# Michigan Learning and Education Advancement Program (MiLEAP) Industry Training

**John L. Irwin**
**Michigan Technological University**

## Abstract

Fluid Power training to retrain the manufacturing workforce is being offered as part of the Michigan Learning and Education Advancement Program (MiLEAP) through the Michigan Department of Labor and Economic Opportunity's Office of Employment and Training. The MiLEAP award is to support innovative, short-term, customized education and training programs in manufacturing and healthcare to assist over 450 participants U.P. wide impacted by COVID-19 to transition to high-skill, high-wage employment and career pathways. The grant is part of a $17.8 million competitive grant awarded to Michigan Department of Labor and Economic Opportunity (LEO) by the U.S. Department of Education. Michigan Tech, Manufacturing and Mechanical Engineering Technology (MMET) Department will use the funds to support these individuals, resulting in industry-recognized credential attainment and reduced educational debt. Partnerships with eight local companies resulted in 40+ employees participating in fluid power training to date as part of this 2-year project. The introduction to fluid power components and systems is 20 hours, run as two sessions (4) hours per day for one week to accommodate companies not having all their employees out at one time. The Advanced Power Systems Research Center (APSRC) Mobile Lab is used in outreach activities supporting the project. The center piece of the Mobile Lab is a 53-foot semi-trailer that is expandable to double width when setup. The Mobile Lab will be deployed at a fair, festival, parade, or other event, where attendees will be welcome to learn more about the MiLEAP program and the various career guidance and pathways being provided by Michigan Works and the partner training providers. The project has completed year one resulting in meeting the goals of partnering with Michigan Works to assist job seekers in their journey to transition to high skill, high wage employment and career pathways.

## Introduction

Michigan Tech's Department of Manufacturing and Mechanical Engineering Technology entered the partnership in 2021 with UP Michigan Works along with five other higher education institutions to seek funding for the Michigan Learning and Education Advancement Program (MiLEAP) from the Michigan Department of Labor and Economic Opportunity's Office of Employment and Training. Michigan Works was awarded $1,695,000 of which Michigan Tech, Northern Michigan University, Lake Superior State University, Bay College, Gogebic Community College, and Bay Mills Community College are contracted to deliver training through June 30, 2023. Each institution was asked to write a One Educational Collaborative for the UP (OneUP) proposal to determine how the funds would be distributed to the institutional partners based on the selection criteria of (a) organization qualifications and experience, (b) cost,


*Copyright ©2023, American Society for Engineering Education*

and (c) comparison with other proposals. Further, the proposals were evaluated on the merit of the described available trainings, short-term trainings, and cost. Proposals were then funded based on a three-tier system based on participant numbers served. A Tier 1 institution serves 120+, Tier 2 serves 40-119, and a Tier 3 serves 39 or less. Michigan Tech was awarded the contract as a Tier 1 institutional partner.

**Literature Review - Background**

Fluid power engineering is growing in the US and globally, which is one of the conclusions of the 2021 NFPA Industry Brief [1]. According to the brief, fluid power has a major downstream economic impact because thousands of companies in the U.S. depend on fluid power. These companies are estimated to employ more than 845,000 people representing more than $60 billion in annual payroll. Employees that are directly employed in the design and manufacturing of fluid power equipment are estimated at 64,000 in the US, and they are dependent on a highly educated workforce.

The International Fluid Power Society (IFPS) also supports the assertion that lifelong learning is important to the future of the workforce. IFPS offers certifications for individuals in seven categories, from fluid power mechanics to engineers [2]. For example, the fluid power instructor for the MiLEAP training was certified while working in industry as a fluid power specialist in hydraulics and pneumatics, and continues to recertify every 5 years. The recertification for the Specialist requires earning 35 professional development points (PDP) which are assigned based on a point system. There are several ways to earn PDP from working in fluid power field, fluid power instruction, or submitting an article or technical paper to the Fluid Power Journal or the IFPS newsletter. Taking and passing the relevant certification test is required if an individual does not meet the recertification requirements.

In response to this industry need, industry collaboration resulted in equipment being purchased with support from the Parker-Hannifin Foundation. Michigan Tech has been a member of the Parker Hannifin Lab Schools [3] since 2019. The Parker-Hannifin Foundation has continued to support the upkeep of the lab with annual funding. Included in the lab are sets of basic and advanced modules for double-sided trainers, an electrohydraulic module, and an electrohydraulic expansion module. The lab was set up and operational by the start of classes in January 2021. In addition, grant funds from the National Fluid Power Association (NFPA) were used to develop a revised curriculum for electro-hydraulics.

Finally, a West Michigan fluid power engineering and distribution company, Donald Engineering, has been instrumental in the advancement of fluid power education. Donald Engineering President, Mark Gauthier, has generously donated a pump test stand, a large power unit, and is sponsoring a student capstone design project to design and manufacture a fluid power system to operate a tensile test apparatus. This industry support has been a great supplement to course learning objectives. For example, the pump test stand enables students to evaluate flow rate and temperature change in and out of the cooling unit for the hydraulic pump, which relates to heat transfer, thermodynamics as well as fluid power topics.


*Copyright ©2023, American Society for Engineering Education*

## Project Description

Fluid power was targeted for training because of the U.S. industry need expressed in the previous section, and the local workforce needs in Western Upper Peninsula of Michigan. The Keweenaw Chamber of Commerce directory of businesses [4] indicates that there are currently 32 Manufacturing, Production & Wholesale companies in the Western UP. This being the third largest category, with the top category listed as Shopping and Specialty Retail (53) and Health Care (35). Michigan is very rural throughout most of the UP with manufacturing and mining as the third top industry. Quantitative analysis indicates that the top five industries in the UP are government, real estate, manufacturing, mining, and health care [5].

The MMET Department floated ideas for training in fluid power, machining, CNC, welding, 3D printing, CAD, GD&T, and mechatronics among the local manufacturers, and fluid power was the most popular. After conducting the initial needs survey, a course format was designed for offering the Hydraulics Bootcamp which consists of 20 contact hours. Future needs expressed by manufacturers are Electro-hydraulic skills which requires a follow up course.

The fluid power training is an introduction to fluid power components and systems. The course includes component selection, circuit design, with hands-on exposure to system hardware for mobile and industrial applications. The training topics are: valves; directional valves, pressure control valves, flow control valves, pumps; gear, vane, piston (pressure comp and load sense), motors; vane, gear, piston (axial, bent axis, radial), ancillary devices; reservoirs, accumulators, filters, hoses, tubing, circuits; simple cylinder and motor circuits, regenerative cylinder circuits, 2-stage uploading circuits, systems; open center, pressure compensated, and load sense pressure compensated load sense, and drives; open loop and closed loop hydrostatic drives. The training is intended to advance a person from an entry level position to a field service technician, or increase their wages.

## Results and Discussion

Four UP companies (Somero Enterprises, Inc., Pettibone, GS Engineering, Inc., & Glenn Hyrkas Logging) participated in the fluid power training offered in spring 2022. The format of the training consisted of lecture and lab components totaling 20 hours, run as two sessions (4) hours per day for one week. The morning session was conducted from 8am-12, and the afternoon session from 1-5pm. This design was selected so that employees from the larger employer would not be all out on training at one time. Therefore, they split their employees so that half attended the morning session while the others attended the afternoon session.

Later in the summer, a second training session was offered in an all-day 8-hour format for two days and the last day for 4 hours running from M-W. This training was for one company that was geographically located too far from campus for commuting. So, this format allowed for the training to be completed requiring only three overnight accommodations. Figure 1 shows the hands-on portion of the course that includes circuit design and analysis.


*Copyright ©2023, American Society for Engineering Education*

Fig. 1. Summer 2022 hydraulic training.

It was interesting to note that there was a wide range of previous education obtained by the participants. Individuals were from various backgrounds, some with 4-year engineering degrees, some with technician training and others with no post-secondary education. All participants were employed in fields that were somewhat familiar with fluid power components, but did not have formal training. One company previously had used an outside training provider to send their service technicians for skills updates, costing the company several hundreds of dollars per employee plus travel and accommodations.

## Conclusion

There were 24 individuals who received certifications in fluid power essentials in the first training session held, and an additional thirteen in the second session. An addition 3 individuals qualified to receive MiLEAP funding to assist with their University tuition for courses during the Spring 2022 semester. The total of 40 individuals received certificates provided by Michigan Tech and were also reported to the Michigan Training Connect Portal [6]. Michigan Training Connect (MiTC) is Michigan's official eligible training provider list for individuals qualifying


*Copyright ©2023, American Society for Engineering Education*

for an Individual Training Account under the Workforce Innovation and Opportunity Act. These records are currently being transferred into the federal credential database called Credential Engine.

There was no cost to the companies to send their employees, except for the 20 hours of production time while they were in training. Michigan Works provided additional funding by utilizing Going Pro Talent Fund and Incumbent Worker grants provided by the Michigan Department of Labor and Economic Opportunity [7]. The MiLEAP program supports regional Workforce Service Specialists employed by Michigan Works to coordinate the registrations and reimbursements to the employees. This allows the training provider to concentrate on the technical content and organizing the equipment required to deliver the material. The costs for delivery include the salary for the instructor, the training equipment and supplies, and administration. Administratively, the duties are minimal including scheduling the training, budgeting, ordering equipment and supplies, and annual reports to Michigan Works and to the training portal.

Future plans include using the Advanced Power Systems Research Center (APSRC) Mobile Lab to advertise the training opportunities to individuals in the region at fairs and outdoor events. In addition, the Mobile Lab has the capability to transport the fluid power equipment, and deliver the training to remote locations within the UP as needed. Follow up surveys of completers will determine the number of advances of individuals from an entry level position to a field service technician, or increases in their wages resulting from the training.

## Acknowledgments

This work was supported in part by the Michigan Learning and Education Advancement Program (MiLEAP) through the Michigan Department of Labor and Economic Opportunity's Office of Employment and Training.

## References

[1]. National Fluid Power Association (2021): https://www.nfpa.com/home/industry-stats/Industry-Brief.htm

[2]. IFPS (2022): https://www.ifps.org/certifications

[3]. Parker Hannifin Corp (2022): https://www.parker.com/portal/site/PARKER/menuitem.34d97bf947aa18280787535d4256d1ca/?vgnextoid=17a72bd093bf2510VgnVCM100000b4a81dacRCRD&vgnextchannel=ae9ff0e5c6b30510VgnVCM100000b4a81dacRCRD&vgnextfmt=EN&vgnextcat=Parker%20Lab%20Schools

[4]. Keweenaw Chamber of Commerce (2022): https://business.keweenaw.org/list


*Copyright ©2023, American Society for Engineering Education*

[5]. Max Steele, A Quantitative Analysis of GDP in the Upper Peninsula, https://ruralinsights.org/content/publications/a-quantitative-analysis-of-gdp-in-the-upper-peninsula/, May 19, 2021.

[6]. State of Michigan (2022): https://www.michigan.gov/leo/bureaus-agencies/wd/programs-services/going-pro-talent-fund

[7]. Michigan Department of Labor and Economic Opportunity (2022): https://www.mitalent.org/mitc

## Biography

**JOHN IRWIN** is a tenured professor, Mechanical Engineering Technology/chair of the MMET Department in the College of Engineering, at Michigan Technological University. He has a master's degree in Occupational Education from Ferris State University, Big Rapids, Michigan, and a doctorate in Curriculum and Instruction from Wayne State University, Detroit, Michigan. He is experienced in industry as well as the teaching profession with a research focus on evaluation of teaching and learning in the area of computer-aided design, analysis, and manufacturing subjects.


*Copyright ©2023, American Society for Engineering Education*