Research Performance Progress Report (RPPR)

N000142012703 : Ohio Manufacturing Talent Expansion for the Defense Industrial Supply Chain Reporting Period: JUN 29, 2020 to JUN 30, 2024
Submitted by: Terri Burgess Sandu

Distribution Statement

- DISTRIBUTION A. Approved for public release: distribution unlimited.

Accomplishments

What were the major goals and objectives of the project?

The Ohio Manufacturing Talent Expansion for the Defense Industrial Supply Chain project focused on meeting the immediate need for production and technician workers in Ohio manufacturing companies, with a particular focus on those serving the defense industry, while building capacity within industry and higher education to prepare incumbent and future workers with the advanced skills needed in an increasingly high-tech environment. Lorain County Community College (LCCC) as the facilitator of the Ohio Technical Skills Innovation Network, or Ohio TechNet (OTN), led the project. OTN is a statewide consortium of community colleges, universities, and career and technical centers partnering and leveraging strategic partnerships to make Ohio a leader in solving 21st century manufacturing and technology workforce challenges. This project was a collaboration of thirteen OTN member community colleges: Lorain County Community College, Stark State College, and Cuyahoga Community College (Tri-C) in Northeast Ohio; Columbus State Community College in Central Ohio; Sinclair Community College and Cincinnati State in Southwest Ohio; and Belmont College, representing and coordinating seven regional Ohio TechPrep program coordinators in Appalachian Southeast Ohio. The project leveraged regional and statewide workforce assets to implement and scale innovations across two key strategic initiatives: 1) Guided Pathways for Youth, and 2) Acceleration Strategies for Adults.

Driven by deep engagement with industry and alignment with state and national workforce priorities, OTN partners launched and scaled high-impact strategies to grow the talent pool and build a sustainable pipeline that will have lasting impact beyond the funding period. This includes expansion of the nationally-recognized FlexFactor program from one college in Ohio (LCCC) to thirteen licensed sites as part of a cohesive Guided Youth Pathways strategy, which to-date has engaged nearly 100 employers and more than 100 middle schools, high schools, and community-based organizations to serve thousands of students with hands-on, engaging exposure to modern STEM and advanced manufacturing education and career pathways. MEEP funding has also supported close engagement of more than 150 employers in Adult Acceleration Strategies, including expansion of innovative earn and learn programs, enhancements to program curricula, and development of a groundbreaking statewide manufacturing competency model, described below.

Innovation and programming alignment at the youth and adult levels resulted in significant successes during the project period. Sinclair Community College has established itself nationally as a leading FlexFactor ecosystem, leveraging the college's academic and workforce development programs as well as strong industry partnerships to great success. One of many highlight stories is that of a student who became excited about manufacturing STEM through FlexFactor, which led to an internship with robotic equipment vendor Yaskawa Motoman – a connection facilitated by the FlexFactor program manager and regional Manufacturing Extension Partnership (MEP) UDRI FastLane. Following that internship and high school graduation, the student enrolled at Sinclair in an academic program and now works full-time at Yaskawa. While this is but one glowing example of success, it provides an impactful – and more importantly, replicable – model for other FlexFactor ecosystems to adopt and scale.

In another highlight, Stark State College teamed with regional industry sector partnership ConxusNEO in Summer 2023 to braid MEEP funding with an EDA Good Jobs Challenge initiative led by the Ohio Manufacturers' Association, to offer three (3) three-week American Welding Society 2G welding training courses. Tuition and lab fees were covered by Conxus, while MEEP funds paid for the AWS certification exam, as well as safety boots for the twenty-three (23) participants, of whom the majority were from underrepresented populations and approximately 25% were women. After certification, participants had the opportunity to be hired at an Akron-area company, a connection facilitated by Conxus. This type of partnership and collaboration defines and drives Ohio TechNet's successes, and builds connections that strengthen and sustain the overall training and workforce development ecosystem in the state.

Funding from the MEEP grant also made possible unanticipated benefits to the state's overall manufacturing and STEM workforce strategy alignment, supporting the development and launch of an Ohio Manufacturing Competency Model in partnership with the Ohio Manufacturers' Association. Tweny (20) large manufacturers – including Lincoln Electric, Ariel Corporation, Intel, Ford, Honda, and Boeing – provided input to the knowledge, skills and abilities highlighted in this model. Today, led by the OMA, the model continues to be introduced to small and medium manufacturers, with 47 Ohio manufacturers having endorsed the model. This enables alignment of curriculum and workforce strategy across systems, including K-12, higher education and career technical education programs, working in collaboration with industry. The competency model continues to inform state strategies in collaboration with the Governor's Office of Workforce Transformation and other partners.

Throughout the project period, partners provided training, certification, and work-based learning opportunities to traditional/adult college students and incumbent workers, and engaged youth participants in hands-on experiential learning to introduce them to STEM and manufacturing, and increase understanding of the educational pathways leading to careers in those fields. Specific strategies under the two main areas of focus include:

- Guided Pathways for Youth
    - FlexFactor engagement program in partnership with NextFlex
    - Enhanced dual enrollment & Career Technical Education pathways
    - Expand innovative earn and learn pathways and connections
    - Expand industry partnerships for outreach

    - Expand engagement of underrepresented audiences

- Adult Acceleration Strategies:
    - Expand innovative earn and learn programs
    - Build/enhance industry partnerships
    - Leverage Military Transfer Assurance Guides (M-TAGS)
    - Leverage Competency-Based Education (CBE) and Prior Learning Assessment

This project also integrated initiatives to reach women, minorities, and other priority or underrepresented audiences, both adults and youth. With partner HHW Ohio, Ohio TechNet expanded resources and use of a program called WISE Pathways to engage more women. FlexFactor has also been used to reach new talent pools. Impacts were assessed through a survey completed by FlexFactor participants, with results captured in an online dashboard developed by NextFlex which aggregates anonymous responses by ecosystem. This powerful data tool will help shape continued OTN FlexFactor program priorities, as partners work to translate increased awareness and interest in STEM careers, into impact in the form of program enrollments and student success following FlexFactor participation as part of a cohesive strategy for Guided Youth Pathways.

What was accomplished towards achieving these goals?

Major Activities

While program activities were initially hampered due to the COVID-19 pandemic and the rapid pivot to remote instruction, a one year no-cost extension approved in October 2022 allowed partners to achieve project goals. Additionally, early innovations in response to pandemic restrictions did allow programming to proceed in hybrid and remote formats.

Project partners deployed a variety of Adult Acceleration strategies over the course of the performance period. For Guided Pathways for Youth, partners pursued and implemented a unified strategy leveraging the FlexFactor program, created by Manufacturing USA innovation institute NextFlex. FlexFactor is a project-based STEM learning curriculum that engages students with advanced technology and manufacturing, entrepreneurship, and the education and career pathways that lead to employment in the high-tech sector. FlexFactor is unique among STEM outreach programs in that it can be implemented in any type of classroom over any curriculum and provides a mechanism to engage students in STEM learning who may otherwise self-select out of STEM programming or coursework. The aforementioned impact analysis demonstrates the program's effectiveness in reaching populations traditionally underrepresented in STEM and manufacturing, specifically women, underrepresented minorities, and veteran / military family members.

Lorain County Community College became the first FlexFactor ecosystem lead outside of San Jose, CA in 2018 and through its leadership of the Ohio Manufacturing Talent Expansion has directly supported the spread of the program to an additional twelve (12) community colleges. This work deepened the strategic partnership of Ohio TechNet and NextFlex, which continues to grow and develop beyond the MEEP period of performance.

Five (5) new FlexFactor ecosystems launched at project partner sites over the first few two years of the project period, with the addition of seven (7) Appalachian Ohio schools in early 2022 bringing the total to thirteen (13). Ecosystems cover a diverse range of communities; 16% of iteration sites are in cities, while 25% are in rural areas. 41% of delivery sites are in public school districts with high or very high levels of student poverty, as identified by the Ohio Department of Education and Workforce, with over 36% of all FlexFactor students served in those predominantly urban and rural districts. This speaks to the success of FlexFactor expansion in reaching underserved and under-resourced communities and lays out next steps for the OTN FlexFactor community of practice as partners work to reach these communities more effectively, and to deploy the program in more innovative and impactful ways.

Adult Acceleration Strategies faced early challenges due to pandemic restrictions, but as partners developed practices and identified opportunities to achieve impact, a set of core innovative strategies emerged, including: curriculum modification to integrate industry-recognized credentials into credit-bearing courses, expanded work-based learning/earn & learn models, and faculty training/professional development to enhance student learning and expand the talent pipeline. Specific program successes are described below.

Specific Objectives and Significant Results

By deploying best practices, aligning strategies, and engaging with industry, MEEP partners achieved grant goals and addressed industry priorities with unique approaches focused on members of the Defense Industrial Base and skills crucial to Ohio manufacturing firms. Partners capitalized on momentum built and practices developed in the first two years of the grant to deploy and scale proven and impactful strategies.

Partners tracked numbers of youth and adult participants – disaggregating by gender, race, and ethnicity when possible – who completed certificate and degree programs, earned industry-recognized credentials, completed work-based learning, and transferred to 4-year partners and degree programs, including Applied Baccalaureate degrees at the community college level. Overall project metrics and percentage of completion are as follows:

- Youth Participants: 3,141 of 4,180 (75% of goal)
- Adult Participants: 1,093 of 1125 (97% of goal)
- Industry Recognized Certifications/Credentials: 631 of 807 (78% of goal)
- Completed Work-Based Learning: 363 of 281 (129% of goal)
- Degree or Credential Obtained: 636 of 334 (190% of goal)
- Articulated to 4-year Postsecondary Partner: 14 of 38 (37% of goal)
- Industry Partners Engaged: 253 of 200 (127% of goal)

These metrics reflect solely those students/participants who provided informed consent documentation. While some metrics have fallen slightly short of project goals, the strategies and practices employed by OTN partners have in fact reached higher numbers of both participant populations and will continue to have impact beyond the grant period of performance. For example, by headcount nearly 7,500 students were engaged through FlexFactor during the MEEP funding period, despite the lower informed consent response. Due to the nature of the project IRB protocol, students benefited from grant-funded programming and interventions, including

both FlexFactor and certain adult student services – e.g. faculty training or curriculum enhancements – regardless of whether informed consent was secured.

Guided Pathways for Youth

The stand-up of twelve (12) new FlexFactor ecosystems in Ohio achieved remarkable results during the funding period. From 2020 through the end of the no-cost extension in June 2024, OTN FlexFactor partners rapidly increased program reach, and numbers of participants served – predominantly middle and high school students, with limited numbers of younger students and adults – engaging them in STEM learning and exposing them to educational and career pathways in entrepreneurship, advanced manufacturing, and technology. IRB and informed consent requirements had a cooling effect on informed consent rate of return. Partner program managers reported hesitance and consternation from principals, teachers, and parents in response to consent language referring to research studies. This was particularly prevalent in schools and districts with a higher percentage of underrepresented minority students. OTN worked with partner program managers to develop best practices and refine talking points to address those concerns, and these practices continue to be refined.

As FlexFactor ecosystems established and matured, student participant numbers increased exponentially over project years 2-4. The number of iterations and delivery sites similarly expanded rapidly, as districts and schools became aware of the program and its success in engaging students with STEM education and career pathways. 40% of Ohio FlexFactor delivery sites were high schools, and 42% middle schools. The remaining 18% is comprised of career technical centers (15%), community-based organizations or other settings outside of a traditional primary or secondary school classroom (2%), and elementary schools (1%). FlexFactor partners have made substantial contributions to the national FlexFactor program, proving its applicability in earlier grade levels. STEM education literature has demonstrated that early and repeated interventions are crucial to increasing student self-selection into STEM pathways. This, in addition to dispelling misconceptions about careers in modern manufacturing, is crucial to expanding the talent pipeline from the K-12 space to careers in STEM and defense industrial base manufacturing.

Partner institutions made significant strides and innovations in deploying the FlexFactor program. Sinclair developed a process to award 1 hour of articulated elective credit in Industrial & Systems Engineering Technology for FlexFactor completion, establishing a potential model for other partner institutions to award credit to program completers. As highlighted above, Sinclair has also partnered with regional MEP UDRI FastLane and the Strategic Ohio Council on Higher Education, to connect FlexFactor students with internships following program completion. This has established a model that OTN is scaling statewide in 2024 under a National Defense Education Program Regional Community College Consortium cooperative agreement. Sinclair also established an annual FlexFactor competition for its partner schools, now in its third year, which invites participation from local industry as well as Wright Patterson Air Force Base and the Air Force Research Lab.

To-date LCCC has delivered FlexFactor programming in 35 schools and cocurricular programs, and outreach efforts continue to reach underrepresented students and integrate FlexFactor with other outreach and engagement programming including Bridges to Careers, IT in Action, and a

pre-apprenticeship program at Firelands HS in rural Lorain County. Tri-C has been a leader in incorporating FlexFactor into College Credit Plus courses – Ohio's high school dual-enrollment program – with notable successes in Cleveland Metropolitan School District, one of the most racially diverse school districts in the state. Tri-C's success in CMSD is also notable among partners given the difficulty faced by many program managers in making inroads into metropolitan school districts due to administrative barriers and teacher capacity limitations. Cincinnati State also made some progress with Cincinnati Public Schools in the final year of the grant and will continue developing that connection under the aforementioned NDEP RC3 funding.

Analysis of the FlexFactor expansion conducted by New Growth Group shows a number of promising trends and speaks to the further potential to engage young learners and diverse communities with STEM pathways. To-date, participant demographics show higher racial/ethnic diversity than the state population; 33% of participants identify as a race other than White/Caucasian, compared to 18.8% of the state. However, 13.2% of Ohioans identify as Black/African American compared to the 11% of survey completers, indicating an opportunity for more intentional engagement in districts with higher percentages of Black/African-American students. Data gathered from 2,837 student responses to the aforementioned FlexFactor exit survey shows that 31% of Ohio FlexFactor students are more interested in a career in advanced manufacturing, while 50% are more interested in STEM and technology pathways (students may express increased interest in both categories). Additionally, 83% of students indicated that FlexFactor made them more aware of career opportunities in STEM, technology, and advanced manufacturing. While a slightly higher percentage of underrepresented minority students (32%) indicated increased interest in manufacturing careers and an equal percentage in STEM/technology, lower percentages of female students indicated an increased interest in both – 21% and 43% respectively. This presents an opportunity for partners to focus efforts and develop innovative new approaches to address this disparity, in the interest of increasing the gender and racial/ethnic diversity of the manufacturing and STEM workforce.

Curriculum Enhancement and Development

Tri-C developed new curricula in Industrial Welding, Industrial Maintenance, and Mechatronics were implemented in Fall 2022. These and other programs, including Additive Manufacturing and Precision Machining Technology, are the subjects of concerted outreach and recruiting efforts, in coordination with college marketing. Tri-C has also seen an increase in employers seeking training for employees, particularly in welding.

Tri-C completed foundational work in developing a new BAS degree in Integrated Digital Manufacturing Engineering Technology, which launches in the Fall 2024 semester. LCCC also launched and grew its Bachelor of Applied Science in Smart Industrial Automated Systems Engineering Technology beginning in 2022. This degree builds on LCCC's certificates and AAS programs, to prepare graduates for careers as automation engineers, systems engineers, and more. The first class of graduates from Lorain's SMART BAS program are on track to graduate in Spring 2025. Applied Baccalaureate degrees offer a unique pathway for students in engineering technology programs, and an alternative to traditional STEM and engineering programs that still meet the increased need for skilled, tech-literate technicians in DIB manufacturing firms.

Sinclair made curriculum modifications to courses shared across multiple programs to embed industry credentials, such as Fanuc Handling Tool and the Certified Solidworks Associate. MEEP funds are also used to cover credential assessments, and a Worksite Developer in the Office of Work-Based Learning to engage industry partners and help students transition from academic to working careers.

Stark State made enhancements to its Welding Technology certificate, creating a non-destructive testing component to the program. Non-destructive testing has been identified by the US Navy and Maritime Industrial Base as a high-demand skill in submarine and surface ship manufacturing and maintenance, validating the need for this program – particularly given Stark's proximity to MIB/DIB companies BWXT and Metallus (formerly Timken Steel). Stark also added NIMS assessments to Machining and CNC courses, allowing students to take up to 4 portable industry credential exams, and works with employers to provide customized training and apprenticeships to incumbent and new hires. Along with LCCC, Columbus State, and Sinclair, Stark State leveraged participation in a DOL Scaling Apprenticeship grant managed by OTN with the Ohio Manufacturers' Association, and an OMA-led EDA Good Jobs Challenge project.

Industry Engagement and Work-Based Learning

Cincinnati State convened a Technical Advisory Committee of 20 employers and industry organizations to solicit input on training program development and enhancement. Topics of interest included Additive Manufacturing, Cybersecurity, Internet of Things, and Robotics & Automation. Cincinnati also worked with employers to offer tuition incentives for grant-affected programs, enticing those employers to send incumbent workers for training and upskilling.

Columbus State's Modern Manufacturing Work-Study Program (MMWS) employs a five-semester earn and learn model, preparing students for careers in advanced manufacturing while receiving the training needed make them marketable to manufacturing employers. Students also participate in guided networking, professional skills development, and Diversity Equity & Inclusion trainings. Columbus additionally established the Accelerated Training Centers (ATCs), community-based centers that provide free training, with the first cohort of students launching in a Fall 2022 Manufacturing and Production course.

OTN's longstanding collaboration with the Ohio Manufacturers' Association, the Ohio Manufacturing Workforce Partnership, achieved a great milestone with MEEP support in its development of the Ohio Manufacturing Competency Model, which provides a shared vocabulary of knowledge, skills, and abilities (KSAs) demanded by manufacturers, with sub-sector focuses on aerospace and defense, electric vehicles and batteries, and semiconductors. This tool enhances collaboration between education and industry and is already making significant impacts on the state-level training ecosystem in Ohio. OTN further engaged consulting firm Accenture to develop a curriculum assessment toolkit to help educational institutions bring technical programs into closer alignment with the competency model and better prepare students to enter the workforce. LCCC and Columbus State CC completed pilot program assessments in early 2024, and a Digital Transformation curriculum at Sinclair has been developed in alignment to the model, tying program elements directly to in-demand skills while

validating the relevance of the curriculum to industry. As additional institutions complete assessments, the aggregate body of curriculum data will contribute to regional program mapping, identifying gaps and coverage in competency training across multiple providers. This will inform industry engagement with education partners, as well as state investments in training equipment. The State of Ohio is also using the competency model to update K-12 manufacturing pathways and inform equipment investments, creating opportunity for alignment with OTN FlexFactor partners and guided pathways initiatives.

OTN participated in and leveraged its connection with the Ohio Defense Manufacturing Community, an Office of Local Defense Community Cooperation-funded initiative led by the Ohio MEP network in partnership with OMA, the ARM Institute, and AmericaMakes. This work helped to inform MEEP program activities, proposed activities under the aforementioned NDEP RC3 project, and has led to ongoing discussions between OTN and OH MEP regarding further cooperation, specifically regarding FlexFactor. Those DoD investments have also dramatically increased OTN's capacity to engage with other elements of the Department of Defense and the Defense Industrial Base, including the Air Force, Navy, and workforce and employer programs within the Maritime Industrial Base initiative.

Faculty Training and Development

LCCC's Industry 4.0 Automation & Robotics Teacher Training addresses one of the key barriers to expanding Industry 4.0 training: a shortage of qualified teachers. The program trains high school, college, career tech, and university instructors to a level that qualifies them to teach Industry 4.0 Robotics and Automation as part of their own curriculum, or for high school and CTC instructors to teach LCCC's AETC-115 – Intro to Industrial Robotics course for dual-enrollment credit. The program was designed and piloted with support from ARM Institute and Department of Labor investments, and informed by a statewide Automation & Robotics Taskforce, initially convened by the Ohio Manufacturers' Association but now facilitated by Ohio TechNet. Teachers earn Fanuc and Allen Bradley credentials, take a NOCTI exam qualifying them to teach the Fanuc credential to their own students, and complete a capstone course. Program successes and updates are described further below.

Reaching New Audiences

One of OTN's key strategies to reach populations historically underrepresented in manufacturing and STEM is WISE Pathways, a career exploration program designed to help women consider careers in non-traditional fields. With MEEP support OTN has partnered with HHW, the organization behind WISE Pathways, to organize a learning community devoted to sharing best practices around engaging women in manufacturing and STEM, and updated open-source materials to support program replication. Shawnee State University, Zane State College and Marion Technical College have become WISE Pathways expansion sites, with support from a recently-concluded Department of Labor Scaling Apprenticeship grant also led by Ohio TechNet. These partners have respectively integrated WISE Pathways with an Intro to Manufacturing curriculum co-developed with Intel, OSHA 10 and FANUC robotics certifications, and the MSSC Certified Production Technician 4.0 credential. OTN and HHW continue to partner and are utilizing OTN's RC3 funding to deliver WISE Pathways programming locally in NE OH, integrating the program with FlexFactor and other outreach and

recruitment initiatives to drive enrollment in manufacturing STEM programs at the college, and continuing to support replication and scale of the program across the state.

What opportunities for training and professional development did the project provide?

LCCC's Industry 4.0 Automation & Robotics Teacher Training was scaled in its pilot stage with MEEP support, braided with US Department of Labor and Air Force ManTech funding. The program is offered to educators of all levels, regardless of prior experience with manufacturing technologies. Over the course of the MEEP period of performance, thirty-two (32) educators across three (3) cohorts completed the program, gaining practical experience with industrial robotics and programmable logic controls (PLCs), and earning both Fanuc and Rockwell industry credentials. By completing a NOCTI certification exam, educators also become qualified to teach the Fanuc Handling Tool Credential and certify their own students.

LCCC has continued to engage its partners at Rockwell Automation and Integrated Systems Technologies (a Fanuc integrator) to refine and update the teacher training program, breaking the 8-month program into two separate modules – industrial robotics, and PLCs – to increase program accessibility for busy educators and appeal to a broader audience. LCCC also developed and piloted a three-day Future Ready Educator bootcamp for educators interested in Industry 4.0 concepts and A&R education, providing a more concise entrée to the subject matter and a recruitment funnel for the redesigned training/credentialing program. This boot camp model also provides an opportunity for educators at earlier grade levels to engage with Industry 4.0 concepts and manufacturing pathways, creating the possibility for earlier interventions to drive student interest in STEM and advanced manufacturing as part of the Guided Youth Pathways strategy.

As described above, a key Adult Acceleration strategy pursued by partner colleges was industry certification training for both students and faculty. LCCC paid for faculty training including an applied electronics instructor's J-STD-001 soldering re-certification. This instructor teaches that credential in courses towards the Applied Electronics and Micro Electromechanical Systems (MEMS) programs. Other faculty completed credentialing through Greenlee and the National Coalition of Certification Centers, which will impact students in a variety of industrial technology and manufacturing courses, including PLC/Sensors and Variable Frequency Drives.

Stark State incorporated numerous industry certifications into credit coursework, including American Welding Society (AWS), National Institute of Metalworking Skills (NIMS), and Manufacturing Skill Standards Council (MSSC) credentials. 128 AWS credentials, 24 CNC technical credentials through NIMS, and 9 MSSC industrial safety certifications were awarded during the period of performance, braiding MEEP funds with resources from a Department of Labor Scaling Apprenticeship Grant also led by Ohio TechNet.

Tri-C similarly funded AWS certification, with 101 certificates issued. Tri-C students also earned 21 MSSC Certified Production Technician certificates, and 6 Siemens Certified Mechatronic Systems Assistant certificates. Sinclair made modifications to course curriculum to prepare students for the Certified Solidworks Associate exam, and embedded numerous industry

credentials in other courses including: Siemens Programmable Logic Control (PLC); soldering; NIMS Measurement, Material, & Safety; Haas Milling; and Fanuc Handling Tool.

How were the results disseminated to communities of interest?

This project leverages Ohio TechNet's consortium of over forty institutions of higher education across the state focused on advanced manufacturing education and training, facilitated by Lorain County Community College. This consortium meets virtually every month, providing updates, information and access to resources on program innovations, FlexFactor, the Industry 4.0 A&R Teacher Training program, and other sharable assets and results are routinely disseminated through this network.

Leaders from the DoD including DoD STEM Director Louie Lopez and Dr. Cindy Waters, as well as Mr. Jeremy Chang and Dr. Nicole Racine, visited LCCC for two days in May 2023. The visit included overviews of LCCC STEM and advanced manufacturing training and education capacities, specific DoD grant program updates, tours of Micro Electromechanical Systems (MEMS) and Automation & Robotics facilities at LCCC, as well as facilities at MEEP partner Cuyahoga Community College and regional manufacturing extension partnership MAGNET. The visit highlighted the collaborative nature of not only the MEEP project, but the broader Ohio TechNet Defense Industrial Base strategy which leverages other investments including: a DoD STEM Regional Community College Consortium award made in 2022; contracts to LCCC and Sinclair through the Air Force ManTech Regional Fabrication and Certification Labs project, Contract no. FA8650-16-D-5524, MITS Effort J; and the Ohio Defense Manufacturing Community initiative managed by the Ohio MEP office and funded by OLDCC. A presentation of the FlexFactor impact analysis conducted by New Growth Group prompted a productive discussion of the promising data gathered on Ohio participants, and plans for a more comprehensive longitudinal study of FlexFactor completion's impact on career and educational pathway selection.

LCCC and partner HHW Ohio presented at the 2023 DoD STEM Technical Exchange on a program designed to increase engagement of women, called WISE Pathways. WISE (Women In Sustainable Employment) Pathways is a career exploration program which aims to introduce women entering or transitioning within the workforce to career opportunities in manufacturing, skilled trades, the energy sector, and others.

The Sinclair project team published an article in the Journal of the League for Innovation in the Community College titled "Sinclair College and NextFlex: Raising Awareness of Careers in Manufacturing." Sinclair also presented at the 2023 annual League conference on their implementation of FlexFactor, leading attendees of the session through a FlexFactor Sprint as a demonstration.

The FlexFactor program's success and further potential as a workforce development tool has been repeatedly emphasized and raised in state-level discussions as semiconductor and microelectronics manufacturing become more prominent in Ohio. LCCC, Columbus State, and Sinclair are members of the Midwest Semiconductor Network, a partnership of more than 30 colleges supporting development of semiconductor nanofabrication facilities in the region and

nation. In March 2023 LCCC hosted the first Network conference, which featured a summary of the OTN FlexFactor expansion and a keynote address by Dr. Dev Shenoy, Principal Director for Microelectronics in the OUSD Research and Engineering. Dr. Shenoy's talk focused on DoD microelectronic/semiconductor initiatives and priorities, helping inform aspects of OTN's DoD and DIB strategy, particularly in connection with the OTN Defense Industrial Base STEM Consortium (NDEP RC3). LCCC is also partnering with the Midwest Microelectronics Consortium (MMEC), one of the regional hubs established by the DoD under the Microelectronics Commons initiative.

In June 2023, LCCC partnered with regional manufacturing extension partnership (MEP) MAGNET to hold an event on campus focused on demonstrating LCCC's Automation & Robotics training capabilities and facilities to regional employers. The event garnered more than 75 attendees, mostly representing local industry, and included the Director of the Ohio MEP and two guests from the Office of Local Defense Community Cooperation in OUSD Acquisition & Sustainment. Ohio MEP office led the Ohio Defense Manufacturing Community initiative, in which OTN participated, and continues to explore further collaboration with LCCC and OTN. The ODMC project addressed a key pillar of Ohio TechNet's Defense Industrial Base strategy by helping to identify small and medium Ohio manufacturers serving the DoD supply chain and connecting them to workforce training Industry 4.0 technical assistance.

Also in June 2023, Ohio TechNet hosted a webinar on the statewide FlexFactor expansion, open to all members of Ohio TechNet. This webinar included a presentation from strategic partner NextFlex, a summary of the program impact analysis completed by New Growth Group, and testimonials from three MEEP partners – Sinclair, Tri-C, and Belmont - on their local FlexFactor implementation and innovation. OTN is making a strategic communications push to solidify awareness and support of the impact of FlexFactor at all partner colleges, for sustainment beyond the lifespan of the MEEP grant.

LCCC has presented the I4.0 Automation & Robotics Teacher Training program to numerous national and statewide stakeholders with extraordinary positive feedback and support. A&R curriculum replication and innovation has begun with support from the NDEP RC3 investment, with projects underway at Ohio University, Miami University, and Central Georgia Technical College. The Central Georgia replication addresses A&R talent needs at Warner Robins Air Logistics Complex.

For distribution beyond the OTN network of educational institutions, Ohio TechNet leverages a collaborative project with the Ohio Manufacturers' Association called the Ohio Manufacturing Workforce Partnership, which partners OMA's statewide network of regional industry-led sector partnerships and state agencies with OTN's member schools to work collaboratively and meet Ohio's manufacturing talent needs. OMA's engagement of state agencies includes representatives from any involved in workforce development, such as the Lieutenant Governor's Office of Workforce Transformation, the Ohio Department of Higher Education, Ohio Department of Education and Workforce, Ohio Department of Jobs and Family Services, ApprenticeOhio, JobsOhio, Veterans Services, Ohio MEP and others.

How will you sustain or maintain program impacts beyond the period of performance?

Project partners implemented strategies and best practices that met the goals for Adult Acceleration Strategies and Guided Pathways for Youth, and which will continue yielding impact beyond the MEEP period of performance. The OTN management team leads efforts with an OTN advisory council and with OMWP colleagues to leverage data, industry support and institutional alignment to sustain and scale high impact practices. This success is reflected in OTN celebrating its 10th anniversary, and its success at generating over $65M of federal and philanthropic investment in a set of focused, aligned workforce strategies built on ongoing industry-education-government collaboration.

OTN members continue to innovate and are deploying FlexFactor as an effective STEM recruitment tool, working together via an OTN FlexFactor Community of Practice. CoP activities aim to develop and pilot data and research tools to more effectively measure program impact, and strategies for earlier student engagement in STEM pathways, leveraging FlexFactor completion into matriculation to STEM programs at partner schools. These strategies include: pre-6th grade STEM engagement activities; leveraging high school dual-enrollment and Career Technical Education (CTE) pathways; bridge experiences and/or work-based learning opportunities for FlexFactor completers; and novel industry engagement tools. Partners continue to collaborate and identify best practices for capturing downstream participant data, particularly transfer to 4-year programs, and academic and industry credentials under its NDEP RC3 award through facilitation of the Ohio TechNet DIB STEM Consortium. Further research and analysis will be conducted as part of a longitudinal study, with the goal of drawing more definitive conclusions and connections between FlexFactor participation as part of Guided Youth Pathways, and pursuit of STEM or advanced manufacturing pathways.

In 2024 Lorain County Community College was recognized as the first NextFlex Education and Workforce Development Innovation Center, further solidifying this key strategic partnership and aligning the organizations to shared proposal and resource development to continue support for FlexFactor in Ohio, but also to expand the scope of their collaboration.

One of the most significant events in Ohio workforce development in the past two years was Intel's announcement of plans to construct two new manufacturing facilities in central Ohio, requiring 3,000 engineers, technicians, and administrators to staff them. Ohio TechNet leads one of eight projects funded by Intel to address semiconductor workforce needs, and supports LCCC faculty in sharing information on its unique microelectronics academic programming that incorporates an earn and learn model open to students from high school to those working on an applied bachelor's degree.

FlexFactor provides a proven on-ramp for middle and high school students to high-tech manufacturing and STEM career and is proving important to raising awareness of these pathways. OTN is among those partnered with the Ohio Association of Community Colleges to develop a standardized Manufacturing Foundations certificate, providing a statewide template for implementation. FlexFactor is well-aligned to fortify the K-12 talent pipeline, and we will continue to leverage semiconductor and other STEM workforce initiatives to align with DoD priorities.

What honors or awards were received under this project in this reporting period?

Lorain County Community College named first NextFlex Education and Workforce Development Innovation Center

LCCC spotlighted in a publication by the Harvard University Project on Workforce

Columbus State Community College Named a Workforce Hub by White House

OTN Listed as Best Practice in CHIPS Act Workforce Development Planning Guide – pg. 80

OTN Selected to Lead 1 of 8 Intel Projects

Technology Transfer

Please list any technology transfer activities including patent applications (include patent number, title, authors, and application date and status), inventions, licenses (include license title, application date and status). Please describe interactions with Navy laboratories or other DoD Agencies. Describe any commercialization efforts.

None to report.

Participants

There are no limits on the number of participants you list for this section; however, you must list participants who have worked one person month or more for the project reporting period. Students are not included in this section.

Name	Role	Person Months
Glazer Stoicoiu, Nikki	Consultant	1
Courtney Power	Consultant	2
Roach, Kaci	Consultant	1
Delgado, Carlos	Other Professional	3
Jensen, Peter	Other Professional	3
Prunty, Kristin	Other Professional	2
Em, Casie	Other Professional	1
Martin, Joseph	Other Professional	1
Stack, Kathryn	Other Professional	2
Strauss-Hersko, Deanna	Other Professional	2
Burgess Sandu, Terri	PD/PI	3
Ganaway, Alethea	PD/PI	1
Franklin, Katelin	PD/PI	1
Smalls Lewis, Franchell	Other Professional	2
Smith, Paul	PD/PI	2
Lisa Miller	Other Professional	2
Hess, Karl	PD/PI	1

Huckaba, Julie	Other Professional	2
Good, Katie	PD/PI	2
Reed, Valerie	Other Professional	1
Waldbillig, Amy	PD/PI	2
Frakes, Jill	Other Professional	2
Jenkins, Nicole	Other Professional	1

Students

Please enter in the number of students for each of the following categories: "Number of undergraduate and graduate STEM participants" and "Number of participants that received a STEM degree"

Number of undergraduate and graduate STEM participants: 1,093

Number of participants that received a STEM degree: 636

Products

There are no limitations to the number of entries you submit and you can also pull information directly using the publication DOI.

Ohio TechNet SkillsCommons – Open Educational Resources
Ohio Manufacturing Competency Model – Landing Page
Automation & Robotics Teacher Training White Paper
Lorain County Community College Industry 4.0 Teacher Training Web Page
Sinclair FlexFactor Publication
DoD STEM Technical Exchange – WISE Pathways Presentation
DoD STEM Program Visit Presentation
FlexFactor Webinar Presentation
FlexFactor Survey Dashboard and Impact Analysis
Ohio Mfg Workforce Partnership Website
WISE Career Pathways Digital Assets
Ohio TechNet Defense Industrial Base STEM Consortium Executive Update
Ohio Governor's Office of Workforce Transformation Auto & Advanced Mobility Workforce Strategy - Built on Manufacturing Competency Model

REPORT DOCUMENTATION PAGE

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED	
		START DATE	END DATE
20241028	Research Performance Progress Report - Final	29/6/2020	30/6/2024

4. TITLE AND SUBTITLE

The Ohio Manufacturing Talent Expansion for the Defense Industrial Supply Chain

5a. CONTRACT NUMBER	5b. GRANT NUMBER	5c. PROGRAM ELEMENT NUMBER
N/A	N00014-20-1-2703	N/A
5d. PROJECT NUMBER	**5e. TASK NUMBER**	**5f. WORK UNIT NUMBER**
N/A	N/A	N/A

6. AUTHOR(S)

Burgess Sandu, Terri
Jensen, Peter

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
Lorain County Community College, 1005 N Abbe Rd Elyria, OH 44035	N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)	11. SPONSOR/MONITOR'S REPORT NUMBER(S)
Office of Naval Research 875 N. Randolph Street, Suite 1425 Arlington, VA 22203-1995	ONR	

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for Public Release; Distribution is Unlimited.

13. SUPPLEMENTARY NOTES

N/A

14. ABSTRACT

The Ohio Manufacturing Talent Expansion for the Defense Industrial Supply Chain project focused on meeting the need for production and technician workers in Ohio manufacturing companies, with a focus on those serving the defense industry, while building capacity within industry and higher education to prepare incumbent and future workers with the skills needed in an increasingly high-tech environment. Partners provided training, certification, and work-based learning opportunities to traditional/adult college students and incumbent workers, and engaged youth participants in hands-on experiential learning via FlexFactor to introduce them to STEM and manufacturing, and increase understanding of the educational pathways leading to careers in those fields. Partner institutions achieved key goals and milestones, and implemented sustainable strategies and best practices to ensure lasting program impact.

15. SUBJECT TERMS

Manufacturing; STEM; Defense Industrial Base; Workforce Development; Guided Pathways; Adult Acceleration Strategies; Certifications; Ohio TechNet; FlexFactor; Ohio Manufacturing Competency Model; WISE Pathways; NextFlex

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES
a. REPORT	b. ABSTRACT	C. THIS PAGE		
U	U	U	UU	14

19a. NAME OF RESPONSIBLE PERSON	19b. PHONE NUMBER *(Include area code)*
Terri Burgess Sandu	440-366-4215

INSTRUCTIONS FOR COMPLETING SF 298

1. REPORT DATE.
Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g. 30-06-1998; xx-06-1998; xx-xx-1998.

2. REPORT TYPE.
State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

3. DATES COVERED.
Indicate the time during which the work was performed and the report was written.

4. TITLE.
Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

5a. CONTRACT NUMBER.
Enter all contract numbers as they appear in the report, e.g. F33615-86-C-5169.

5b. GRANT NUMBER.
Enter all grant numbers as they appear in the report, e.g. AFOSR-82-1234.

5c. PROGRAM ELEMENT NUMBER.
Enter all program element numbers as they appear in the report, e.g. 61101A.

5d. PROJECT NUMBER.
Enter all project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

5e. TASK NUMBER. Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

5f. WORK UNIT NUMBER.
Enter all work unit numbers as they appear in the report, e.g. 001; AFAPL30480105.

6. AUTHOR(S). Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g. Smith, Richard, J, Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES). Self-explanatory.

8. PERFORMING ORGANIZATION REPORT NUMBER.
Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES). Enter the name and address of the organization(s) financially responsible for and monitoring the work.

10. SPONSOR/MONITOR'S ACRONYM(S). Enter, if available, e.g. BRL, ARDEC, NADC.

11. SPONSOR/MONITOR'S REPORT NUMBER(S). Enter report number as assigned by the sponsoring/monitoring agency, if available, e.g. BRL-TR-829; -215.

12. DISTRIBUTION/AVAILABILITY STATEMENT. Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/ restrictions or special markings are indicated, follow agency authorization procedures, e.g. RD/ FRD, PROPIN, ITAR, etc. Include copyright information.

13. SUPPLEMENTARY NOTES. Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.

14. ABSTRACT. A brief (approximately 200 words) factual summary of the most significant information.

15. SUBJECT TERMS. Key words or phrases identifying major concepts in the report.

16. SECURITY CLASSIFICATION. Enter security classification in accordance with security classification regulations, e.g. U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of this page.

17. LIMITATION OF ABSTRACT. This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.