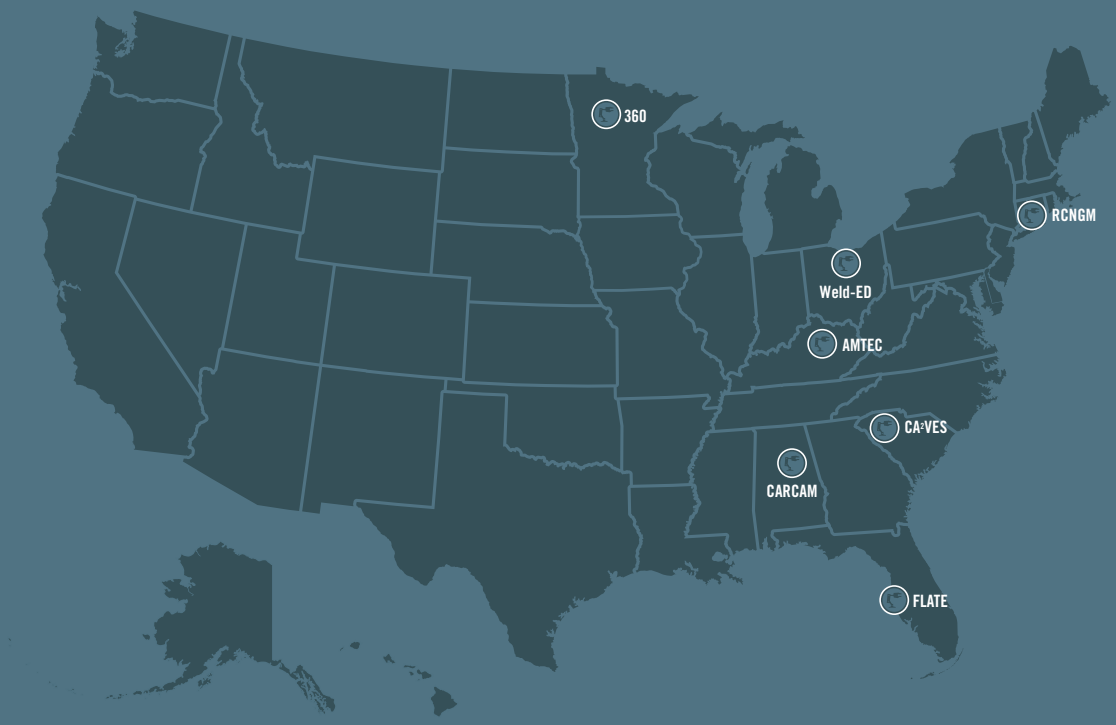
ATE CENTERS

ATE CENTERS FOR
ADVANCED MANUFACTURING



This publication was produced by the Division of Academic and Student Affairs of the Maricopa County Community College District with support from the National Science Foundation under grant **DUE-1261893**.

For additional information about the ATE program, visit **www.nsf.gov/ate**.

For additional information about the ATE centers and projects, visit **www.atecenters.org**, **www.atecentral.net**, and **www.aacc.nche.edu/ateprogram**.

The National Science Foundation's Advanced Technological Education (ATE) program provides grants that support the development of innovative approaches for educating highly skilled technicians for the industries that drive the nation's economy. The program funds educational initiatives across the full range of high-tech fields—biotechnology, chemical technology, engineering technology, advanced manufacturing, energy and environmental technology, information technology, and others.

Two-year college educators lead most ATE initiatives because public community and technical colleges are the major sources for technician education in the United States. The program also encourages partnerships with employers, universities, and secondary schools. As a result, the innovations that ATE grantees devise and test are model programs that reach students from secondary schools to community colleges and universities. They also generate career pathways for students to follow from certificate and degree programs to employment in established and emerging industries.

ATE grantees focus on boosting both the quantity and quality of technicians in the workforce. They test new ways of teaching about established and emerging technologies. Results include new instructional modules, new courses, and entire certificate and degree programs. In tandem with creating products to improve students' learning, many ATE grantees offer professional development for faculty. Through these opportunities, community college instructors and secondary school teachers learn about cutting-edge technologies and how to utilize proven teaching techniques to meet a wide array of industry-identified needs for the workforce.

The ATE program funds large, comprehensive Centers of Excellence, as well as smaller-scale, more focused projects. Each ATE Center generally involves a collaboration among several educational institutions, along with partners from business, industry, and government, all of which work together to improve education and build the workforce in a particular area of technology. The approximately 40 ATE Centers provide leadership, have a broad impact, and act as resources for curricula and faculty development either within a defined geographic region or across the nation.

Complementing the broad missions of the ATE Centers, approximately 300 smaller project grants focus more narrowly on specific aspects of technician education, such as developing or improving educational materials, learning environments, courses, and curricula; providing professional development for educators; preparing future K-12 teachers with strong backgrounds in technology; or giving students the business and entrepreneurial skills needed to succeed in the modern workplace.

> *"AACC is proud to serve as a long-standing partner of the National Science Foundation's ATE program, which provides invaluable support to our nation's community colleges enabling them to expand institutional capacity, develop effective collaborations with industry, and strengthen innovative STEM technician education programs across the country."*
>
> ***Walter G. Bumphus***
> *President & CEO, American Association of Community Colleges*

ATE CENTERS FOR ADVANCED MANUFACTURING

Manufacturing and Applied Engineering ATE Regional Center of Excellence (360) | **Bemidji, MN**
360 works to develop a qualified workforce for advanced manufacturing through program improvement, faculty development, online and blended education, and career pathway opportunities. | **www.360mn.org**

Automotive Manufacturing Technical Education Collaborative (AMTEC) | **Versailles, KY**
AMTEC leads the nation in industry-driven quality mechatronics education. Its competency-based modules prepare students to meet advanced manufacturers' expectations in core subject areas. | **www.autoworkforce.org**

Center for Aviation and Automotive Technology Education Using Virtual E-Schools (CA2VES) | **Clemson, SC**
Through its online learning platform CA2VES facilitates accelerated distribution and implementation of digital learning tools to increase the qualified advanced manufacturing talent pipeline. | **www.clemson.edu/ca2ves**

Consortium for Alabama Regional Center for Automotive Manufacturing (CARCAM) | **Gadsden, AL**
CARCAM's partnerships unite educators and employers to develop highly skilled technicians. CARCAM certificates and degrees position graduates for careers in advanced manufacturing. | **www.carcam.org**

Florida Advanced Technological Education Center of Excellence (FLATE) | **Tampa, FL**
To support Florida manufacturers, FLATE's leadership fosters expansion of Florida's Engineering Technology AS degree program by reaching out to students, growing enrollments and closely linking with industry certifications. | **www.fl-ate.org**

Regional Center for Next Generation Manufacturing (RCNGM) | **Farmington, CT**
The primary impact of the RCNGM has been to make students, educators, and other persons involved in career choices aware of the opportunities available in advanced manufacturing. | **www.nextgenmfg.org**

National Center for Welding Education and Training (Weld-Ed) | **Elyria, OH**
Weld-Ed has helped institutions strengthen and diversify their certificate, diploma, associate, bachelor, master, and PhD welding technology/engineering programs. | **www.weld-ed.org**

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360

Manufacturing and Applied Engineering
ATE Regional Center of Excellence

BEMIDJI STATE UNIVERSITY | BEMIDJI, MN

www.360mn.org

LEADING THE MANUFACTURING TALENT REVOLUTION

KEY ACTIVITIES

- Designs a 21st century education system that prepares individuals for careers in advanced manufacturing.
- Meets the needs of the region's manufacturing employers through an enhanced pipeline and industry-driven curricula.
- Increases the quantity, quality, and diversity of talent in the field of manufacturing.

360 Develops Workforce

360, led by Bemidji State University, works with 14 technical and community colleges to develop a qualified workforce for advanced manufacturing. 360 impacts affiliated programs through program improvement funds, faculty professional development, learning modules, online and blended education programs, and career pathway opportunities. Since 2012,

- 294 individuals gained foundational skills through 360 eTECH, a consortium-based online and hands-on education program;
- 360 partner colleges saw a 36% increase in their graduates in just two years, from a baseline of 466 graduates compared to 636 graduates in May 2014;
- 50%, or 55 students out of 110 students, in Bemidji State University's BAS degrees transferred credit from a 360 partner college.

Technology students learn to verify a model engine component to ensure the part meets specifications.

360 Recruits with Dream It. Do It.

360 works closely with manufacturing businesses throughout Minnesota to promote advanced manufacturing through Dream It. Do It. Minnesota, a recruitment strategy. 360 leads Dream It. Do It. Minnesota by providing resources and hosting events to reach youth and their families. Since 2012,

- more than 25,000 individuals in Minnesota have been educated about modern manufacturing careers;
- 1,200 teacher guides with lessons, activities, and videos have been disseminated; and
- more than 200 total businesses participated in the Statewide Tour, opening their doors for the public to experience modern manufacturing, reaching an estimated 13,530 total individuals.

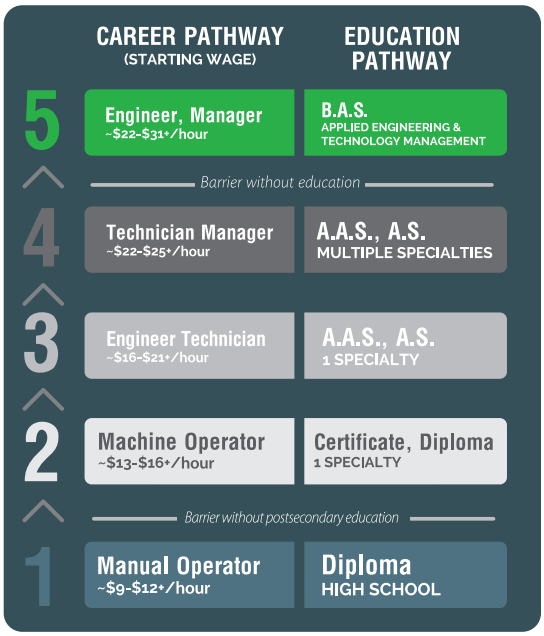
The 360 eTECH program has been leveraged to develop new technicians. The program is now offered in six high schools. Since fall 2014, 31 students have enrolled in high school and college dual-credit courses that enable them to learn the technical skills needed to start manufacturing careers.

360 developed 26 Career Success Skills learning modules on topics prioritized by industry. They are free and can be used by instructors and employers to help individuals develop their soft skills. Since they were launched in 2014, 659 individual learning modules have been viewed.

> *"Manufacturing is the engine that drives our economy. Innovative collaborations between education and industry like 360 Manufacturing and Applied Engineering ATE Regional Center of Excellence are crucial in order to keep that engine running on all cylinders."*
>
> *Bill King, Manufacturing Manager*
> *Mate Precision Tooling*

360 Career Ladder for Manufacturing Shows Advancement Potential

360's Career Ladder shows how individuals can advance their manufacturing careers through lifelong learning and attainment of additional skills.



An operator programs a turret press.

AMTEC

Automotive Manufacturing
Technical Education Collaborative

KENTUCKY COMMUNITY AND TECHNICAL COLLEGE SYSTEM | VERSAILLES, KY

www.autoworkforce.org

AMTEC
Ignite. Educate. Accelerate.

KEY ACTIVITIES

- Implements industry-led, competency-based online curricula to increase students' critical-thinking and problem-solving skills.
- Provides assessments to validate learning.
- Institutionalizes AMTEC's Career Pathway model to develop multi-skilled technicians.
- Expands AMTEC's industry-endorsed collaborative model.
- Disseminates Career Pathways research.

AMTEC Leads US in Mechatronics Education

AMTEC leads the nation in industry-driven quality mechatronics education. Its competency-based modules prepare students to meet advanced manufacturers' expectations in 12 core subject areas: electricity, drafting-schematics, fluid power, mechanical drives, preventive and predictive maintenance, welding, machine tools, controls and instrumentation, programmable logic controllers, robotics, safety, and computer literacy.

Industry needs have also led to AMTEC's research and development of multiple assessments to validate the knowledge students and incumbent multi-skilled maintenance technicians gain in AMTEC certificate programs.

AMTEC utilizes a continuous improvement process to foster evidence-based decisions that guide enhancements of its curricula, assessment tools, and faculty professional development programs.

A Bluegrass Community and Technical College student troubleshoots a problem with a robot.

> *"The AMT (Advanced Manufacturing Technician) program with the AMTEC curriculum and skills assessments has accelerated the student to be fully job ready for a multi-skilled maintenance position at the end of the two-year program vs. current five to seven years for a new employee."*
>
> *Mary Batch, Assistant Manager of Human Resource Development*
> *Toyota Motor Manufacturing Texas, Inc.*

Modules Cut Employer Training Costs

AMTEC's nationally standardized competency-based modules provide students with valuable knowledge and skills that they are able to put to use immediately on the manufacturing floor.

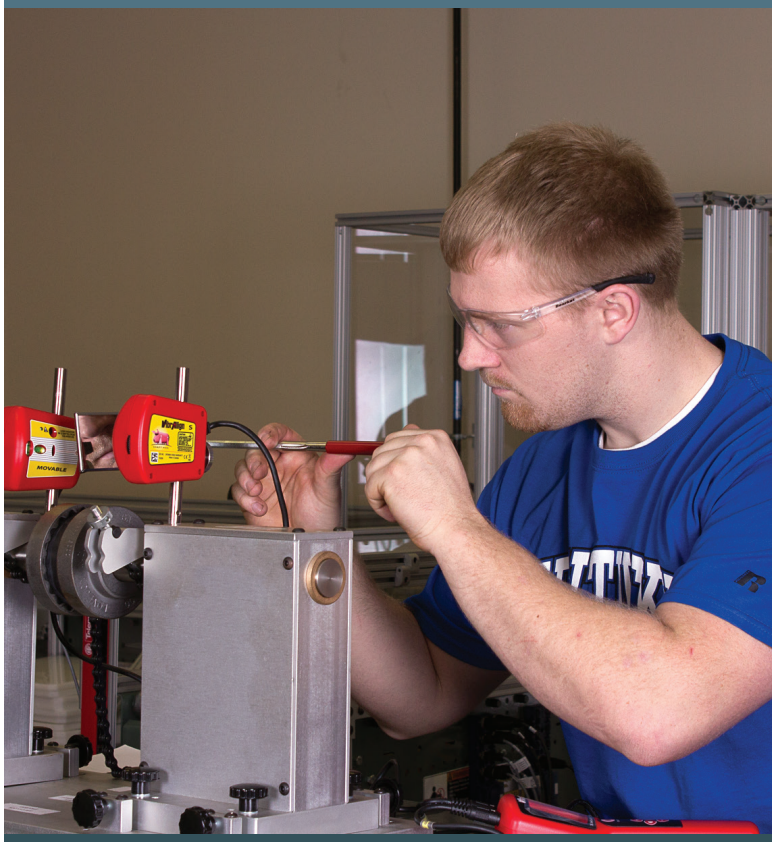
AMTEC's modules are so effective that Nissan North America in Tennessee has reduced its apprenticeship from six years to three years for substantial savings in training costs. As of mid-2015, 22 AMTEC graduates of Tennessee College of Applied Technology – Murfreesboro had transitioned from the general assembly area to maintenance apprenticeships with a minimum increase of $10 per hour. After one year, the apprentices will be multi-skilled maintenance technicians.

AMTEC Fosters Productive Connections

AMTEC's e-learning portal makes technical education easier to access. Its careers portal provides links to information about open positions at AMTEC industry partners' facilities.

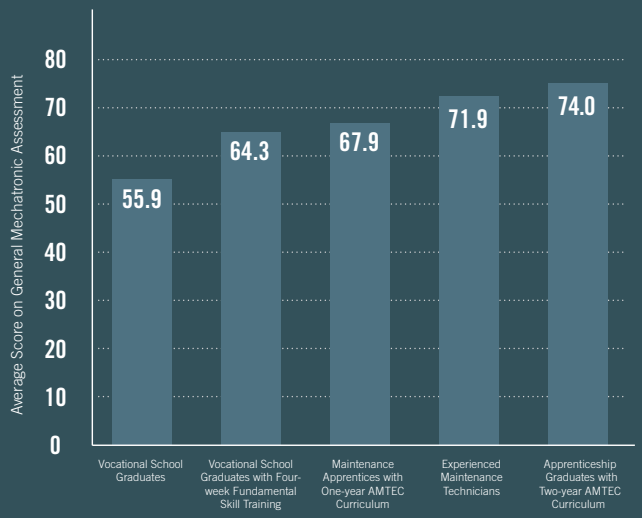
AMTEC has recently grown to 55 collegiate partners and 30 industry partners in 15 states. One AMTEC college offers technical instructor training in Mexico. AMTEC has hosted visitors from India and Brazil who want to incorporate AMTEC into their educational systems.

A technician checks the precision shaft alignment on a chain drive.



AMTEC Modules Improve Scores

The scores of students who learn with AMTEC modules are, on average, better than incumbent multi-skilled maintenance technicians' scores.



CA²VES

Center for Aviation and Automotive Technology Education Using Virtual E-Schools

CLEMSON UNIVERSITY | CLEMSON, SC

www.clemson.edu/ca2ves

CA²VES

KEY ACTIVITIES

- Facilitates accelerated distribution and implementation of digital learning tools.
- Designs and develops virtual reality (VR) and digital curricula.
- Increases the diversity and quality of the advanced manufacturing talent pipeline.
- Provides research and other resources for two-year colleges.

EducateWorkforce.com Enhances the Talent Pipeline

Through its online learning platform, EducateWorkforce.com, CA²VES has impacted more than 1,500 students nationally. Recent research studies indicate that CA²VES's digital learning tools positively impact student learning.

As of April 2015, the platform supported 140 virtual reality (VR) modules and digital learning tools used by students in 23 states. This reach has sparked partnerships with ATE centers, such as CAAT and FLATE, to create and disseminate high-impact VR modules and courses for two-year colleges. The capacity to create, disseminate, and research the effectiveness of VR on technician education sets CA²VES apart as a resource that two-year college faculty can explore to equip their students.

A student identifies workplace hazards using VR simulations in CA²VES's safety course.

CA²VES Seeks to Redefine Advanced Technological Education

Since the center's origination, CA²VES has built a network of 150+ collaborators spanning education, industry, and government who have helped it pioneer the use of VR in technician education. The center's in-house experts have worked with industry and two-year colleges to design, develop, and implement high-end VR to support technician education needs. These VR simulations can be accessed 24-7 through CA²VES's online platform, EducateWorkforce.com. Students experience hands-on interaction with virtual equipment without the cost of physical equipment. Additionally, CA²VES engages in rigorous, evidence-based research about the impact of VR in technician education and the use of materials by affiliates.

CA²VES's leaders realize the importance of a diverse, qualified workforce. Consequently, the center pursues efforts to develop an advanced manufacturing talent pipeline through sustainable pathways and outreach campaigns that reach underserved populations. Combining outreach initiatives and the research and development of VR learning tools helps the center's personnel understand the broader impacts of innovations in teaching and learning, as well as technology integration and workforce development. Based on their findings, CA²VES and its partners intend to redefine advanced technological education.

> *"We're excited that CA²VES is developing VR to help increase quality, quantity, [and] maximize instructor and program flexibility for all curriculum levels. These resources are necessary to help advance technological education for aerospace and automotive industries—our state's fastest-growing sectors."*
>
> *Chuck Spangler, Interim CEO*
> *South Carolina Manufacturing Extension Partnership*

3-D rendering in a VR simulation allows students to practice removing electric vehicle batteries.

Digital Learning Tools Expand Two-Year Colleges' Technician Education Capacity

More than 1,500 students and instructors at two-year colleges use digital learning tools developed by CA²VES.

- Virtual reality modules | **72**
- CAD models | **47**
- Courses | **8**
- e-learning modules | **75**
- e-learning sections | **373**
- Interactive e-books | **5**

CARCAM

Consortium for Alabama Regional Center for Automotive Manufacturing

GADSDEN STATE COMMUNITY COLLEGE | GADSDEN, AL

www.carcam.org

KEY ACTIVITIES

- Provides industry-recognized workforce development and STEM learning.
- Recruits and educates multi-system technicians for careers in emerging technologies and advanced manufacturing.
- Supports professional development to meet technology trends.
- Partners with educators and manufacturers for innovative curriculum and skills development.

CARCAM Prepares Students for Wide Array of Careers

CARCAM's advanced manufacturing partnerships unite educators and employers to develop highly skilled technicians. In 2014, more than 600 students earned certificates or degrees in CARCAM programs. These credentials position graduates to pursue careers in advanced manufacturing and industrial research.

CARCAM's partnership with the Alabama Automotive Manufacturing Association provided 239 scholarships to date totaling $358,500. Before graduating from the electronics engineering technology program at Gadsden State Community College in 2015, Corey Edwards echoed other scholarship recipients when he said, “I am glad that I am a part of the program, and I think it is a really good fit for me."

CARCAM's advanced hydraulics curriculum thoroughly covers this challenging aspect of modern manufacturing.

> *"The technology component of the automotive industry is very dynamic. There is a continual demand for students entering the workforce, and, for those already employed, to be educated and trained on the latest developments. CARCAM does this exceptionally well."*
>
> *Gene Cleveland, Senior Manager*
> *KTH Leesburg Products*

CARCAM Delivers Innovative Workforce Solutions

CARCAM and its partner colleges continually work with industry leaders to develop and redesign workforce education for evolving technologies.

Today's workforce environment requires that associates have technological skills as well as excellent communication skills, workplace ethics, and problem-solving abilities. CARCAM recognized this multi-faceted need and in collaboration with the Alabama State Department of Postsecondary Education developed an industry-vetted curriculum that addresses it.

CARCAM colleges' utilization of dual enrollment, stackable credentials, and credit for prior learning adds flexibility to CARCAM's certificate and degree programs.

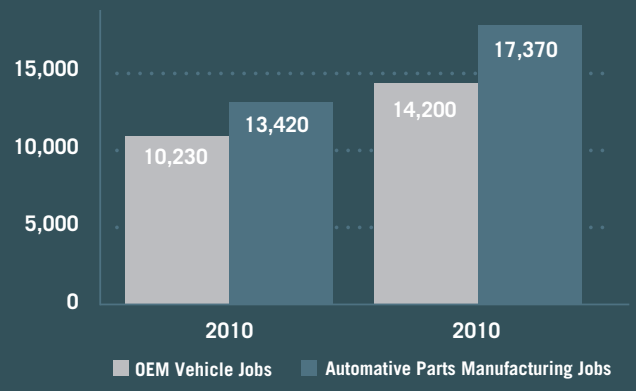
CARCAM has also responded to a survey finding that 81% of employers feel additional industrial experience would make students more employable. It works with industry partners to facilitate cooperative, internship, and apprentice programs that help students launch highly successful careers. The relationships CARCAM-affiliated colleges had with 56 companies in 2014-15 provided 188 students with work-study opportunities designed to improve their employment prospects.

CARCAM's faculty professional development programs are similarly outcomes-based. For instance, the general industry-related safety program CARCAM provided to 44 instructors in 2014 was quickly followed by 275 students earning industry-recognized stackable safety credentials.

Technicians not only program robots, but perform vital maintenance on mechanical components.

CARCAM Prepares Technicians for Automotive Manufacturing Job Growth

The Alabama Department of Labor forecasts that jobs will increase 30% in original equipment manufacturing (OEM) for motor vehicles between 2010 and 2020, and 22% in automotive parts manufacturing.



FLATE

Florida Advanced Technological Education Center of Excellence

HILLSBOROUGH COMMUNITY COLLEGE | TAMPA, FL

www.fl-ate.org

KEY ACTIVITIES

- Facilitates adoption of Engineering Technology (ET) Associate in Science (AS) degree.
- Integrates the Manufacturing Skill Standards Council Certification (MSSC) into ET core courses.
- Promotes and supports advanced manufacturing through "Made in Florida" student outreach and faculty professional development.

FLATE Leads Expansion of ET AS Degree Programs

FLATE's leadership fosters expansion of Florida's ET AS degree program. Enrollments grew from 145 in 2008-09 to 1,525 in 2013-14. Completion of the associated MSSC Certified Production Technician (CPT) certificate also increased from 11 in 2007 to 2,336 in 2014.

In a survey of ET AS graduates, 92% of 24 respondents reported using the technical knowledge acquired in college in their jobs. A separate state study found that 86% of 30 ET graduates in a quarterly sample were employed.

Gulf Coast State College students learn how to program a PLC.

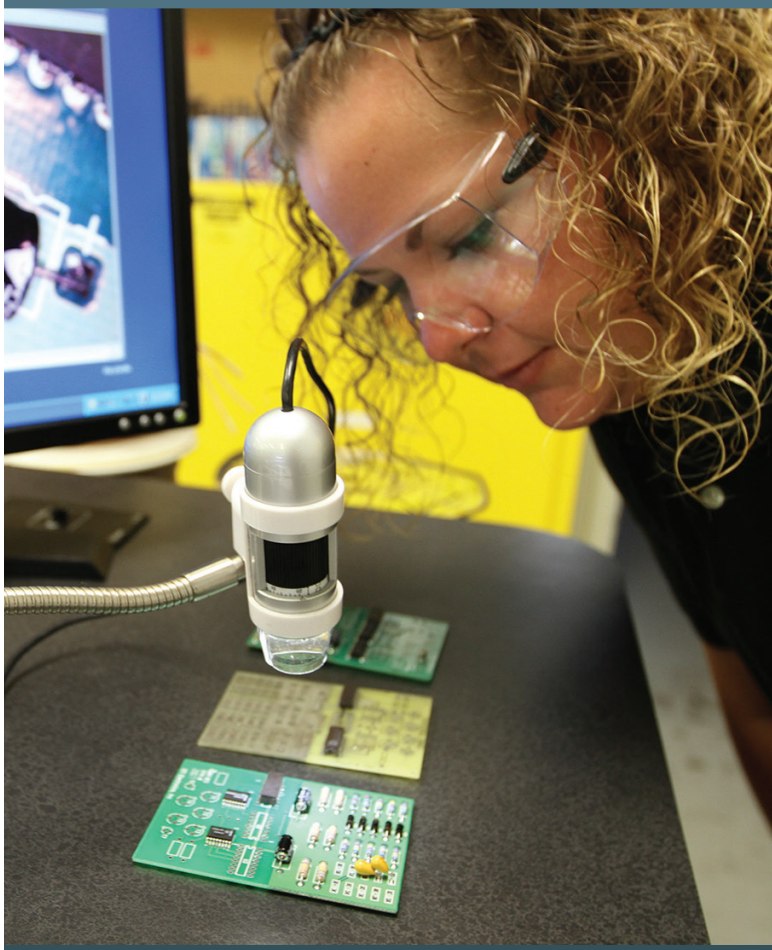
FLATE's Credential Articulation Pathways Address Florida Manufacturers' Needs

In 2007, using FLATE's established integrated credentialing procedure, the Manufacturing Skill Standards Council Certification (MSSC) Certified Production Technician (CPT) credential was aligned to the FLATE-designed and Florida Department of Education-maintained ET AS degree program. This articulated, credential pathways model now extends into secondary, postsecondary, and workforce programs. In 2015, 21 secondary and postsecondary institutions offered programs with MSSC CPT alignment and articulation to ET AS degrees.

Leveraging the workforce-training pathway to the ET degree, FLATE and its Florida TRADE Consortium partners have successfully educated new audiences including veterans and the underemployed. In 2015, this consortium reported that 450 students had applied their earned MSSC CPT toward college degrees. The use of FLATE's pathway for attaining this employer-preferred credential has grown in Florida from 11 in 2007 to 2,336 in 2014. Many of the CPT holders have gone on to enroll in ET AS degree programs. Statewide, ET degree enrollment has grown from 145 in 2008 to 1,525 in 2014.

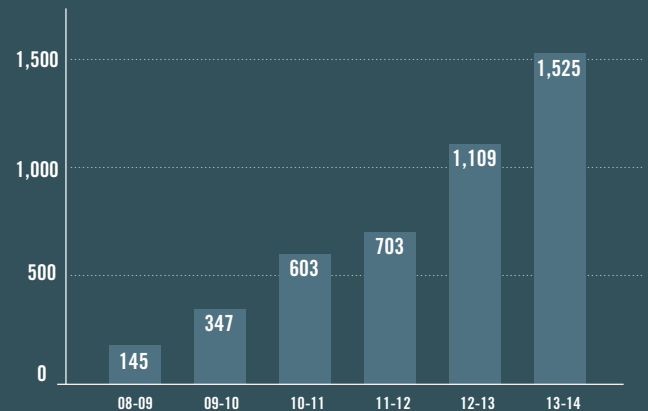
> *"We greatly appreciate the service FLATE is providing to the region and look forward to producing even more extraordinary future events in collaboration with FLATE."*
>
> *Jay Matteson, Director*
> *Palm Beach State College Institute for Energy & Environmental Sustainability*

ET AS degree holders know to inspect and measure before soldering.



ET AS Degree Enrollment Grows

Enrollment continues to grow across Florida in FLATE-designed ET AS degree programs.



RCNGM

Regional Center for
Next Generation Manufacturing

TUNXIS COMMUNITY COLLEGE | FARMINGTON, CT

www.nextgenmfg.org

KEY ACTIVITIES

- Develops hands-on student experiences to create interest in manufacturing careers.
- Provides faculty externship opportunities in manufacturing companies.
- Produces and distributes manufacturing career materials.
- Develops industry-driven career programs, engineering and technology certificates, and AS and BS degree pathways.

RCNGM Expands Career Opportunities

The primary impact of the RCNGM has been to make students, educators, and other persons involved in career choices aware of the opportunities available in advanced manufacturing. In 2014 more than 700 students earned certificates or degrees in RCNGM programs at Connecticut community colleges.

RCNGM builds interest in manufacturing through faculty externships that provide educators with insights into technicians' work at local industry facilities, career expos that give students the opportunity to meet manufacturers, and marketing materials that feature manufacturing careers. Since the RCNGM's creation in 2004, enrollment in Connecticut manufacturing programs has increased 190% from 598 to 1,733 students.

A student uses a grinding machine with a polishing wheel to smooth a finished part.

> *"These experiences enriched my lectures and labs and enabled me to talk with confidence about how what I was teaching my students is being used by manufacturers in our region."*
>
> *Sharon Gusky, Professor*
> *Northwestern Connecticut Community College*
> *Faculty Extern, BD Medical*

Industry Input Equals Successful Output

In 2014 RCNGM, in collaboration with the Connecticut Business and Industry Association (CBIA), surveyed 246 local manufacturers regarding workforce needs. The results reported that 99% of the manufacturers hire graduates from Connecticut community colleges; 72% of them reported higher than average satisfaction with Connecticut community college graduates.

A well-prepared workforce can be credited to RCNGM initiatives such as faculty externships in industry. Externship participants develop curriculum that is incorporated into the College of Technology (COT), a statewide initiative that includes all 12 Connecticut community colleges.

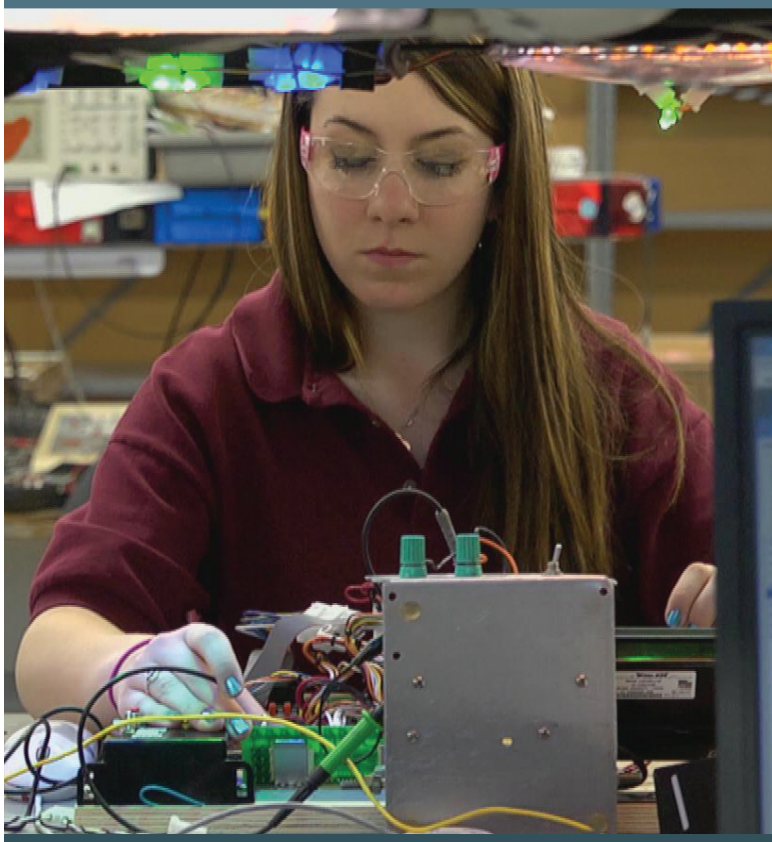
RCNGM Impacts Connecticut, New England & Nation

In 2015 the RCNGM organized the first Greater Hartford Mini Maker Faire where 1,500 attendees participated in entrepreneurial activities highlighting "making" and next-generation manufacturing.

The COT model was leveraged for both state funds and US Department of Labor grant funds to create or expand manufacturing centers in seven Connecticut community colleges.

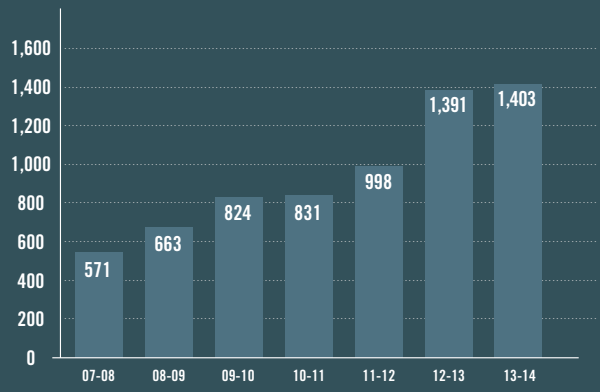
RCNGM works with regional partners to ensure the growth of advanced manufacturing in New England and to disseminate nationally promising practices such as professional development initiatives that are open to faculty throughout the US.

A test technician inspects LED lights for police cars.



Total Connecticut Community College STEM Certificates & AS Degrees Awarded

The number of STEM certificates and AS degrees awarded continues to rise in Connecticut community colleges.



Weld-Ed

National Center for Welding Education and Training

LORAIN COUNTY COMMUNITY COLLEGE | ELYRIA, OH

www.weld-ed.org

Weld-Ed

KEY ACTIVITIES

- Strengthens diversity and quantity of welding technicians in industry.
- Improves the quality of education offered to welding technology students.
- Designs and delivers professional development for welding educators.
- Provides data on welding education and employment trends.

Weld-Ed Strengthens Welding Education Programs

Weld-Ed partner institutions have graduated more than 3,000 students. In 2014 the graduation rate increased 113% from 99 to 211. Weld-Ed has helped 10 institutions strengthen their 21 certificate, diploma, associate, bachelor, master, and PhD welding technology/engineering programs.

More than 700 welding instructors from 40 states have participated in at least one Weld-Ed professional development program. Altogether these educators have shared what they learned with 40,000 students. The first community college Society of Women Engineers Collegiate Interest Group is now an established success at Lorain County Community College. The group hosted the Cleveland Engineering Society's fall conference with more than 200 professionals and students in attendance.

Weld-Ed graduates possess the skills welding industry employers need.

Two-Pronged Approach Addresses Workforce Needs

Welding plays an important role in Americans' everyday lives from bridges to highways, automobiles to pipelines. As many current welding professionals near retirement age, demand is growing for new and replacement workers. Weld-Ed's *State of the Welding Industry* highlights the critical shortage the nation faces: by 2024 more than 350,000 welding professionals will be needed.

Weld-Ed is immediately impacting the workforce by increasing the number of skilled graduates who are ready to fill these openings today due to the standardization of associate degree programs using Weld-Ed's national core curriculum model. Weld-Ed is also focused on creating a pipeline of skilled workers to fill the jobs of tomorrow by educating faculty through its summer professional development offerings.

The Careers in Welding mobile exhibit features virtual reality welding simulators. It offers an educational experience and a wealth of career information to prospective students, their families, and educators. The mobile exhibit, on tour for four years, has introduced more than 115,000 visitors at 65 events to the many highly technical career opportunities available in the welding industry.

> ***"Ten years ago, we were at about 10 students. Since I have been working with Weld-Ed, our program's exposure has increased and I have had a dramatic increase in students from across the US. We have now topped over 100 students in the program."***
>
> *Mark Baugh, Welding Program Chair*
> *Weber State University*

Welding technicians work in many industries including petro-chemical.

Weld-Ed Adds Technicians to Workforce

The number of students completing AAS Welding Technology degrees increased 113% from 2013 to 2014 at Weld-Ed's 10 partner institutions.