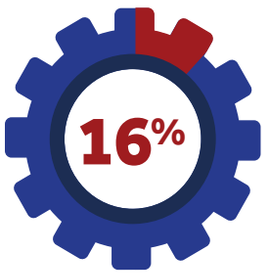
PROBLEM THREE: Jobs Are Being Left Unfilled

Over the next decade, nearly 3.5 million manufacturing jobs in the United States likely need to be filled. Pending retirements coupled with a declining flow of new workers and an increasing need for talent have created a large skills gap resulting in estimates predicting that two million of those jobs will remain unfilled.

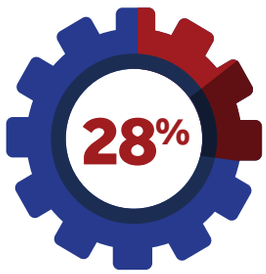
Employers seeking advanced manufacturing workers in the 5-state LIFT region posted over 77,500 online job ads during Q4 2016, including nearly 20,000 jobs posted in Ohio alone, up 16 percent from Q4 2014. Building the pipeline of talent necessary to fill these jobs demands more solutions to prepare students and new workers with necessary STEM knowledge and skills.

MORE AWARENESS AND ACCESS ARE NEEDED

Numerous world-class initiatives are addressing the serious and growing disconnect between America's youth and the STEM knowledge and skills required to succeed in the new and exciting advanced manufacturing jobs. The challenge is awareness and access, with too few students, parents, and educators learning and sharing information about the programs and how to better engage young people in activities that connect them to the world of STEM. LIFT and its partners believe a recently developed initiative will help address this challenge.



of senior year high school students are proficient in mathematics and interested in STEM



of Bachelor's degree students enter a STEM field at some point during their postsecondary education, but nearly half leave

increase of advanced manufacturing employer job demand in Ohio alone since Q4 2014

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

THE SOLUTION

CHANGING MINDSETS AND INCENTIVIZING STUDENTS AND SCHOOLS TO TAKE ACTION IN STEM EDUCATION

The MakerMinded web portal, designed by Tennessee Tech University, brings together actionable information, the power of competition and campaign communications to saturate the learning infrastructure with a manufacturing mindset to bridge the gap between activities and programs that engage and educate youth and the students who can take advantage of them. The solution delivers a diverse portfolio of successful STEM awareness and education activities to schools and students in a simple, accessible platform including both national and local-level STEM and manufacturing career exploration activities, project-based learning, formal educational resources, and other experiential learning opportunities.

MakerMinded was founded on four core principles that not only change attitudes about STEM and manufacturing, but also drive students and schools to act.

- Campaign-style communications
  All students and schools work towards a common goal—building awareness and engagement in STEM
- The power of competition
  Schools compete for points acquired for completing activities, which builds community, unites disconnected students, and empowers all stakeholders
- Student-driven programs
  Students and schools own STEM activities
- Leveraging, not reinventing, successful activities
  MakerMinded brings to scale impactful programs and saturates the marketplace with STEM.

HOW IT WORKS

The portfolio provides students with alternative options to gain foundational STEM/manufacturing skills emphasizing work-based, project-based and problem-based learning. Other key components include using cutting-edge technology, relevant "real-world" content, and industry partnerships that provide mentorship, subject matter expertise, and other learning experiences.

The programs and activities encouraged via MakerMinded provide students with a comprehensive array of foundational, technical and employability skills and essential experiences core to understanding and being prepared for STEM/manufacturing careers.

SAMPLE ACTIVITIES IN THE MAKERMINDED PORTFOLIO

A few examples of the programs and activities that are part of the MakerMinded Portfolio include:

- FIRST Robotics
- Learning Blade
- SkillsUSA
- Science Olympiad
- Destination ImagiNation
- Manufacturing Plant Tours
- Local STEM Career Days
- MATHCOUNTS
- LIFT Virtual Reality Simulation
- Science and Engineering Fairs

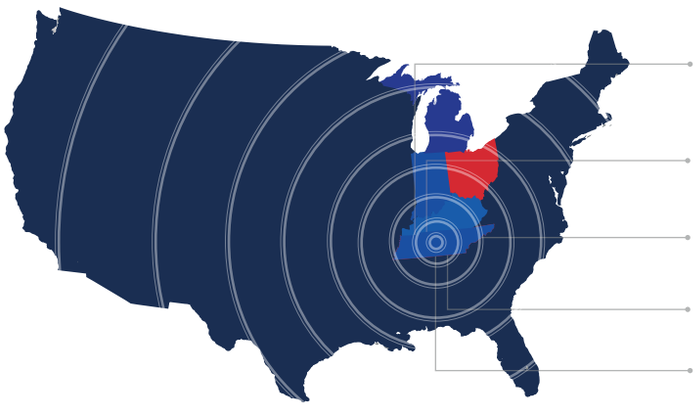
ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing

Linking & leveraging resources and related initiatives on the ground today

EXPECTED OUTCOMES



- Changed perceptions and broadened understanding among students regarding manufacturing
- More students engaged in STEM/manufacturing learning experiences
- An increase in students pursuing further STEM education and training
- More opportunities for students to develop foundational technical skills
- Increased number of under-represented populations exposed to manufacturing and STEM fields

Potential to reach over 3,800 middle and high schools and 5.9 million students across the 5-state LIFT region.

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

lift LIGHTWEIGHT INNOVATIONS

ABOUT THE PROJECT

MakerMinded will have a national scope with a continuing roll-out, starting in Tennessee, rolling out in Kentucky and now to Ohio.

Battelle will drive the Ohio state roll- out process, initially through the Ohio STEM Learning Network. Statewide rollout will include:

- Customizing the portfolio programs for local employers and organizations
- Leading the statewide communications & marketing efforts for program implementation
- Tracking progress for each school and the state
- Sponsoring and co-hosting a recognition event

The Tennessee Tech University team will manage the MakerMinded platform and Ohio-specific portal, including:

- Developing and hosting the custom web portal for Ohio's program
- Managing the leader board and reports
- Ensuring consistent platform functionality

LAUNCH AND EVALUATION IN OHIO

Battelle will drive the Ohio state roll- out process, initially through the Ohio STEM Learning Network. Statewide rollout will include:

Fall 2017

Roll-out and implementation

- Roll out MakerMinded initially leveraging the Ohio STEM Learning Network's STEM schools and expanding to other schools across the state.
- Goal to get 100 middle and high schools signed-up and active on the platform.

June 2018

June 2018 – Year one results report

Metrics to be collected:

- Schools activated and engaged in the MakerMinded platform
- Activities/programs completed by students (at school, county, and state-levels)
- Percentage of students who indicate interest in pursuing further STEM/manufacturing education and careers (through participation surveys)
- Real-time feedback of students' experiences with programs and activities
- Reported completion point variance in schools, to determine areas of strength and weakness
- Manufacturing industry awareness and interest as demonstrated in STEM surveys pre- vs. post-implementation
- Number of rural and at-risk schools that participate in the program

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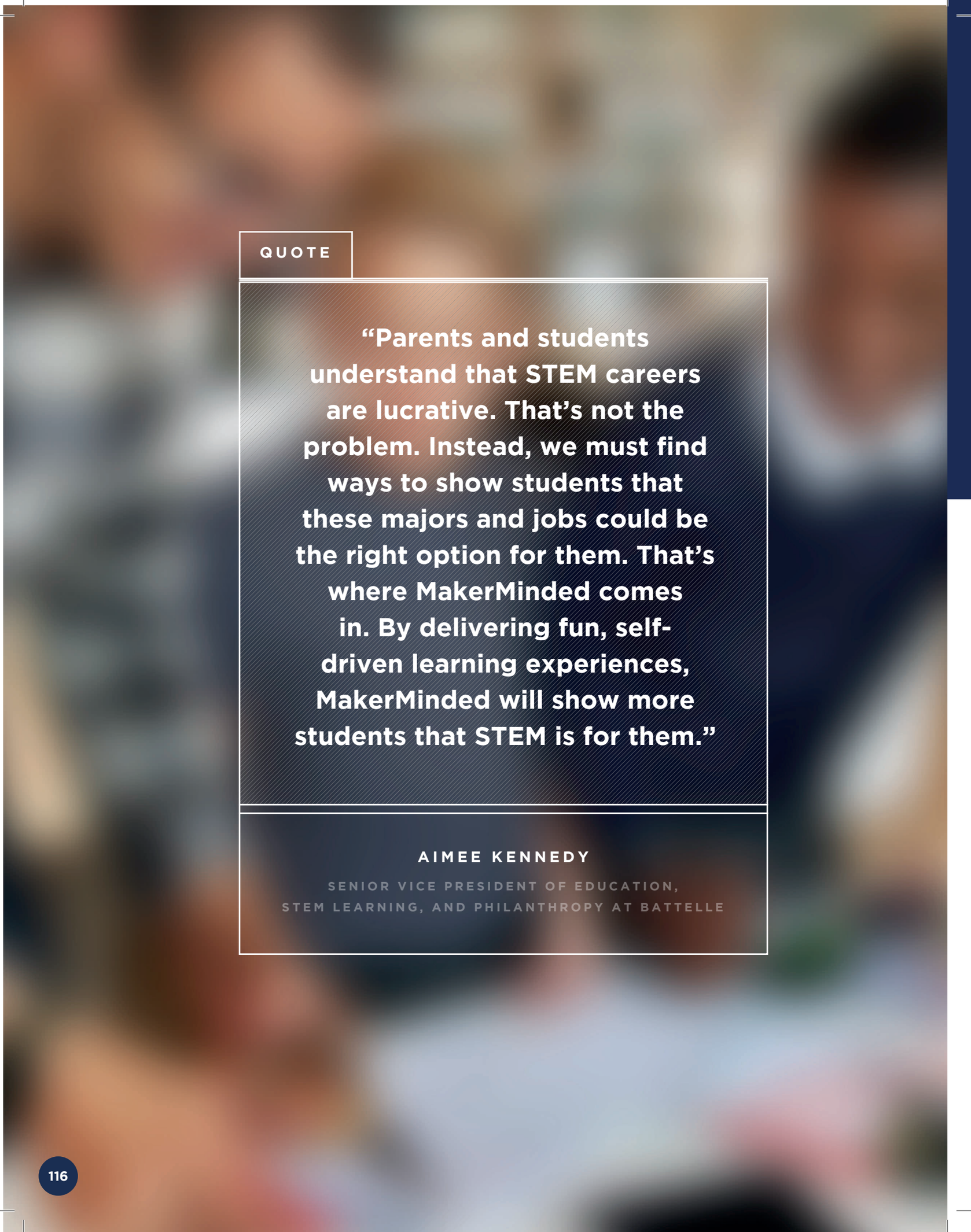


QUOTE

“Parents and students understand that STEM careers are lucrative. That’s not the problem. Instead, we must find ways to show students that these majors and jobs could be the right option for them. That’s where MakerMinded comes in. By delivering fun, self-driven learning experiences, MakerMinded will show more students that STEM is for them.”

AIMEE KENNEDY

SENIOR VICE PRESIDENT OF EDUCATION, STEM LEARNING, AND PHILANTHROPY AT BATTELLE

BUILDING 21st CENTURY MANUFACTURING TALENT

A Resource for Career Counseling: Engaging Students in Educational Pathways to Careers in Modern Manufacturing

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

The U.S. manufacturing industry faces an increasing shortage of available high-skilled technology-savvy workers. Demand for workers in STEM-related fields is expected to grow 17 percent by 2018, while the number of college graduates in those fields continues to decline. For example, in 2009, just 18 percent of bachelor's degrees awarded were in STEM fields, down from 24 percent two decades ago.

While we are beginning to increase the number of college graduates in STEM fields, the gender and racial gap within the STEM workforce continues to widen. While women comprise 49% of the college-educated workforce, only 14% of engineers are women and just 27% are working in computer science and math positions. Similar disparities exist for Hispanic and African American workers, who account for only six percent of STEM workers.

As reported in the Ohio Quarterly LIFT Report for the fourth quarter of 2016, employers in Ohio posted nearly 20,000 jobs related to lightweighting. The employment growth of lightweighting-related advanced manufacturing jobs in Ohio has gone from 651,800 jobs in 2010 to over 735,000 in 2016, a nearly 13% increase, demonstrating the growing demand for Ohio workers with lightweight manufacturing-related skills and knowledge.

With employer demand on the rise and supply of students on the decline, the manufacturing skills gap is continuing to widen and needs to be addressed with demand-driven, results-oriented solutions.

THE SOLUTION

LIFT, Battelle Education, Thinking Media and Edge Factor are developing a program to guide students towards lightweight metals and other advanced manufacturing careers by engaging them in middle and high schools in Ohio.

The program includes two proven systems – Learning Blade and eduFACTOR - that introduce metals and manufacturing careers, show engaging stories about how these careers can provide exciting and meaningful jobs, and offer activities that demonstrate and strengthen the skills needed to pursue these career paths.

Together, these programs will create a coordinated emphasis on advanced metals manufacturing careers from middle school through high school, pointing students toward post-secondary training for high-demand jobs.

PARTNERS

- Battelle for Kids
- Thinking Media
- Edge Factor
- Ohio STEM Learning Network, operated by Battelle Education
- DRMA – Dayton Region Manufacturers Association
- Fastlane MEP
- Various Ohio School Districts

MIDDLE SCHOOL
Learning Blade: LIFT, Manufacturing and other missions

→

HIGH SCHOOL
Educator: Lightweighting, machining and careers

→

COMMUNITY COLLEGES
Job-specific training

ABOUT THE PROJECT

Learning Blade ®, a product of Thinking Media, introduces STEM technologies and career opportunities through an entertaining game-based format. In the web-based system, students pursue engaging missions that solve problems, like helping an injured dolphin or building an orphanage after an earthquake. From an earlier LIFT investment, a metals manufacturing mission, "Lightweight Aircraft," has been developed and implemented as part of the Learning Blade curriculum.

eduFACTOR is a membership-based, online suite of multimedia resources including a TV series, virtual field trip experiences, technology video series, career pathways video series, hands-on CNC and 3D printing projects, interactive STEM activities, CTE success video series and more.

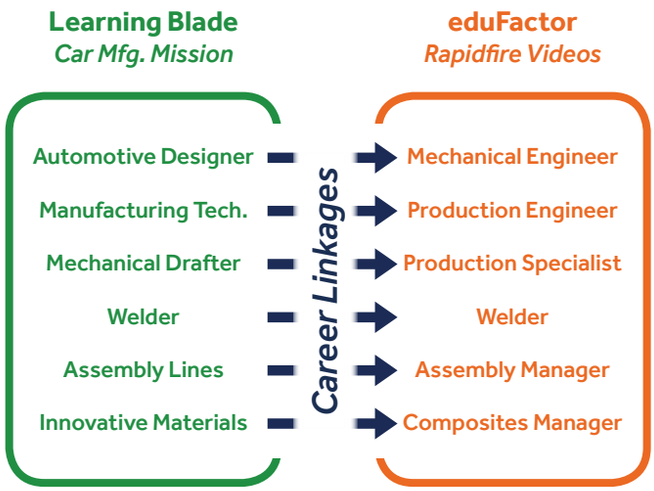
Middle School Engagement:

Students who complete selected units on manufacturing careers in Learning Blade will be directed to video resources and activities on the eduFACTOR platform that provide real-life examples of using these skills in exciting applications.

High School Engagement:

Schools will have access to a library of multimedia tools to inspire their students towards careers in manufacturing and CTE training and make learning concepts relevant in the context of a story. The platform provides teachers with 24/7 access to media, lesson plans, projects and presentations in an easy-to-understand online portal.

Here is an example of how these learning resources make a direct connection between middle and high school activities, using the Learning Blade Car Manufacturing mission and eduFactor's rapid fire videos.



DELIVERABLES

- eduFACTOR will be implemented in up to 50 high schools in Montgomery County, Ohio – including Dayton
- Learning Blade will be implemented in the feeder middle schools for the selected high schools
- Professional development will be available to all participating schools
- Informational sessions will be held to highlight the project in the involved communities

ALIGNMENT TO STRATEGIC FOCUS AREAS

Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing careers

Linking and leveraging resources and related initiatives on the ground today

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

BUILDING 21ST CENTURY MANUFACTURING TALENT

Piloting a New Model to Prepare Today's Military Personnel for Tomorrow's "Operation Next" Advanced Manufacturing Lightweighting Jobs

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

The need for individuals with the knowledge, skills and abilities to fill the projected job growth in advanced manufacturing – particularly in manufacturing that utilizes emerging technologies such as those related to lightweight metals – is well documented. There are projected to be 3.5 million available manufacturing jobs over the next 10 years and more than 2 million of those jobs will likely go unfilled unless something changes that trajectory. This 'gap' represents a daunting challenge to private sector manufacturers in general, but perhaps more critically, it represents a potentially significant threat to our nation's defense industrial base.

The National Problem Explained at a Regional Level

The national skills gap problem can be described locally. Tennessee and Kentucky are two of the top manufacturing states in the nation with employment in lightweight-related advanced manufacturing jobs in 2016 at 418,000 and 280,000 people, respectively.

With employment in lightweighting-related jobs already high, demand for additional workers is also strong. In the 4th Quarter of 2016, more than 7,800 lightweight-related advanced manufacturing jobs were posted by manufacturers in Kentucky, while Tennessee employers posted about 9,000 jobs.

Kentucky

- **280,000 people** employed in lightweight-related advanced manufacturing jobs in 2016.
- **More than 7,800** lightweight-related advanced manufacturing jobs posted in the 4th quarter of 2016.

Tennessee

- **418,000 people** employed in lightweight-related advanced manufacturing jobs in 2016.
- **About 9,000** lightweight-related advanced manufacturing jobs posted in the 4th quarter of 2016.

THE SOLUTION

OPERATION NEXT
POWERED BY lift

Separating military men and women can help to answer this challenge.

Service men and women are cited often for the leadership, integrity, work ethic and team work skills obtained through their service. The opportunity to add technical manufacturing skills to their portfolio - though Operation Next - will ensure they are highly sought after candidates for the most in-demand advanced manufacturing jobs and careers.

While there are many programs and initiatives that aim to support veterans after they make the transition from military to civilian careers, this program is different in several ways.

Separating Personnel Are In Transition Status for 6 Months

First, because separating personnel are in transition status for up to six months, Operation Next will begin before they even leave their military careers. The individuals will be able to make the most of any off-duty hours during their transition time by gaining critical skills needed in the civilian economy and, most importantly, earning nationally portable, standards-based, industry-recognized credentials in the most in-demand occupations in advanced manufacturing today.

Second, the regional manufacturers will be involved in the program even before training begins. They will meet and get to know the individuals in training. The manufacturers will offer facility tours, job-shadow opportunities and mentorship so when individuals complete their training and transition out of the military, they have the skills and the relationships to walk directly into a civilian career.

ABOUT THE PROJECT

The key components of Operation Next are:

1. Enroll in Operation Next Before You Transition
2. Connect to Program Manager and Connect to Virtual Learning Platform
3. Take Self Assessments to Determine Customized Learning Plan
4. Select Job Focus Area
5. Complete Self-Paced Online Learning
6. Complete Applied, Real-World Lab Work
7. Earn Industry Credentials
8. Connect to Employers and In-Demand Jobs

- The opportunity is accessed through a dedicated website to include exciting and engaging materials and videos about the training and advanced manufacturing careers.
- The participants can then conduct a virtual self-assessment to understand their transferable skills. They will also develop a Customized Learning Plan which considers existing skills and competencies so that 'credit' is given for what each individual already knows and can do.
- A major is then chosen: Precision Machining or Industrial Technology Maintenance.
- They sign up for lab experience - the necessary hands-on portion of the learning continuum - from a participating area post-secondary institution.
- The virtual learning portion of the training then begins. This training, including simulated hands-on application, can be done anywhere and during any time the individual has available after their daily duty assignments are complete.
- As milestones are reached in the virtual learning, the individual will be triggered to schedule on-campus college labs, hands-on learning and then, ultimately, performance assessments to earn the credential in their chosen field.

PARTNERS

Fort Campbell , US Army, Tennessee Department of Labor

IMPACT

101 Fort Campbell soldiers will participate in the pilot beginning in 2017. These soldiers will earn NIMS credentials for Precision Machining or Industrial Technology Maintenance. Based on the success of this pilot initiative, the model will be available for replication at military bases across the country.

ALIGNMENT TO LIFT STRATEGIC FOCUS AREAS

Creating enhancements to engineering curriculum using lightweighting technologies

Attracting students and workers to educational pathways and careers in manufacturing

Linking and leveraging resources and related initiatives on the ground today

Ensuring students gain STEM foundational skills for success in manufacturing careers

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

BUILDING 21st CENTURY MANUFACTURING TALENT

Heroes Alliance Cooperative Learning Center Pilot

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

The state of Michigan, and the U.S. as a whole, is currently experiencing a major skills gap for a wide range of advanced manufacturing disciplines including lightweighting technologies and additive manufacturing. Many secondary and post-secondary students have little to no awareness of the myriad advanced manufacturing careers available. Exacerbating this issue is the fact that the state is also experiencing the drain of its talent pool to other regions of the country.

For example, as of Q1 2017, there were nearly 35,000 online job ads for occupations related to lightweighting in Michigan – up from 29,000 the previous quarter and 8 percent from the previous year.

THE SOLUTION

LIFT and Heroes Alliance pilot program will develop an after-school, STEM engagement, vehicle technology competition and curriculum for Detroit high school students for the 2017-18 school year. The program will initially establish two teams that will work both independently and cooperatively to complete a vehicle technology project themed around lightweighting technologies and additive manufacturing. The pilot teams, made up of between 16-24 students, will include Western International High School and Academy of Americas High School, both from Detroit Public Schools Community District.

In response to the national agenda for increased STEM education, Heroes' Alliance has created a platform to engage students, especially underrepresented minorities in Southeastern Michigan, in STEM education through after-school enrichment. In addition to focusing on learning outcomes that increase both knowledge and skills, Heroes' Alliance is committed to creating a systematic means of supporting our students from secondary education through entry into the STEM workforce.

ABOUT THE PROGRAM

During the project, students will be working with industry professionals to design, build, and test an electric-solar vehicle that will be raced by the students in a national competition during summer 2018. Two DPSCD schools will work collaboratively to complete the project during year one of the pilot.

The program will accomplish a number of goals to provide the students and their parents with an increased level of awareness related to potential careers in advanced manufacturing, as well as continue to foster improved relationships between industry and academia to better serve those students.

PROJECT PARTNERS

lift LIGHTWEIGHT INNOVATIONS

HEROES ALLIANCE
RAISING A RIGHTEOUS GENERATION

DPSCD

WAYNE STATE

Michigan Technological University
1885

GM

TARDEC

Among the topics in the program are:

Curriculum validation

The program will include a standardized after school curriculum with learning objectives defined in collaboration with Detroit Public Schools Community District (DPSCD), LIFT, Wayne State University, and General Motors. The program will validate that curriculum and assess the cooperative learning environment.

Establish and Expand Industry and Academic Relationships

This pilot will also focus on the establishment and expansion of industry and university partners and formalizing the relationships and roles that create opportunities for long-term student success.

Parental Engagement

The pilot will include a platform for parental engagement that will allow students and parents together to explore pathways toward advanced manufacturing including college and career options. Students and parents will come together once a month to explore STEM pathways in advanced manufacturing side by side. As options and opportunities are presented to the students, they will simultaneously be presented to the parents, creating an atmosphere of shared interest and responsibility. Likewise, as myths concerning advanced manufacturing careers are debunked for the students, they will simultaneously be debunked for the parents, thus breaking down potential barriers to a student's long-term success.

Mentorship

The pilot program will incorporate a two-fold mentorship program that includes peer mentors from Wayne State University as well as industry mentors from General Motors.

DELIVERABLES

- Working with two DPSCD schools, including between 16-24 students and two certified teachers
- Learning outcomes specific to lightweighting technologies and additive manufacturing along with state aligned standards will be identified, implemented, and analyzed for effectiveness during the pilot.
- Attracting additional industry partners that are key to the success of the full-scale program that will have reach and impact across the entire state of Michigan and beyond.

ALIGNMENT TO STRATEGIC FOCUS AREAS

Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing

Linking and leveraging resources and related initiatives on the ground today

For more information about the education & workforce development initiative visit www.lift.technology and contact LIFT Workforce & Education Director, Emily DeRocco at ederocco@lift.technology

lift LIGHTWEIGHT INNOVATIONS

BUILDING 21ST CENTURY MANUFACTURING TALENT

LIFT Learning Lab Internship Pathway Development – Phase 1

An Education & Workforce Development Initiative for LIFT...Lightweight Innovations for Tomorrow

THE PROBLEM

A major skills gap exists across the country and in the state of Michigan for a wide range of advanced manufacturing disciplines including lightweighting manufacturing. For many post-secondary students, there are few work-and-learn opportunities to provide the hands-on experience and exposure to advanced manufacturing which will help them progress in their education and, later, in their careers.

Internships and other work-and-learn experiences better prepare students for engineering careers in in-demand fields, including lightweighting, particularly in Michigan.

While Michigan is home to the highest concentration of manufacturing and industrial engineers in the country, the demand for more talent is still high and expected to grow. For example, there are currently 1,300 materials engineers in Michigan with demand expected to grow by nearly 10 percent by 2024.

THE SOLUTION

LIFT is launching an internship program pathway for undergraduate and graduate students to provide them with the opportunity to gain exposure to lightweight manufacturing technologies and get hands-on experience in the industry. The internship experience will be built around projects that support the education of the students in the areas of interest to LIFT members.

The LIFT internship program includes three levels of internships that will allow students to take on progressively complex tasks and develop specific knowledge and expertise in LIFT's technology pillars.

All three levels will be designed in coordination with academic partners to ensure that learning outcomes are defined and measured and that students are engaged in projects aligned with their academic work to provide a pathway to a career in lightweight metals manufacturing.

LIFT Internship Levels

LEVEL 3 INTERNS	LEVEL 2 INTERNS	LEVEL 1 INTERNS
Undergraduate Juniors	Undergraduate Seniors	First Year Graduate Student or Recent BS Graduate

ABOUT THE PROJECT

LIFT has contracted with the Oak Ridge Association of Universities (ORAU) to design and administer the internship program during Phase I.

PHASE 1 **(August 2017- December 2018)**

- Designing all three levels of the internship program
- Hiring two students to complete a Level 3 internship
- Hiring three students to complete a Level 2 internship during the Fall 2018 term

ORAU is a 121-member nonprofit university consortium which brings together university faculty and students to collaborate on major scientific initiatives that help keep America on the leading edge of science and technology.

LIFT and ORAU will also work in collaboration with Wayne State University (WSU) and the University of Michigan (U of M) to recruit students, develop learning outcomes, and align the internship with academic programs of study at each respective institution.

In future phases, recruitment will be opened to additional partnering LIFT universities.

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DELIVERABLES

Phase I of the LIFT Internship Pathway program will establish a program model that can be replicated beyond the initial pilot phase to cultivate a pipeline of engineering talent for the lightweight industry. Specific outcomes will include:

Program development including a standard logic model that includes defining program inputs (resources dedicated to the program), activities (what the program does with the inputs to fulfill the mission), outputs (the direct products of the activities), and outcomes (learning and programmatic).

Two students completing Level 3 internships

Three students completing Level 2 internships

PROJECT PARTNERS

Lightweight Innovations for Tomorrow (LIFT)

Oakridge Association of Universities (ORAU)

Wayne State University

University of Michigan

ALIGNMENT TO STRATEGIC FOCUS AREAS

Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing

Expanding work-and-learn opportunities

For more information, please see lift.technology or contact LIFT Education & Workforce Director Emily DeRocco at ederocco@lift.technology.

LIFT LIGHTWEIGHT INNOVATIONS

BUILDING 21st CENTURY MANUFACTURING TALENT

Leading a MakerMinded Vision in Detroit

Connecting the next generation of manufacturers and business leaders to the skills and experiences they need to be successful and to the companies that need their talents

makerminded
Powered by lift

PROBLEM ONE: Innovation Demands Talent

Employer demand for skilled workers is rapidly increasing, yet current workers are not prepared to fill these jobs and students are not pursuing the STEM education and training that would prepare them for a career in manufacturing.

For the U.S. to become the world leader in advanced manufacturing – particularly lightweight metals manufacturing – an educated and skilled workforce is necessary to use the new manufacturing technologies and processes being developed.

PROBLEM TWO: Students Leaving STEM Behind

In eighth grade, students start considering careers, and these considerations become clearer through high school. By the time they are seniors, however, only 16 percent are proficient in mathematics and interested in a STEM-related (Science, Technology, Engineering, Math) career. Students are less engaged in STEM training, with fewer selecting college majors in STEM fields, making it even more difficult to encourage a career in advanced manufacturing once they reach high school and college age.

Roughly 28 percent of Bachelor's degree students enter a STEM field at some point during their postsecondary education. Nearly half of those students, however, leave STEM by either changing majors or leaving college completely, creating an even larger gap in the trained workforce.

The small share of students entering STEM fields displays the lack of preparation for those careers. For manufacturers, this "disconnect" between students gaining the foundational STEM skills and the educated, skilled, and ready workforce our manufacturers need must be a national priority.

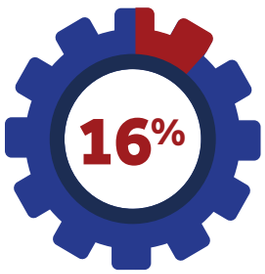
PROBLEM THREE: Jobs Are Being Left Unfilled

Over the next decade, nearly 3.5 million manufacturing jobs in the United States likely need to be filled. Pending retirements coupled with a declining flow of new workers and an increasing need for talent have created a large skills gap resulting in predictions that two million of those jobs will remain unfilled.

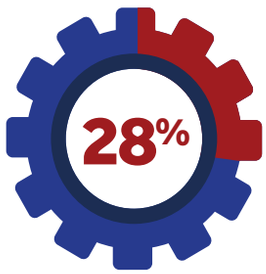
Employers seeking advanced manufacturing workers in the 5-state LIFT region posted over 80,000 online job ads during Q2 2017, including nearly 31,000 jobs posted in Michigan alone, up 63 percent from Q1 2013. Building the pipeline of talent necessary to fill these jobs demands more solutions to prepare students and new workers with necessary STEM knowledge and skills.

MORE AWARENESS AND ACCESS ARE NEEDED

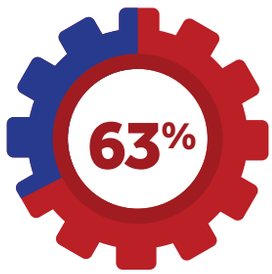
Numerous world-class initiatives are addressing the serious and growing disconnect between America's youth and the STEM knowledge and skills required to succeed in the new and exciting advanced manufacturing jobs. The challenge is awareness and access, with too few students, parents, and educators learning and sharing information about the programs and how to better engage young people in activities that connect them to the world of STEM. LIFT and its partners believe a recently developed initiative will help address this challenge.



of senior year high school students are proficient in mathematics and interested in STEM



of Bachelor's degree students enter a STEM field at some point during their postsecondary education, but nearly half leave



increase of advanced manufacturing employer job demand in Michigan since Q1 2013

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THE SOLUTION

CHANGING MINDSETS AND INCENTIVIZING STUDENTS AND SCHOOLS TO TAKE ACTION IN STEM EDUCATION

The MakerMinded web portal, designed by Tennessee Tech University, brings together actionable information, the power of competition and campaign communications to saturate the learning infrastructure with a manufacturing mindset to bridge the gap between activities and programs that engage and educate youth and the students who can take advantage of them. The solution delivers a diverse portfolio of successful STEM awareness and education activities to schools and students in a simple, accessible platform including both national and local-level STEM and manufacturing career exploration activities, project-based learning, formal educational resources, and other experiential learning opportunities.

MakerMinded was founded on four core principles that not only change attitudes about STEM and manufacturing, but also drive students and schools to act.

- Campaign-style communications
  All students and schools work towards a common goal—building awareness and engagement in STEM
- The power of competition
  Schools compete for points acquired for completing activities, which builds community, unites disconnected students, and empowers all stakeholders
- Student-driven programs
  Students and schools own STEM activities
- Leveraging, not reinventing, successful activities
  MakerMinded brings to scale impactful programs and saturates the marketplace with STEM.

HOW IT WORKS

The portfolio provides students with alternative options to gain foundational STEM/manufacturing skills emphasizing work-based, project-based and problem-based learning. Other key components include using cutting-edge technology, relevant "real-world" content, and industry partnerships that provide mentorship, subject matter expertise, and other learning experiences.

The programs and activities encouraged via MakerMinded provide students with a comprehensive array of foundational, technical and employability skills and essential experiences core to understanding and being prepared for STEM/manufacturing careers.

SAMPLE ACTIVITIES IN THE MAKERMINDED PORTFOLIO

A few examples of the over 75 STEM and manufacturing activities in the MakerMinded portfolio are:

- FIRST Robotics
- Learning Blade
- SkillsUSA
- Science Olympiad
- Destination ImagiNation
- Manufacturing Plant Tours
- Local STEM Career Days
- MATHCOUNTS
- LIFT Virtual Reality Simulation
- Science and Engineering Fairs

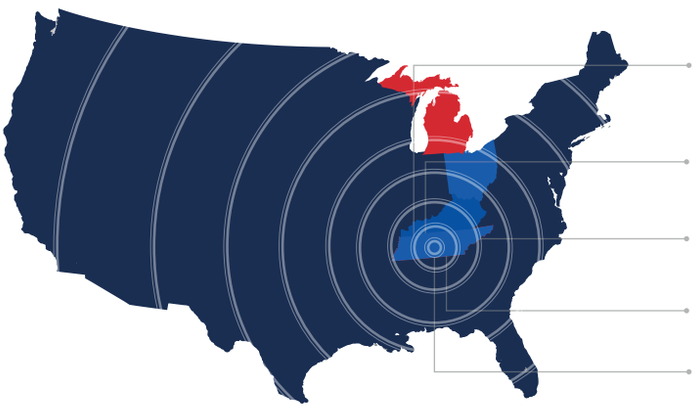
ALIGNMENT TO LIFT WORKFORCE & EDUCATION GOALS

Attracting students and workers to educational pathways and careers in manufacturing

Ensuring students gain STEM foundational skills for success in manufacturing

Linking & leveraging resources and related initiatives on the ground today

EXPECTED OUTCOMES



- Changed perceptions and broadened understanding among students regarding manufacturing
- More students engaged in STEM/manufacturing learning experiences
- An increase in students pursuing further STEM education and training
- More opportunities for students to develop foundational technical skills
- Increased number of under-represented populations exposed to manufacturing and STEM fields

Potential to reach over 3,800 middle and high schools and 5.9 million students across the 5-state LIFT region.

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lift LIGHTWEIGHT INNOVATIONS

ABOUT THE PROJECT

MakerMinded will have a national scope with a continuing roll-out, starting in Tennessee, rolling out in Kentucky and Ohio, and now to Detroit..

Detroit Public Schools Community District will drive the Detroit roll-out process. Rollout will include:

- Customizing the portfolio programs for local employers and organizations
- Leading the citywide communications & marketing efforts for program implementation
- Tracking progress for each school and the city
- Sponsoring and co-hosting a recognition event

The Tennessee Tech University team will manage the MakerMinded platform and Detroit-specific portal, including:

- Developing and hosting the custom web portal for Detroit's program
- Managing the leader board and reports
- Ensuring consistent platform functionality

LAUNCH AND EVALUATION IN DETROIT

Detroit Public Schools Community District will drive the Detroit roll-out process. Rollout will include:

Fall 2017

Roll-out and implementation

- Goal to get 50 middle and high schools signed-up and active on the platform.

June 2018

June 2018 – Year one results report

Metrics to be collected:

- Schools activated and engaged in the MakerMinded platform
- Activities/programs completed by students (at school, county, and state-levels)
- Percentage of students who indicate interest in pursuing further STEM/manufacturing education and careers (through participation surveys)
- Real-time feedback of students' experiences with programs and activities
- Reported completion point variance in schools, to determine areas of strength and weakness
- Manufacturing industry awareness and interest as demonstrated in STEM surveys pre- vs. post-implementation
- Number of rural and at-risk schools that participate in the program

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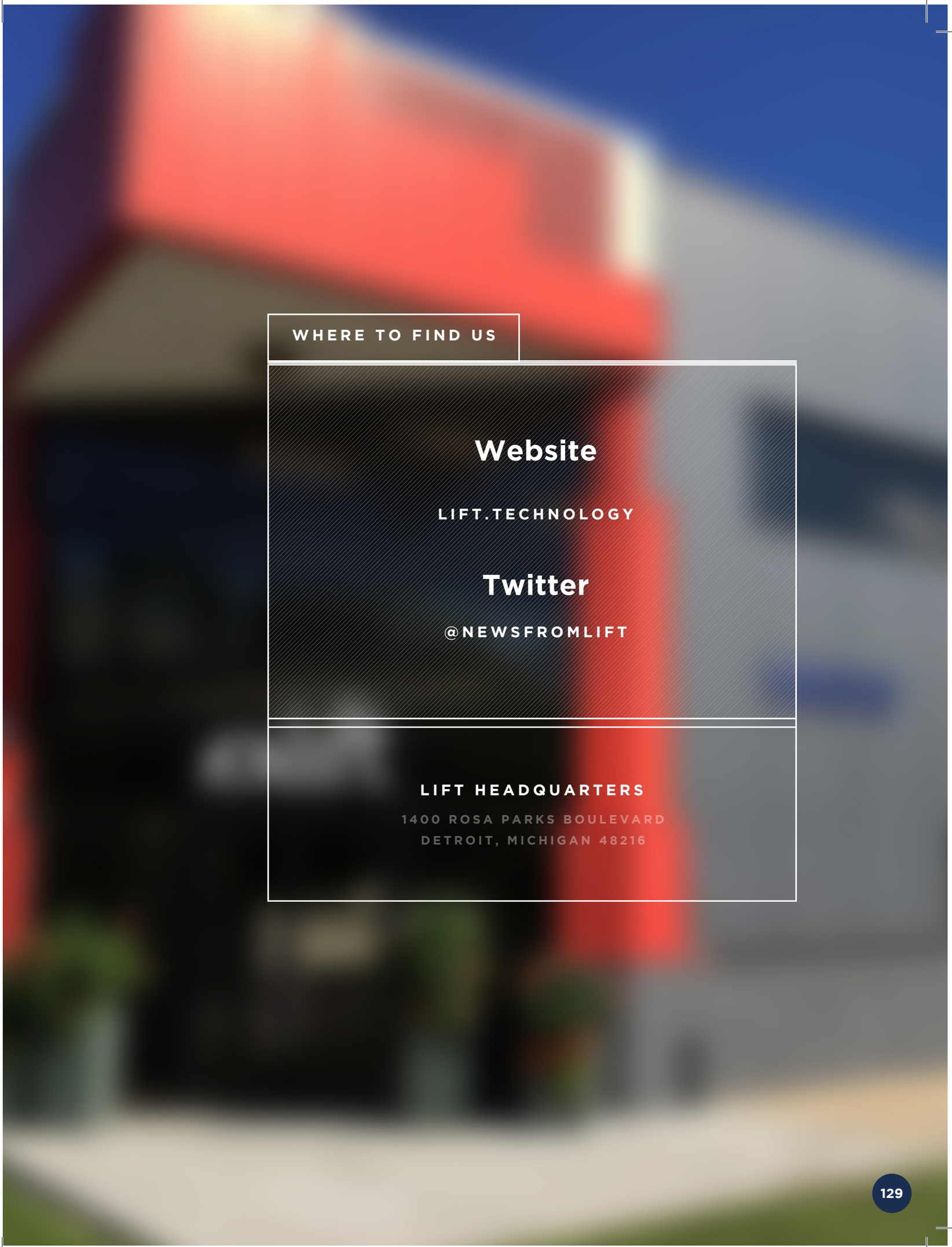

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LIFT THIRD ANNUAL ALL-MEMBERS MEETING

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