

ATE-CENTERS

ADVANCED TECHNOLOGICAL EDUCATION CENTERS



PARTNERS WITH INDUSTRY FOR A NEW AMERICAN WORKFORCE



National
Science
Foundation

Highlighting the Advanced Technological Education (ATE) centers sponsored by the National Science Foundation (NSF)



The Advanced Technological Education (ATE) program endeavors to strengthen the skills of technicians whose work is vitally important to the nation's prosperity and security. In ATE centers and projects, 2-year colleges have a leadership role and work in partnership with universities, secondary schools, business and industry, and government agencies to design and carry out model workforce development initiatives.



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For information about the ATE program, visit www.nsf.gov/ate. For additional information about the ATE centers and projects, visit www.atecenters.org, www.ateprojectimpact.org, and www.aacc.nche.edu/ateprogram.

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ADVANCED TECHNOLOGICAL EDUCATION CENTERS



PARTNERS WITH INDUSTRY FOR A NEW AMERICAN WORKFORCE

www.atecenters.org

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IN THE NATIONAL SPOTLIGHT



THE ATE PROGRAM SERVES AS A TRUE CATALYST FOR STUDENT SUCCESS AND ECONOMIC DEVELOPMENT.



NSF's Advanced Technological Education Program: A Catalyst for Student Success & Economic Development

The National Science Foundation's Advanced Technological Education (ATE) program is the NSF's premier community college program that educates technicians for America's cutting-edge industries. I encourage you to read this publication and learn about the many ways ATE centers strengthen the nation's technical workforce through their partnerships with industry, educators, government agencies, and non profit organizations.

The ATE centers' missions involve them deeply in the most difficult issues facing U.S. educators and employers. By focusing on science, technology, engineering and mathematics (STEM) and workforce development, the ATE centers help students succeed in ways that benefit them, their families, their employers, and the nation.

While college completion rates have recently become a national priority, for more than a decade ATE centers have been busy figuring out

- How to recruit teens and adults—particularly underrepresented populations—for STEM careers;
- What helps students succeed in STEM courses essential to a wide range of technical fields;
- Why some existing programs struggle to meet employer needs;
- Where curricula should change to develop world-class technicians; and
- When to incorporate new technologies in classrooms and laboratories.

For the past 14 years, the Maricopa Community Colleges have been pleased to host one of the 39 ATE Centers of Excellence. Our colleges have been awarded ATE project grants as well. With ATE support, our faculty members have collaborated with the biotech industry to help build the knowledge and skills that are critical for technicians in this highly competitive field. ATE grants have funded externships for our faculty to work in industry and gain firsthand experiences that immediately enrich their teaching of technicians in our occupational programs. ATE grants have enabled our colleges to revamp STEM programs to provide state-of-the-art instruction. Outreach and recruitment efforts funded with ATE grants have significantly enhanced our enrollment in critical programs. All of these outcomes have directly benefited advanced technology employers.

Our colleges and community colleges throughout the United States are very fortunate to work in partnership with this National Science Foundation initiative. The ATE program serves as a true catalyst for student success and economic development.



RUFUS GLASPER, Ph.D.

Maricopa Community Colleges' Chancellor Rufus Glasper

has led the 10-college district since 2003. It is one of the nation's largest multi-college community college systems. Glasper is a staunch advocate for educational access and opportunity. "Inclusiveness, engagement, and respect" are the guiding principles of his administration. He currently serves as the committee co-chair with Fred Duval, Vice Chair of the Arizona Board of Regents, on the Lumina Foundation for Education "Getting AHEAD" Initiative. It aims to be a comprehensive and collaborative initiative by Arizona's universities, community colleges, K-12 sector, business community, and legislative and executive branches of government to reshape Arizona's post secondary education system and enable more residents to successfully obtain a college degree. He also serves on the board of the League for Innovation in the Community College.

ATE AT A GLANCE

The Advanced Technological Education (ATE) program prepares technicians for the high-technology workplaces that the United States needs to prosper. ATE centers serve as the program's flagships and work on national and regional approaches to key issues in specific technology fields. ATE projects focus on particular technician education challenges. The strategies used by both centers and projects include educational resources, faculty enrichment, outreach and recruitment, industry involvement, and research. More and better qualified science and engineering technicians, and model programs that benefit every level of education are the results that ATE delivers.

ATE History & Community College Leadership

The National Science Foundation created the ATE program in response to the Science and Advanced Technology Act of 1992. This first Congressional mandate to the independent federal science agency emphasizes the role of community colleges, the public 2-year educational institutions that are located throughout the country, as the main providers of technician education in the U.S.

ATE has become the largest community college initiative in the NSF portfolio. Its budget has grown from \$13.5 million in the 1994 fiscal year to \$64 million in the 2010 fiscal year. A total of 972 ATE grants have been awarded in every state, Guam, and Puerto Rico.

ATE has expanded its focus over the years to include emerging technologies, such as nanotechnology and biotechnology, and to address specific priorities, such as the education of technicians in rural areas and research to advance the knowledge base related to technician education.

ATE Impacts Students

The ATE program encourages efforts to increase the participation of diverse populations in advanced technology fields where they have been underrepresented, and promotes the inclusion of persons with disabilities in the technical workforce.

ATE Empowers Innovative Educators

ATE competitive grants make it possible for educators and others involved in technician education to test their ideas for improving the technical skills of technicians, and for boosting the general science, technology, engineering, and mathematics (STEM) knowledge of students at various education levels. ATE also supports professional development programs for educators who teach prospective technicians.

ATE Creates Productive Industry Partnerships

ATE initiatives facilitate technical educators' collaborations with industry and professional organizations. ATE also strengthens the connections among community colleges, elementary and secondary schools, and universities. These multifaceted ATE partnerships produce coordinated responses to new workplace or instructional technologies, and they benefit students and technicians in a myriad of ways.

ATE BY THE NUMBERS



ATE centers and projects had

6,900 collaborations with industry, business, public agencies, and educational enterprises during 2009. These partners contributed

\$11 million IN MONETARY SUPPORT

\$9 million OF IN-KIND SUPPORT

ATE encourages the participation of underrepresented populations in STEM fields. Of the **85,300** students who took at least one ATE-supported course during 2009

45% WERE NON-WHITE

27% WERE WOMEN

52% WERE ENROLLED IN TWO-YEAR COLLEGES

32% WERE SECONDARY SCHOOL STUDENTS

58,100 people participated in ATE professional development programs during 2009.

47% WERE TWO-YEAR COLLEGE FACULTY

27% WERE SECONDARY SCHOOL TEACHERS

15% WERE FROM BUSINESS AND INDUSTRY

11% WERE FOUR-YEAR COLLEGE FACULTY

In **2009**, ATE centers and projects developed

1,740 CURRICULUM MATERIALS

1,372 ARTICULATION AGREEMENTS AMONG **958** INSTITUTIONS

VOICES OF INDUSTRY

iv

Our training partnership with the Advanced Technological Education program is on target to grow by 30% each year over the next 3 years, yet we anticipate a need for a 40% increase in our workforce. The SMART Center [Southeast Maritime and Transportation Center] is poised to do just that—help us grow our maritime workforce.

DAN WELCH
VICE PRESIDENT
AND GENERAL MANAGER
BAE SYSTEMS SOUTHEAST SHIPYARDS



It seems like fun and all games, but what has really been enacted here is leadership. You've created a cohesive team around a project that is STEM-based, that has a vision to it, and applies skills and aptitude to something that says you need to give back. The beauty of the Regional Center for Next Generation Manufacturing and the entire Advanced Technological Education program is that you are planting seeds for a future that isn't yet built.

ANTONIO FARIAS
DIRECTOR OF DIVERSITY AFFAIRS
U.S. COAST GUARD ACADEMY



The SEMI Foundation's High Tech U program, produced with the MATEC Center (Maricopa Advanced Technology Education Center), enables high school students to see real possibilities for careers in high tech. The opportunity they have to experience active learning creates a "Wow" factor. They see that what they learn in school translates to real life.

LISA ANDERSON
VICE PRESIDENT
SEMI FOUNDATION



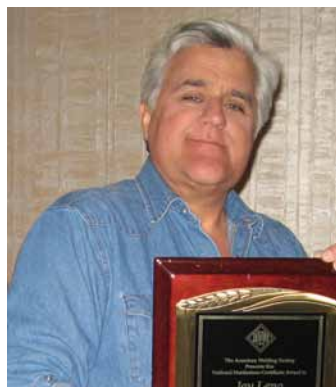
Because of the increased demand for qualified technicians, laboratory personnel, and engineers in the field of composites and materials manufacturing, The Boeing Company is fully committed to the success of the MatEd Center (National Resource Center for Materials Technology Education). Public awareness of career opportunities in materials and advanced manufacturing is increased by MatEd's presence.

GEORGE A. PARKER
LEAD ENGINEER AND CHIEF CHEMIST
THE BOEING COMPANY



This country was built by welders and somewhere along the line we lost our focus . . . We've lost some of the basics that made this country great . . . Welding is a skill, it's a skill as much as anything else in this country. But for some reason, I don't know where, working with our hands suddenly became a detriment.

JAY LENO
THE TONIGHT SHOW HOST
NBC UNIVERSAL, INC.



The relationships and the learning shared by the AMTEC [Automotive Manufacturing Technical Education Collaborative] partners are encouraging and rewarding. It is remarkable that the UAW [United Auto Workers], GM, Ford, Toyota, BMW, and others can sit in a room and work together openly and cooperatively with our college partners in the interest of developing the best technical workforce in the world.

JOANNE PRITCHARD
GLOBAL MAINTENANCE MANAGER
GENERAL MOTORS COMPANY



INTRODUCTION



Dynamic Industry-Education Partnerships Prepare Students to Succeed in Knowledge Age

The 39 centers of the National Science Foundation's Advanced Technological Education program lead dynamic, productive partnerships among industry, community colleges, and other education sectors. These partnerships begin with ATE center principal investigators listening—really listening—to employers describe the skills they seek in technicians.

The science and engineering technicians who are the focus of the National Science Foundation's ATE program are knowledge workers in high-tech fields of vital importance to the nation's security. They are the men and women who maintain energy supplies, secure digital information networks, transform plans into products, sustain the food supply, and protect natural resources. Their work often utilizes new technologies; it requires a solid foundation in math and science specific to their fields as well as teamwork, timeliness, and other workplace skills.

Understanding employers' expectations for technicians now and in the future helps ATE centers formulate new strategies to educate more students to become full-fledged participants in the world-class workforce the U.S. needs to compete globally.

ATE Centers Impact 2011 highlights ATE centers' creative responses to employers. The centers' national and regional approaches provide practical solutions to issues that challenge both educators and employers. Their programs ensure that students enter the workforce having completed degrees or certificate programs that truly equip them with the knowledge and skills they and their employers need to succeed.

Researchers Study ATE Program Implications

As the Advanced Technological Education (ATE) program has matured, grantees' work has become the subject of research.

Liesel Ashley Ritchie of the University of Colorado's Institute of Behavioral Science coordinates the work of 20 researchers from 7 institutions who are involved in the Discovering the Educational Consequences of ATE (DECA) project. This research is in addition to the annual program report by The Evaluation Center of Western Michigan University and individual centers' and projects' evaluations.

The reports that the DECA researchers began making in 2010 advance understanding of the impact of the ATE program, the value of the National Science Foundation's (NSF) investment in it, and the program's broader implications for technician education and community colleges.

Researchers' Findings

Wayne Welch of Rainbow Research is studying the sustainability of ATE programs. One of his preliminary findings is that 90.9% of the 216 grant recipients who participated in the survey agreed or strongly agreed that the program changes initiated by their grants would continue after NSF funding ends.

Darrel M. Hull of the University of North Texas found that technician education students generally have higher abilities in spatial reasoning than non-technological students at the same colleges. He recommends structuring curricula and pedagogy

to use students' spatial strengths to increase their motivation to learn math and science. He also encourages assessment of spatial abilities as part of career guidance services so students with spatial aptitudes receive information about technician education programs.

Louise Yarnall of SRI International analyzed ATE instructional materials for instructional fit, technical quality, and ease of use. "The study indicates that higher quality ATE materials provide good models for teaching professional skills [those that go beyond narrow technical content], and provide clear guidance on teaching methods and rich materials for classroom use."

Ron Anderson of Rainbow Research examined the gender gaps among students enrolled in ATE programs and found that "ATE funds facilitate a variety of important recruitment and retention activities for getting students into and remaining with technician education programs." Preliminary results of his analysis of technician education students' attainment of critical milestones—such as course completion and program persistence—indicate that "gender, race, and age play a major role in the student pipeline and that the magnitude of this role changes across time."

Charles Henderson, Herb Fynewever, and Heather Petcovic of Western Michigan University conducted case studies on the direct and indirect impacts of 3 national ATE centers on their home institutions. They found that the most successful centers have clear visions of their core competencies and use these competencies to collaborate with colleagues at their institutions.

FIND ALL SOURCE INFO AT WWW.ATECENTERS.ORG/SOURCES



This is the Knowledge Age. The U.S. cannot prosper based on low wages, geographic isolation, or military might. We can prosper only based on brainpower: properly prepared and properly applied brainpower.



CHARLES M. VEST - PRESIDENT
NATIONAL ACADEMY OF ENGINEERING



ADVANCED MANUFACTURING TECHNOLOGIES



- 01 **AMTEC** - Automotive Manufacturing Technical Education Collaborative - www.autoworkforce.org
- 02 **CAAT** - Center for Advanced Automotive Technology - www.macomb.edu/CAAT
- 03 **CARCAM** - Consortium for Alabama Regional Center for Automotive Manufacturing - www.carcam.org
- 04 **FLATE** - Florida Advanced Technological Education Center - www.fl-ate.org/www.madeinflorida.org
- 05 **NCME** - National Center for Manufacturing Education - www.ncmeresource.org
- 06 **RapidTech** - National Center for Rapid Technologies - www.rapidtech.org
- 07 **RCNGM** - Regional Center for Next Generation Manufacturing - www.nextgenmfg.org
- 08 **TIME Center** - Technology and Innovation in Manufacturing and Engineering - www.time-center.org
- 09 **Weld-Ed** - National Center for Welding Education and Training - www.weld-ed.org

**1/3 OF U.S. COMPANIES
NEED MORE SKILLED
WORKERS**



1/3

**IN 2009 THE ANNUAL
AVERAGE WAGE
FOR WORKERS**

IN MANUFACTURING

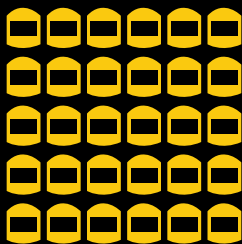
\$72,258

NON- MANUFACTURING

\$58,411

**THE U.S. NEEDS
30,000 NEW WELDERS
EACH YEAR**

30,000



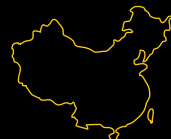
**THE U.S. IS THE
LEADING PRODUCER OF
MANUFACTURED GOODS**



**21%
U.S.**



**13%
JAPAN**



**12%
CHINA**



ADVANCED MANUFACTURING TECHNOLOGIES

01

AMTEC

AUTOMOTIVE MANUFACTURING
TECHNICAL EDUCATION COLLABORATIVE

www.autoworkforce.org



KENTUCKY COMMUNITY
& TECHNICAL COLLEGE
SYSTEM / VERSAILLES, KY



- » Develops and delivers a modularized industry-endorsed curriculum.
- » Creates a sustainable career pathway model.
- » Supports and sustains a collaborative industry-education model.
- » Implements a continuous improvement process for workforce preparation using industry-endorsed assessments and certifications.

Employer Engagement Important In AMTEC Model

AMTEC wants to increase the number of students who transition successfully from secondary to postsecondary technical programs and then into the workforce. To accomplish this goal, AMTEC is building on the career pathways work of its partners—CARCAM, Alamo Community College, and Lansing Community College. Most importantly, it is engaging Ford Motor Company, General Motors Company, Toyota Motor Manufacturing, BMW, and other employers in the development of effective pathways to the auto industry's high-skill and high-wage careers.

AMTEC implemented its advanced automotive manufacturing and mechatronics pathway model at Bluegrass Community and Technical College and Toyota Motor Manufacturing, Kentucky Inc. in 2010. The 24 students in the pilot program work at the Toyota plant 3 days a week and attend classes 2 days a week. At the college, students are held to the employer's expectations for attendance, dress code, and safety.



STUDENTS LEARN ELECTRONICS, HYDRAULICS, AND OTHER AUTOMOTIVE MANUFACTURING SKILLS USING TRAINERS IN COLLEGE LABS.



To continue to be successful into the future there are two crucial achievements to gain: 1) a total career pathway that is seamlessly linked from the K-12 system, through the technical community college, and into career-long learning in the workplace; 2) a modular learning system comprised of short, flexible courses ... We look to the AMTEC coalition to help provide us with both.



DENNIS PARKER - ASSISTANT MANAGER OF MULTI-SKILLED MAINTENANCE DEVELOPMENT
TOYOTA NORTH AMERICA PRODUCTION SERVICE CENTER



AMTEC Develops National Standardized & Industry-Endorsed Curriculum

AMTEC community college and industry partners have committed to serve as the foundation for a new kind of technician: a multidiscipline problem-solver who thinks in systems and is an integral part of continuous improvement. AMTEC has grown from 1 program in Kentucky to a multi-state, multi-company collaboration. As a National Center for Excellence in Automotive Manufacturing, AMTEC leads collaborations between 30 community colleges and 34 automotive-related facilities in 12 states.

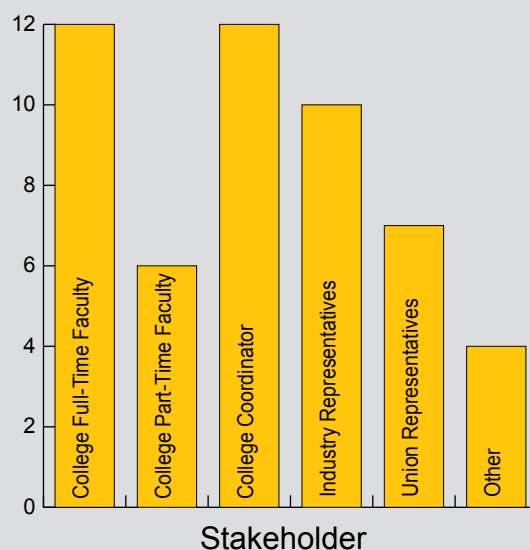
AMTEC and partners are developing an online, modularized curriculum that meets national standards. It consists of 12 courses and 57 modules based on 26 duty areas and 170 tasks. The course development teams are made up of representatives from community colleges, industry, and United Auto Workers, and are led by industry employees who bring real-life manufacturing perspectives to the curriculum development process. Consequently, students are better prepared and begin their careers as cost-efficient employees.

AMTEC Creates National Industry-Endorsed Assessments & Certification

AMTEC's ongoing national assessment and certification processes focus on making sure workers, companies, and educational institutions are all engaged in a continuous learning process so that the skills and curricula stay current at all times. As a result of AMTEC's leadership

- Community colleges acquire state-of-the-art curriculum that is updated efficiently on an ongoing basis. AMTEC's modules may be configured in various ways to serve many employers.
- Companies gain a highly skilled workforce with the precise skills they require to be globally competitive.
- Students receive highly targeted instruction that accommodates many learning styles.

Many Stakeholders Shape AMTEC Curriculum



FIFTY-SEVEN PEOPLE FROM INDUSTRY, UNIONS, AND COLLEGES WORKED TOGETHER ON AMTEC'S MODULARIZED CURRICULUM.

EXPERIENCED TECHNICIANS LEARN NEW TROUBLESHOOTING SKILLS AT AMTEC PARTNER COLLEGES.



ADVANCED MANUFACTURING TECHNOLOGIES

02

CAAT

CENTER FOR ADVANCED
AUTOMOTIVE TECHNOLOGY

www.macomb.edu/CAAT



MACOMB
COMMUNITY COLLEGE
WARREN, MI



- » Employs “seed grants” to encourage adoption of CAAT curricula and development of curricula across the advanced automotive spectrum to support local economic development.
- » Leverages strategic partnerships with industry, education, and government to form a single Web-based, interactive source for sharing
 - Up-to-date educational resources for advanced automotive technology.
 - Latest technology and industry needs in green mobility.
- » Prepares students for careers in new and developing advanced automotive technologies through
 - Establishment of seamless 2+2+2 educational pathways.
 - Integration of STEM concepts into high school curricula.
 - Faculty professional development.

CAAT Helps Students Shift to Advanced Automotive Technology Careers

CAAT is located in southeast Michigan, home to the largest American automakers, numerous foreign automakers, and more than 270 automotive research and development centers. CAAT focuses on meeting the nation’s need for skilled technicians in advanced automotive technologies. These technologies are shifting the transportation economy from petroleum-powered engines to new vehicle propulsion systems. These new systems include electric vehicles, hybrid electric vehicles, plug-in hybrid electric vehicles, alternative fuel vehicles, and fuel cell vehicles.

CAAT is taking a leadership role in partnering with industry, education, and government to forecast industry needs and position educators for success in preparing technicians to research, design, develop, tool, manufacture, service, and ultimately reuse and recycle these vehicles and their components.

This new center is a critical piece of the economic development pie to introduce new technicians to the rapidly evolving automotive industry.

ANDREA EBBITT - HUMAN RESOURCES DIRECTOR
GENERAL MOTORS POWERTRAIN

STUDENTS ACCESS THE BATTERY SYSTEM DURING
A CLASS ON AUTOMOTIVE POWER SYSTEMS.



CAAT Leverages Partnerships to Transform Workforce

In response to a national effort to reduce dependence on oil and improve our nation's trade balance, stringent Corporate Average Fuel Economy (CAFE) standards on new vehicles are in place and more limitations are proposed. To meet CAFE standards, the U.S. auto industry is developing vehicle propulsion systems that will reduce emissions and meet worldwide customer demands. These new vehicle propulsion systems utilize advanced automotive technologies. The use of these technologies will increase significantly in the near future and they will have implications, such as charging stations and smart grid requirements, for the nation's electrical infrastructure.

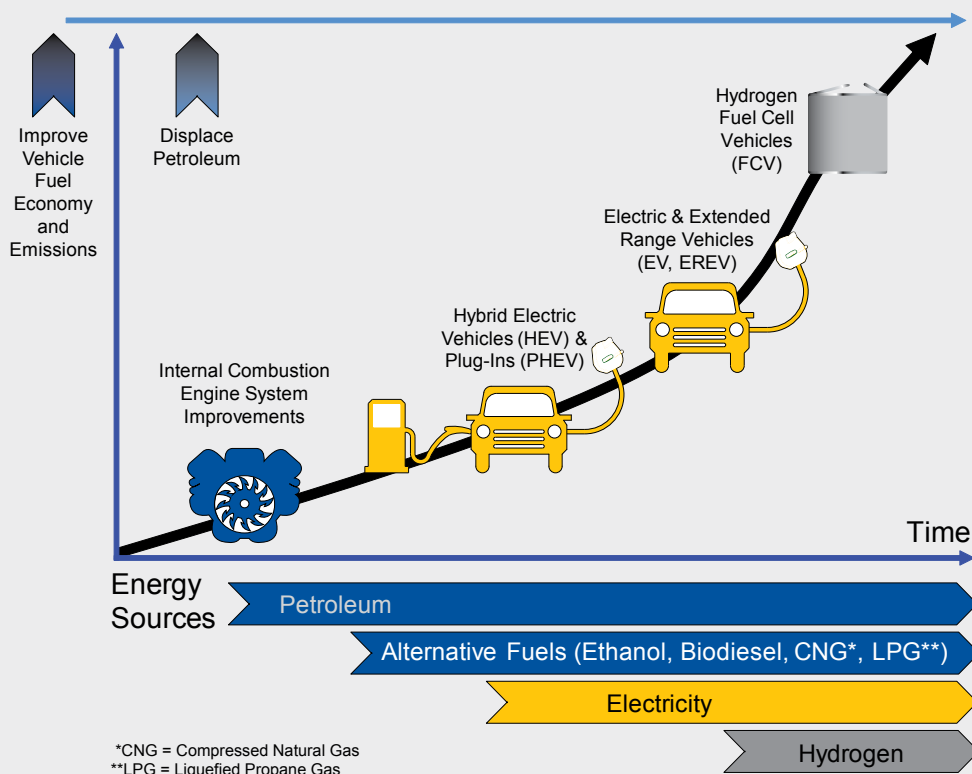
As the use of advanced automotive technologies grows, the demand for highly trained technical workers, who are already in short supply, is expected to grow too. More than 80% of manufacturing companies reported in 2005 that they needed more highly trained technicians.

Thirteen percent of those surveyed for the *2005 Skills Gap Report - A Survey of the American Manufacturing Workforce* were experiencing severe shortages of skilled technicians.

CAAT is engaging key partner organizations that will be leveraged for their broad reach to specific audiences such as industry, community colleges, universities, government agencies, and professional organizations. These partnerships are essential to deliver the education that will transform the workforce to meet employers' needs for technicians who possess the knowledge and skills to work with advanced automotive technologies and the infrastructure that supports them.



A COMPACT POWER, INC., TECHNICIAN TESTS COMPONENTS USED IN A LITHIUM-ION BATTERY.



CAAT PREPARES
TECHNICIANS
FOR WORK WITH
ADVANCED
AUTOMOTIVE
TECHNOLOGIES.



ADVANCED MANUFACTURING TECHNOLOGIES

03

CARCAM

CONSORTIUM FOR ALABAMA REGIONAL
CENTER FOR AUTOMOTIVE MANUFACTURING

www.carcam.org



GADSDEN STATE
COMMUNITY COLLEGE
GADSDEN, AL



STUDENTS CREATE AND TEST ROBOT PROGRAMS
WITHIN THE ROBOTICS LAB.

- » Educates technicians for the automotive and advanced manufacturing industries.
- » Collaborates with industry to develop and continuously revise curricula to meet manufacturing educational needs.
- » Offers flexible career pathways to recruit, retain, and prepare students for careers in automotive manufacturing.
- » Provides professional development to advance the technical knowledge of faculty and incumbent workers.

CARCAM Drives Success in Automotive Manufacturing Technician Education

CARCAM operates on the principle that manufacturing education must be ever-changing as it keeps pace with industry's high-tech improvements. Consequently, graduates of CARCAM college programs are multi-skilled technicians who have the knowledge required to succeed in today's high-tech job market.

CARCAM's current projects involve enhancing its Automotive Manufacturing Technology (AUT) degree. The revamped curriculum responds to industry needs for technicians to know modern automated production system concepts related to lean manufacturing, continuous improvement, and quality systems. Students also learn basic skills for programmable logic controllers and other automated control systems. Through classroom and lab instruction, and through hybrid and distance learning, students receive hands-on educational experiences with current machining, welding, and robotics equipment. Curriculum modules cover electronics, hydraulics, programmable logic controllers, welding, machine tool technology, and robotics as well as problem solving and team building.

CARCAM builds soft skills into the curriculum using a Knowledge, Skills, and Abilities (KSA) indicator. This is an agreed upon knowledge level that students are expected to attain for successful completion of learning and performance objectives.

A highly skilled workforce is essential to be competitive in the automotive industry. There is no better time to launch a career in some of the best jobs in automotive manufacturing and no better place to receive the education required.

MARK BRAZEAL - GENERAL MANAGER OF ADMINISTRATION
TOYOTA MOTOR MANUFACTURING, ALABAMA, INC.
PRESIDENT - ALABAMA AUTOMOTIVE MANUFACTURERS ASSOCIATION

STEM Camps Generate Interest in Technical Careers

CARCAM has sponsored Science, Technology, Engineering, and Mathematics (STEM) Camps annually for pre-college students since 2006. The 1-week summer camps are effective in reaching underrepresented student populations and increasing their interest in technical careers. As of 2010, 75% of the 560 enrolled STEM camp students were female and/or minority. Most noteworthy, 85% of the students from underrepresented populations have enrolled in at least 1 high school STEM course.

At STEM camp, students experience a college campus environment, observe various engineering classes, visit robotic labs, and participate in team-building activities. Through interaction with college faculty and on-site industry tours, camp participants learn about the courses they should take in high school and college to prepare for a technical career in manufacturing.

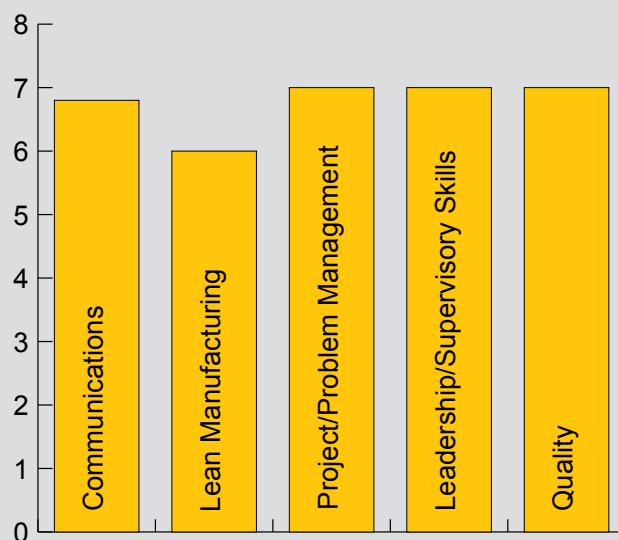
Partnerships with Industry Build Workforce of Tomorrow

The Alabama Automotive Manufacturers Association (AAMA) works with CARCAM to promote technical careers. The industry association supports student success by offering scholarships for students to pursue automotive-related degrees. Of the 197 AAMA scholarships awarded from 2005 to 2010, 190 recipients were students enrolled in CARCAM partner college programs.

AUT Program Helps People Advance

CARCAM's innovative AUT incumbent worker education program provides a career pathway for associates currently employed by Original Equipment Manufacturers (OEMs). The associates attend classes, which CARCAM works with multiple OEMs to provide, to qualify for highly skilled maintenance technician positions and advance through an internal process known as the Equipment Maintenance Service Technician Pool Program. CARCAM recently celebrated a milestone with an OEM that placed its 18th pool member associate as an Equipment Service Technician. This manufacturer has placed slightly more than 10% of its 175 high-tech equipment maintenance employees from the AUT pool program.

Top 5 Soft Skills that Automakers Want



A 2009 INDUSTRY SURVEY INDICATES THAT SOFT SKILLS ARE ESSENTIAL COMPONENTS OF AUTOMOTIVE TECHNICIAN EDUCATION.

A HONDA TECHNICIAN REVIEWS INFORMATION FROM AN EMISSION TEST UNIT.



04

FLATE

FLORIDA ADVANCED TECHNOLOGICAL
EDUCATION CENTER

www.fl-ate.org / www.madeinflorida.org



HILLSBOROUGH
COMMUNITY COLLEGE
TAMPA, FL



FLATE educates and influences the high-tech workforce with its

- » Made in Florida campaign, which reaches more than 52,000 Florida students and educators.
- » Engineering Technology (ET) degree, which articulates statewide with stackable, industry-aligned credentials.
- » Partnerships, which build effective, outcome-based relationships with industry, education, and government organizations.
- » Baldrige Evaluation Model, which is an industry-recognized business evaluation system structured on organizational performance excellence.
- » Education expertise, which influences the technical, skill-based content of curricula throughout Florida.

FLATE Builds Interest in Manufacturing

FLATE's efforts to nurture teens' interest in manufacturing careers are evident as 17,651 students have expressed interest in high-technology education and careers in response to an advertorial in Florida Trend's publication *NEXT*, an annual teen-focused careers publication. More than 5,000 college students are currently enrolled in engineering technology and related degree programs in Florida. Responding to a need expressed by the National Association of Manufacturers (NAM) and Florida industries, FLATE's Made in Florida campaign provides innovative marketing materials to middle and high school students statewide to generate interest in and to project a positive image of manufacturing education and careers in Florida.



A STUDENT USES AN INDUSTRIAL MICROSCOPE.

CARLOS SOTO - PRESIDENT
HILLSBOROUGH COMMUNITY COLLEGE, BRANDON CAMPUS



FLATE's role in redefining engineering technology education in Florida puts a whole new face to what's happening in manufacturing.



ET Degree Program Meets Expressed Workforce Needs

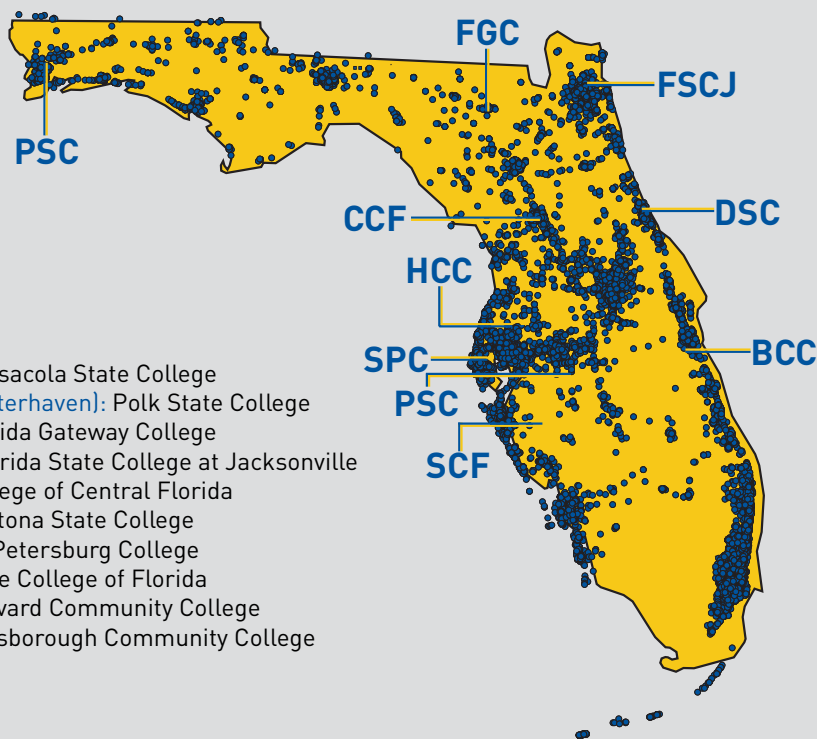
The Engineering Technology (ET) degree program conceived, engineered, and coordinated by FLATE is the first of its kind to offer a cohesive, comprehensive, and completely articulated inter-institutional program. The ET degree program's core courses align with Manufacturing Skills Standard Council (MSSC) certification, which is part of the NAM-endorsed certificate system. This gives students the option to join the workforce quickly through an ET certificate program or to apply their certificate toward an associate in science or associate in applied sciences degree.

FLATE's ET degree program focuses on core courses covering introductory computer-aided drafting, electronics, instrumentation and testing, processes and materials, and quality and safety. By working closely with its Industry Advisory Council, FLATE has expanded degree specializations to include alternative energy, digital design and modeling, and biomedical systems. Ten colleges across Florida currently offer 8 degree specializations and 15 certificates that are preparing students and workers from both rural and metropolitan areas for careers in advanced manufacturing and high-technology industries.

FLATE facilitates preparation for entry-level technical workers, too. Thanks to FLATE's work with high school frameworks at the state level, high school students can choose career education with an industry certification and be workforce-ready upon graduation. In 2009 to 2010, 14,592 Florida high school students enrolled in engineering technology and related programs.



FLATE Partner Colleges Serve Florida's High-Tech Industries



- PSC: Pensacola State College
- PSC (Winterhaven): Polk State College
- FGC: Florida Gateway College
- FSCJ: Florida State College at Jacksonville
- CCF: College of Central Florida
- DSC: Daytona State College
- SPC: St. Petersburg College
- SCF: State College of Florida
- BCC: Brevard Community College
- HCC: Hillsborough Community College

A TECHNICIAN ENTERS DATA INTO A COMPUTER NUMERICAL CONTROLLED MILLING MACHINE PROGRAM MODULE.

FLATE PARTNER COLLEGES WORK THROUGHOUT FLORIDA WITH THE MANUFACTURING COMPANIES REPRESENTED BY DOTS ON THE MAP.



ADVANCED MANUFACTURING TECHNOLOGIES

05

NCME

NATIONAL CENTER FOR
MANUFACTURING EDUCATION

www.ncmeresource.org



SINCLAIR COMMUNITY
COLLEGE
DAYTON, OH



FACULTY AND STUDENTS LEARN PHYSICS
AND MATH WHILE DESIGNING AND
BUILDING THEIR OWN CUSTOM GUITARS.



- » Serves manufacturing and engineering technology educators with high-quality resources in emerging technologies and innovative classroom strategies via METEC (Manufacturing and Engineering Technologies Education Clearinghouse).
- » Participates in a wide range of professional and educational initiatives to improve K-12 student preparedness in science, technology, engineering and mathematics (STEM) fields.
- » Provides faculty an opportunity to disseminate their innovative materials nationally.
- » Offers customized curriculum and professional development services.
- » Partners with manufacturing and engineering technologies-related grants to provide Web-site and curriculum support.

NCME Interactive Web Site, Social Networking Site Reach Students

NCME engages in a wide range of activities all targeted at improving manufacturing and engineering technology education, as well as increasing the pipeline of skilled workers for the in-demand advanced technology jobs that are the backbone of the U.S. economy.

The center's interactive Web site www.careerME.org helps high school and college students explore the lucrative and exciting careers in a variety of advanced manufacturing fields. In 2010, NCME launched www.mycareerme.org, a social networking Web site that connects students with other students, companies, and mentors.

The center also provides Web site and curriculum support to other Advanced Technological Education projects. One current project teaches auto repair technician educators about hybrid automobiles. Another develops curriculum on diesel-cycle airplane engines.



NCME is a unique and vital component locally and nationally in filling the worker pipeline for the advanced manufacturing careers of the 21st century.



ANGELIA ERBAUGH - EXECUTIVE DIRECTOR
DAYTON TOOLING AND MANUFACTURING ASSOCIATION





NCME PROVIDES PROFESSIONAL DEVELOPMENT FOR FACULTY WHO TEACH AUTOMOTIVE TECHNICIANS HOW TO WORK ON THE HIGH VOLTAGE SYSTEMS IN HYBRID ELECTRIC VEHICLES.

NCME Prepares Teachers To Teach New Generation of Technicians

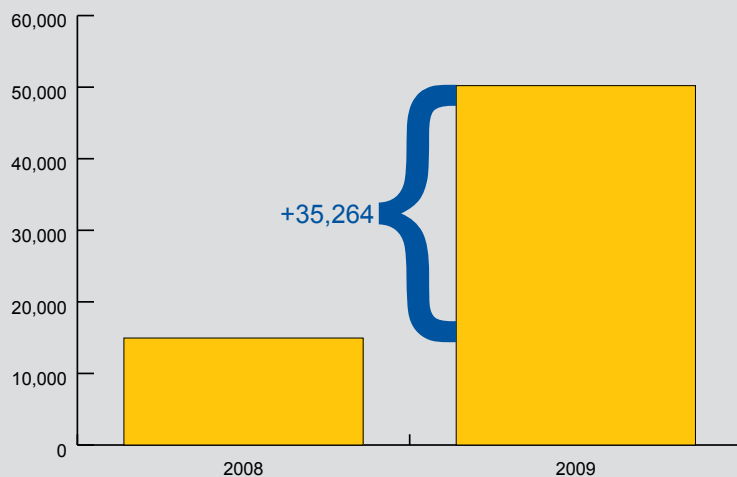
By using www.meteconline.org, NCME's searchable database of materials, educators have easy access to high-quality, innovative resources, and exemplary practices in manufacturing and engineering technology education. The number of unique visitors to METEC has increased dramatically since 2009 when the center's previous online service MERC (Manufacturing Education Resource Center) merged with the NETEC (National Engineering Technology Education Clearinghouse). NCME also hosts webinars that address both content and pedagogy in emerging technology fields.

The center also partners with such outstanding STEM initiatives as Project Lead the Way (PLTW), a nationally recognized pre-engineering program for high school students, through which they can earn college credit. NCME, based at Sinclair Community College, is proud to be the Ohio affiliate institution for PLTW. It serves as the teacher professional development facility for the state and region.

Guitar-Building Course Boosts STEM Know-How

In 2009, NCME partnered with Purdue University, Butler County Community College, Mott Community College, and Fox Valley Community College to develop a guitar-building course for 2-year colleges. It is an offshoot of a National Science Foundation Advanced Technological Education grant for product lifecycle management (PLM). Originally part of the design-and-build component of the PLM grant, the guitar-building class integrates math and science with manufacturing and supply chain competencies. The class draws a variety of students of all ages, both men and women, from a wide range of majors. In the process of producing their own guitars, students learn the physics of tension and compression, the mathematical logarithms of the musical scale, and the electronics of connecting to an amplifier. Students become so engrossed in the class that they often wish to work extra hours. See it at www.guitarbuilding.org.

Unique Visitors to METEC



THE MERGER OF MERC AND NETEC IN 2009 DRAMATICALLY INCREASED THE NUMBER OF UNIQUE VISITORS TO NCME'S CLEARINGHOUSE.





**ADVANCED
MANUFACTURING TECHNOLOGIES**

06

RapidTech

NATIONAL CENTER FOR
RAPID TECHNOLOGIES

www.rapidtech.org



SADDEBACK
COLLEGE
MISSION VIEJO, CA



- » Provides industry leadership through additive manufacturing materials and process research.
- » Recruits, retains, and prepares incumbent and emerging workforce students for careers in the expanding field of additive manufacturing.
- » Offers secondary and postsecondary professional development opportunities.
- » Supplies instructional materials for certificate and degree programs that enable college and high school students to enter a variety of emerging fields in additive manufacturing.

**RapidTech Focuses on
Additive Manufacturing Careers**

RapidTech and its partners support careers in the expanding field of additive manufacturing technologies. With the formation of the ASTM International F42 standard and direction from its Industry Advisory Board on Additive Manufacturing, RapidTech is realigning existing instructional materials to be infused into new and existing design, manufacturing, and engineering courses. The realignment will allow educators to implement additive manufacturing education while minimizing the impact on existing coursework. New and updated instructional materials are being evaluated that will highlight the new skill and knowledge sets that will be required in the additive manufacturing industry.

RapidTech supports professional development for secondary school teachers, as well as community college and university faculty through its National Teacher Training Workshop. This workshop provides valuable hands-on experiences utilizing instructional materials and equipment not normally found in the classroom, and it brings together industry, equipment manufacturers, and educators for a truly unique learning experience.

In fall 2010 the Rapid Digital Manufacturing Program at Saddleback College had 207 students. This is a 16% increase from 2008 when 178 students were enrolled in the associate of science degree program.



WITH BRUSHES AND A VACUUM STUDENTS FINALIZE PARTS CREATED WITH 3-DIMENSIONAL (3D) TECHNOLOGIES THAT USE POWDER AND LASERS.

VINCENT ADAMS - GLOBAL MARKETING MANAGER
DSM SOMOS

RapidTech cultivates the future of our industry. It helps our industry by continuing to host conferences, training events, and most importantly by continuing to train the future engineers and designers of tomorrow.



RapidTech Connects Industry & Education As Use of Additive Manufacturing Grows

RapidTech has taken a leadership position within the additive manufacturing industry by actively participating in conferences and national boards such as SME Rapid and the ASTM F42 Committee on additive manufacturing. With input from its industry advisory board, RapidTech has also taken a leading role in the preparation of students to support additive manufacturing activities within the U.S. manufacturing base.

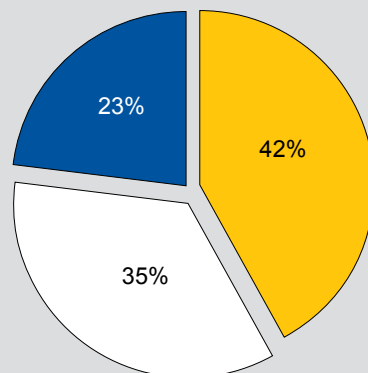
RapidTech assists educational institutions at all levels by defining current and future workforce trends and identifying the knowledge and skills needed by the emerging workforce. The center places this information in the hands of educational institutions at all levels in order to ensure that the instructional support material and programs at colleges across the country reflect current workforce needs. RapidTech encourages educational institutions across the country to adopt real-world experiences within the classrooms by utilizing project-based learning models that incorporate science, technology, engineering, and mathematics (STEM) learning experiences.

RapidTech actively collaborates with more than 197 educational institutions and 529 companies and agencies across the country. RapidTech's industry partners provide employment opportunities for students in a wide range of industries including aerospace, animation, automotive, defense, consumer products, and medical devices.

TECHNICIANS UTILIZE HIGH-POWERED
ULTRAVIOLET FIBER OPTIC TOOLS TO REPAIR
PARTS MADE WITH STEREO LITHOGRAPHY.

IN ADDITION TO CERTIFICATE AND DEGREE
PROGRAMS, RAPIDTECH OFFERED PROGRAMS
FOR EDUCATORS, INDUSTRY PERSONNEL, AND
CAREER COUNSELORS DURING ITS FIRST 3 YEARS.

RapidTech Professional Services 2007 through 2009



- Vital Link Career Counselor Workshops
(85 participants)
- Industry 3D User Workshops
(127 participants)
- Faculty Professional Development
(152 participants)



07

RCNGM

REGIONAL CENTER FOR NEXT
GENERATION MANUFACTURING

www.nextgenmfg.org



CONNECTICUT COMMUNITY
COLLEGES' COLLEGE OF
TECHNOLOGY (COT)
HARTFORD, CT



COT STUDENTS VISIT TRUMPF INC. TO SEE
HOW MANUFACTURERS USE LASERS.



I learned new ways to inspire and enrich students through integrating hands-on, real-world experiences with textbook knowledge.



CHRISTIE PROUT - SCIENCE TEACHER
MONROE ACADEMY
PARTICIPANT - TEACHERS' ENGINEERING CHALLENGE

- » Professional development for faculty and teachers that includes industry externships, seminars, workshops, expos, and professional conferences.
- » Curricula in new and emerging technologies responding to workforce needs.
- » 2 + 2 + 2 seamless career pathways.
- » Resources and leadership to improve existing programs as well as the establishment of new programs in advanced manufacturing and related technologies.
- » Career marketing materials distributed regionally and nationally to secondary and community college educators as well as parents, industry, government agencies, and policy makers.

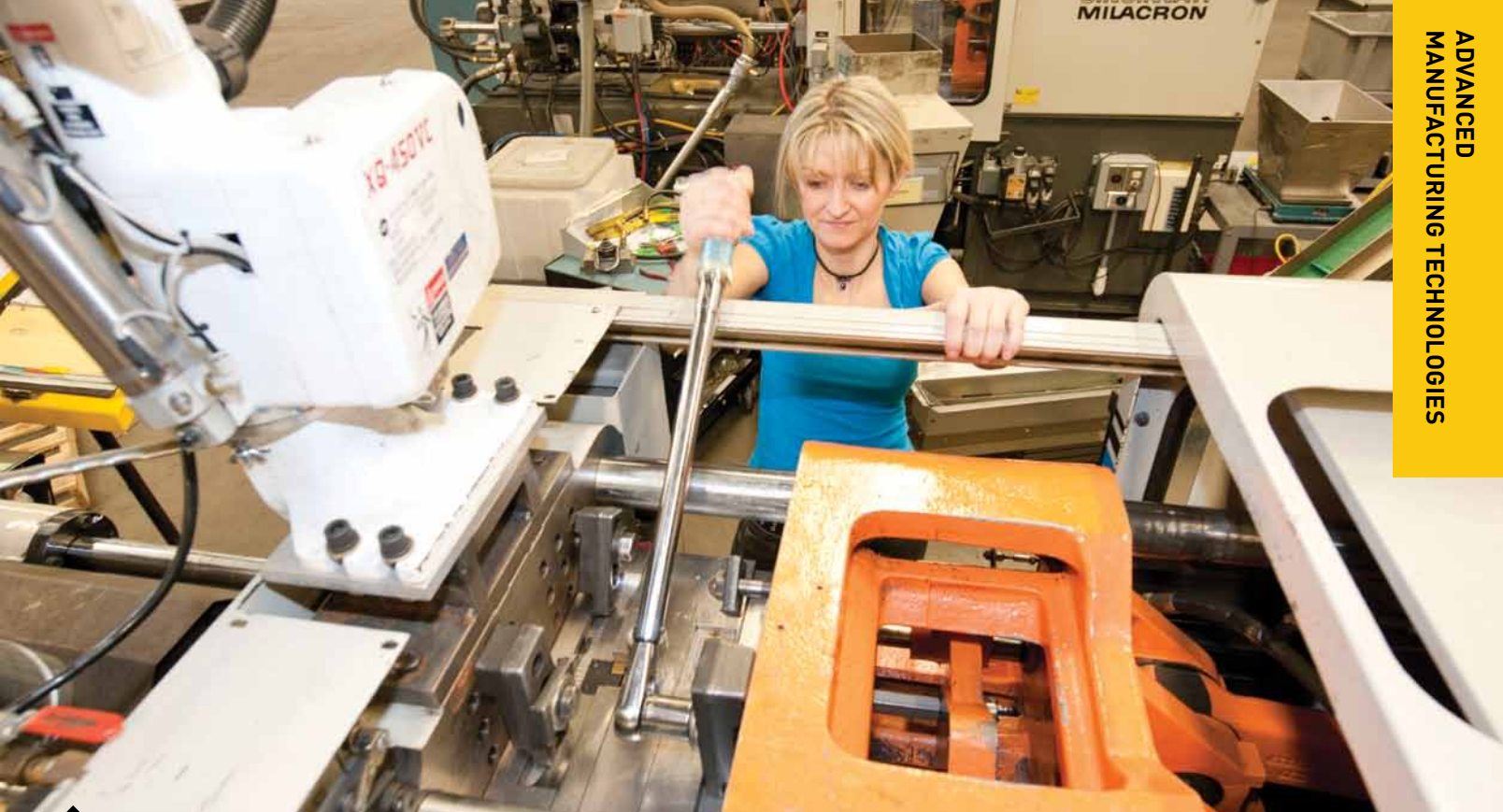
Center Builds Overall Enrollment, Participation of Underrepresented Minorities

RCNGM's aggressive marketing efforts, which include the production and distribution of a nationally recognized career pathway DVD, are formidable and systemic. Since the center's creation in 2004, enrollments in COT science, technology, engineering, and math (STEM) programs have increased from 2,865 to 3,913 students in 2009. From 2004 through 2009 the number of women enrolled in STEM programs increased from 540 to 630; the number of Hispanic students increased from 666 to 944; and the number of Black students increased from 310 to 407.

Since 2006, 355 students have participated in an Engineering Challenge for the 21st Century program that uses real-world problems to teach technical and professional skills such as teamwork and time management. RCNGM's outreach activities have also directly affected 40,000 students since 2004. Through its many collaborations with industry, 30 new programs and 65 new courses have been developed and implemented by the center since 2004. All of them prepare students for the advanced technology workforce.

Summer Workshops Excite Teachers, Then Students about Engineering

Teachers from 15 states and Puerto Rico have learned new technologies and pedagogy at the Teachers' Engineering Challenge, a week-long residential workshop that RCNGM co-sponsors with the U.S. Coast Guard Academy (USCGA). As a result of the 5-day summer workshops, the teachers have incorporated engineering into their instruction of more than 5,000 students.



A TECHNICIAN AT SIEMENS AG PREPARES AN INJECTION MOLDING MACHINE THAT MAKES PLASTIC COMPONENTS USED IN ELECTRONICS.

THE NUMBER OF WOMEN AND UNDERREPRESENTED MINORITY STUDENTS ENROLLED IN STEM PROGRAMS IS GROWING AT COT.

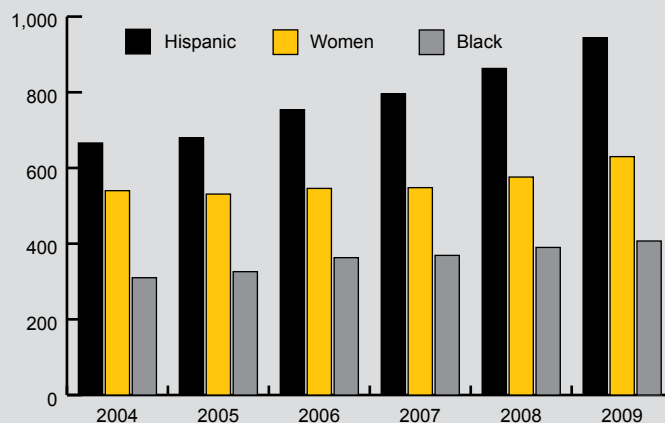


Center Develops Manufacturing Workforce with Industry Partners

The RCNGM works dynamically with regional and national partners to improve manufacturing practices essential for keeping the U.S. competitive in today's global economy. To achieve its goals, RCNGM works closely with key stakeholders: community college administrators, faculty members, high school educators, and industry partners. The center utilizes its industry partnerships to inform educators about cutting-edge technologies and to help them teach the nation's next generation of top-performing technicians and engineers.

The distribution of more than 4,000 *Manufacture Your Future* DVDs and *Manufacture Your Future* Teacher's Guide has increased students' awareness of career opportunities within Connecticut's manufacturing workforce. RCNGM's multimedia encouragement of students to pursue careers in advanced manufacturing is a factor in increasing COT enrollments. RCNGM has integrated proven strategies to engage and sustain underrepresented populations in the delivery of statewide and regional expos, Saturday outreach programs, peer mentoring, and industry-driven curriculum that addresses real-world problems. The center maximizes its impact through business, industry, professional and organizational partners such as the 10,000-member Connecticut Business and Industry

Underrepresented Populations Enrolled in COT STEM Programs



Association (CBIA), the Connecticut Center for Advanced Technology, the National Association of Workforce Improvement, the Office of Workforce Competitiveness, Department of Labor, and Department of Economic Development. Through its partnership with CBIA, for instance, RCNGM placed 130 educators with advanced manufacturing companies for 4-week externships. All the instructors gained new insights about how to prepare students for today's advanced manufacturing workforce. Following their externships, they implemented new curricula and classroom activities using real-world, hands-on design projects.



ADVANCED MANUFACTURING TECHNOLOGIES

08

TIME Center

TECHNOLOGY AND INNOVATION IN
MANUFACTURING AND ENGINEERING

www.time-center.org



COMMUNITY COLLEGE
OF BALTIMORE COUNTY
BALTIMORE, MD

- » Prepares students for manufacturing and engineering technology careers.
- » Produces flexible, responsive, and current industry-driven curricula.
- » Updates faculty skills through innovative professional development experiences.
- » Promotes a positive image of manufacturing and engineering technology careers.
- » Builds strategic partnerships among industry, education, and government stakeholders.

TIME Center Focuses Students on Emerging Careers

TIME Center and its partners support careers in manufacturing and engineering technology aligned with innovative production techniques, robotics, and automated systems. New and updated curricular efforts highlight the new skills that advanced manufacturers need.

TIME Center supports professional development for secondary school teachers and college faculty through learning projects that provide opportunities to utilize new technologies. The educators learn to transfer this new knowledge to students through applications, simulations, and problem-solving experiences.

Through a partnership with the Maryland Business Roundtable, the center is improving the perception of manufacturing and is encouraging students to pursue careers in manufacturing and engineering. The *You and Improved* career campaign will use the TIME Center's Web site to direct high school students to information about related community college programs.



A MANUFACTURING TECHNOLOGY STUDENT
MAKES A DISPLAY SIGN IN THE FAB LAB.



The TIME Center provides a total business solution mind-set when identifying and meeting the technical needs of manufacturers.



BARBARA BILLER - PRESIDENT
INTELLITECH, INC.



TIME Center Advances Workforce Needs

TIME Center addresses Maryland's manufacturing and engineering technician workforce needs in a planned and purposeful way. Gathering data on emerging needs directly from manufacturers and organizations, such as the Regional Manufacturing Institute and the Governor's Workforce Investment Board, the center and its 5 college partners develop industry-responsive curricula and provide high-quality professional development programs. Most importantly, the center and its partners promote technician education programs to prospective students.

TIME Center's accomplishments include a variety of new associate of applied sciences degree programs, new certificates, and course upgrades. TIME Center and its partners are collaborating in the development of 5 core electronics courses that will be offered in an online blended format. Partners also helped the center implement a FAB Lab at the Community College of Baltimore County to provide access to design and prototyping capabilities for industry, students, and the community.

As a result of the center's many initiatives, enrollments are growing in partner colleges' manufacturing and engineering technician programs. When TIME Center began in 2003, 1,979 students were enrolled in these programs. In 2010, enrollment was 3,448. During this 7-year period, a total of 18,215 individuals took credit and noncredit courses in TIME Center-affiliated college programs. Annual enrollment in high school programs grew from 5,200 to 9,588.

More students from underrepresented populations are among those enrolling. Enrollment by minority students increased 86% from 396 in 2005 to 740 in 2010. Enrollment by women increased 65% from 341 in 2005 to 563 in 2010. With its industry partners, TIME Center has also introduced 1,788 secondary and post-secondary educators to the new world of manufacturing. The center's outreach efforts have involved contact with more than 10,260 individuals since 2003.

In recognition of its continuing successes, TIME Center received the 2010 Maryland Advocacy Award of Excellence from the Technology Education Association of Maryland.

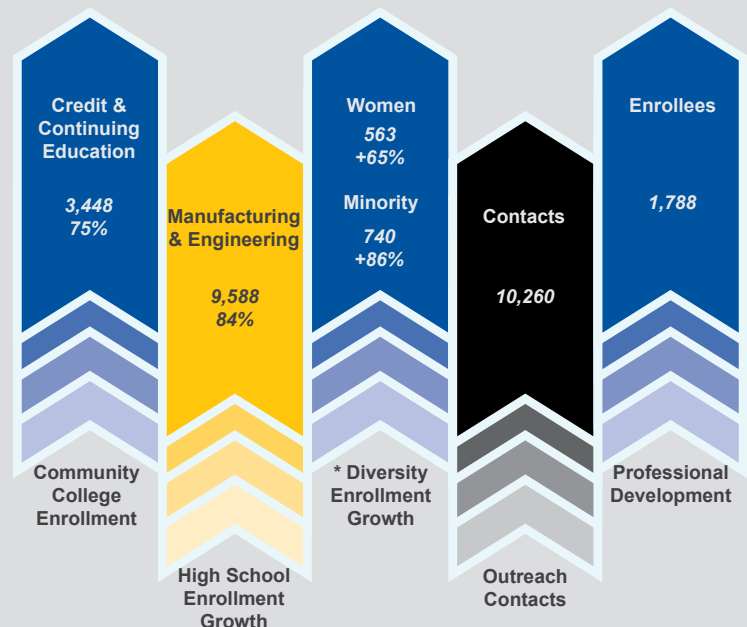


A GENERAL MOTORS BALTIMORE TECHNICIAN ASSEMBLES A 2-MODE HYBRID TRANSMISSION.

TIME CENTER BOOSTS ENROLLMENTS VIA OUTREACH AND PROFESSIONAL DEVELOPMENT.



TIME Center Dashboard 2003 - 2010



* Underrepresented population data from 2005 through 2010



09

Weld-Ed

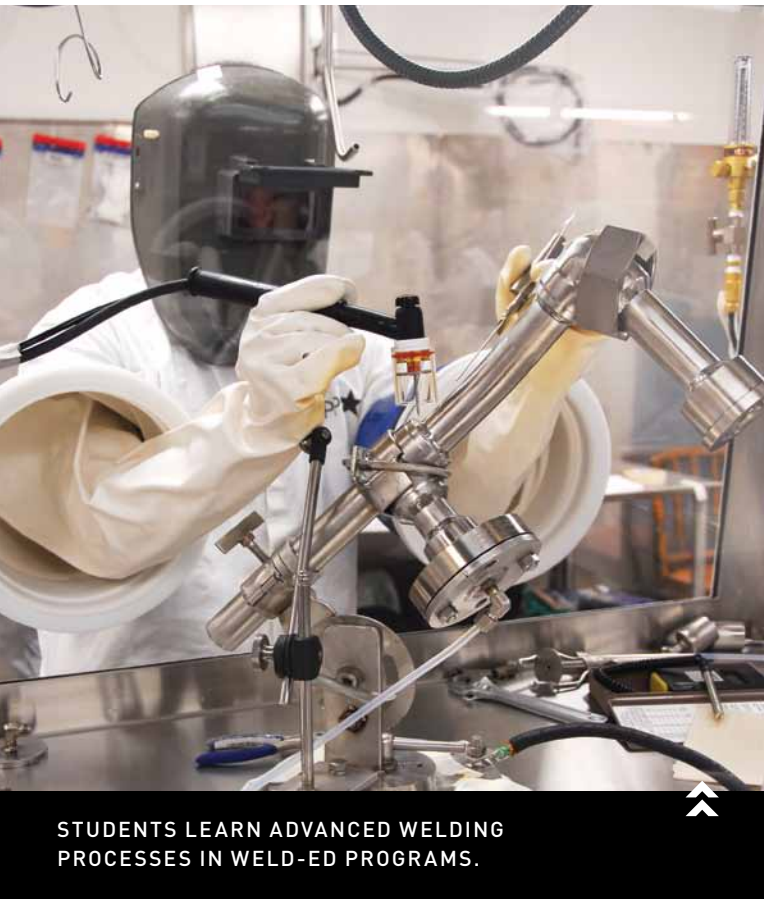
NATIONAL CENTER FOR WELDING
EDUCATION AND TRAINING

www.weld-ed.org



LORAIN COUNTY
COMMUNITY COLLEGE
ELYRIA, OH

- » Increases the number of welding technicians to meet ongoing workforce needs through recruitment efforts.
- » Improves the education of associate degree students in welding technology through curriculum model development and enhancement.
- » Designs and delivers professional development for welding educators.
- » Conducts research on education and employment trends in welding.



STUDENTS LEARN ADVANCED WELDING
PROCESSES IN WELD-ED PROGRAMS.

Weld-Ed Revamps Programs

In 3 years Weld-Ed's 10 partner institutions have graduated more than 1,700 students. Weld-Ed has helped 9 of the institutions revise their welding technician programs; it assisted the tenth in creating a new associate degree program.

To reach as many students as efficiently possible, Weld-Ed created faculty professional development workshops, designed an Introduction to Materials Joining course, and convened the annual National Welding Educators Conference at FABTECH, a prominent industry trade show.

Nearly 400 welding instructors have participated in 1 or more of these professional development opportunities through 2010. Ninety-six percent of the 157 workshop participants rated the effectiveness of the training as at least a 4 out of 5. Of the 78 instructors who took the Materials Joining course, 95% reported that it increased their capacity to help students. Sixty-nine percent had implemented the new Materials-Joining curriculum they learned within a year of finishing the course. For the conference, 100% of the 200 attendees responded to a survey; all of them indicated that they had learned useful tips and techniques for delivering welding education. By running in tandem with FABTECH, the National Welding Educators Conference has had significant participation from both welding educators and industry professionals.

I simply cannot overemphasize the value of the Weld-Ed summer professional development training for those who offered their expertise, for those who participated, and for those future welders who will be the end recipients of the cumulative effect of the seminar.



CAROLE DEL VECCHIO - WELDING INSTRUCTOR
ASNUNTUCK COMMUNITY COLLEGE





A TECHNICIAN DOES TUNGSTEN INERT GAS WELDING AT CASTOLIN EUTECTIC.

WELD-ED PROGRAMS INCREASE WELDING ENROLLMENTS AT 10 PARTNER INSTITUTIONS.

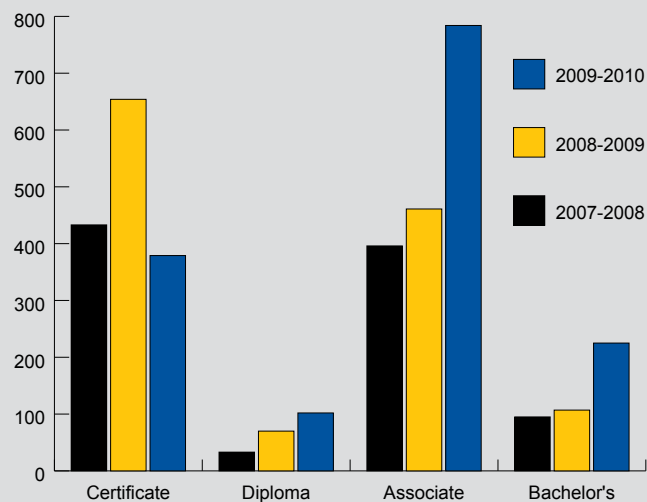
Weld-Ed Report Lays Groundwork For Educators & Industry to Address Critical Workforce Needs

In 2008, Weld-Ed brought together 33 welding industry leaders. They represented business, education, professional organizations, and government. After some discussion these leaders commissioned Weld-Ed to prepare a national report on the workforce challenges facing the industry.

The *State of the Welding Industry Report* contains the most comprehensive data that have ever been gathered at one time on the U.S. welding industry, including its history, its needs, and its future. The report contains labor-market data from traditional sources and from the industry itself. In addition to data from 2002 and 2010, the report uses economic modeling to project where the industry will be in 2019.

The report quantifies the urgent need for at least 30,000 additional welding professionals per year to address the need for 238,000 new and replacement workers through the year 2019. The report also proposes ways to change the image of welding. The executive summary of the report is available at www.weld-ed.org. The full report can be ordered by calling (866) 529-WELD or e-mailing weld-ed@lorainccc.edu.

Weld-Ed Increases Enrollments



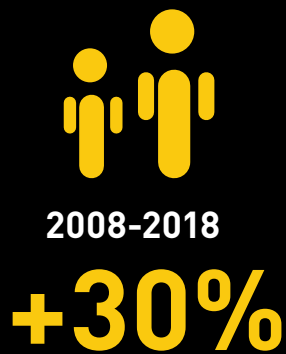
To address the critical needs of the welding industry and its pipeline of future workers, the report calls for the welding industry, American Welding Society, higher education, adult and K-12 education, the publicly funded workforce system, the government, economic development groups, and others to enter into dialogues at the national, state, and local levels. In addition to engaging all these stakeholders, Weld-Ed leads efforts to change the perception of welding and attract more people to the important work welders do.

AGRICULTURAL, ENERGY, AND ENVIRONMENTAL TECHNOLOGIES



- 10 **AgrowKnowledge** - National Center for Agriscience and Technology Education - www.agrowknow.org
- 11 **ATEEC** - Advanced Technology Environmental and Energy Center - www.ateec.org
- 12 **CREATE** - California Regional Consortium for Engineering Advances in Technological Education - www.create-california.org
- 13 **NCSR** - Northwest Center for Sustainable Resources - www.ncsr.org
- 14 **VESTA** - Viticulture and Enology Science and Technology Alliance - www.vesta-usa.org

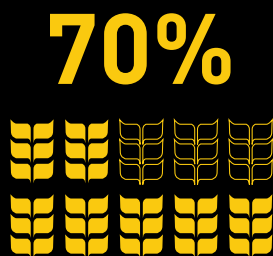
**ENVIRONMENTAL
ENGINEERING
EMPLOYMENT GROWTH**



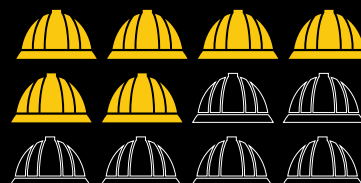
**42% OF U.S. AGRICULTURE
STUDENTS IN 2007 WERE
WOMEN**



**FEEDING THE PLANET
WILL REQUIRE AN
INCREASE IN AGRICUL-
TURE PRODUCTIVITY OF**



**40-60% OF ENERGY UTILITIES'
SKILLED WORKERS AND
ENGINEERS ARE ELIGIBLE TO
RETIRE BY 2012**





10

AgrowKnowledge

NATIONAL RESOURCE CENTER FOR
AGRISCIENCE & TECHNOLOGY EDUCATION

www.agrowknow.org



AgrowKnowledge

KIRKWOOD
COMMUNITY COLLEGE
CEDAR RAPIDS, IA

AgrowKnowledge enhances the math, science, and technology content in agriculture, food, and natural resources programs with

- » Outstanding faculty development workshops and webinars.
- » Downloadable courses and other instructional materials in its Resource Clearinghouse.
- » Industry and education collaborations.
- » A national student organization (www.nationalpas.org) partnership.
- » Job and internship listings in 7 career clusters.

PAS & AgrowKnowledge Prepare Students for High-Tech Jobs in Agriculture

The National Postsecondary Agricultural Student (PAS) Organization joined AgrowKnowledge as a partner in preparing students for careers in the increasingly technical field of agriculture. Seven hundred student members from 12 states attended the 2010 PAS Conference in St Louis, MO. These students represented 47 community and 4-year colleges. The conference included competitions in 17 career-related events known as Career Program Areas (CPAs) that prepare students for the workforce. Contestants were judged on knowledge, oral and written communication, problem solving, and interactive communication skills. More than 600 individuals and teams competed in 2010. With the new partnership between PAS and AgrowKnowledge, the CPAs will receive more math, science and technology emphasis. There are plans to add new CPAs on geospatial technology, biofuels, agricultural biotechnology, and food technology and safety.



HYDROPONIC GREENHOUSE MANAGEMENT IS ONE OF THE NEW TECHNOLOGIES THAT AGRICULTURE STUDENTS LEARN.

By providing the latest information and training on science and technology being used in agriculture, food, and natural resources systems, AgrowKnowledge continues to have a positive impact on students, teachers and the general public.

LARRY CASE - RETIRED SENIOR PROGRAM SPECIALIST & COORDINATOR FOR AGRICULTURAL & RURAL EDUCATION
U.S. DEPARTMENT OF EDUCATION
ADVISOR - THE NATIONAL FFA ORGANIZATION

AgrowKnowledge Partners with Industry to Prepare High-Tech Workforce

AgrowKnowledge works with its Industry Partner Council to identify employers' needs, define skill requirements, and prepare students for careers in the evolving field of agriculture. In addition, 11 sponsors helped to make the National PAS Conference possible by providing \$37,000 for cash awards to the winners of CPA competitions. Sponsorships also helped cover leadership training for the National PAS officers. Conference sponsors included Deere & Company, Firestone Agricultural Tire Division, Kuhn North America, Inc., Monsanto Company, Crop Production Services, The GSI Group Inc., Tractor Supply Company, Bimeda Inc., CHS Inc., Archer Daniels Midland Company, and The National FFA Alumni.

AgrowKnowledge Helps Students Connect With Employers

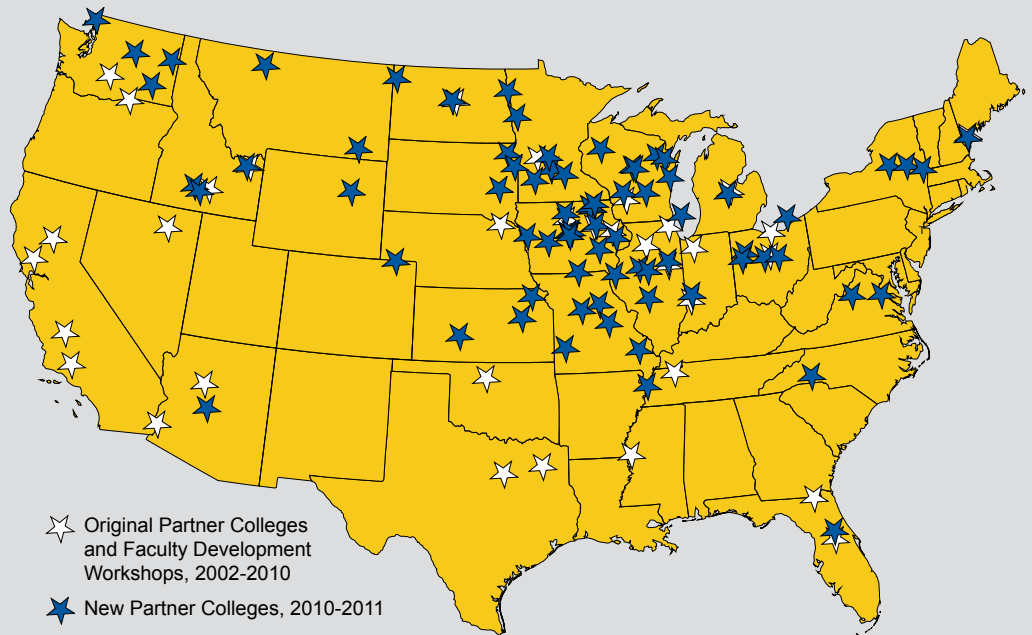
Students connect with career opportunities in agriculture, food, and natural resources through actual openings listed in the Career Clusters section of AgrowKnowledge's Web site. Internships and jobs are posted there through AgCareers.com, another AgrowKnowledge partner. During 2010 this section of the center's Web site received more than 3,200 views.



AGRICULTURE TECHNICIANS ASSIST WITH FOOD RESEARCH.



THE AGROWKNOWLEDGE-PAS PARTNERSHIP INCREASES THE CENTER'S CONTACT WITH STUDENTS AND ENRICHES THE CONTENT OF STUDENT COMPETITIONS.





11

ATEEC

ADVANCED TECHNOLOGY
ENVIRONMENTAL AND ENERGY CENTER

www.ateec.org



EASTERN IOWA
COMMUNITY
COLLEGE DISTRICT
BETTENDORF, IA

- » Partners with business, industry, governmental agencies, professional organizations, and academic institutions.
- » Defines technician knowledge, skills, and competencies needed for the evolving, converging, and emerging technical workforce.
- » Collects, validates, and broadly disseminates exemplary educational materials.
- » Supports and mentors institutions with environmental science and sustainable energy technology programs.

ATEEC's Nahant Marsh Education Center Serves Natural Science Students of All Ages

Because of ATEEC's close proximity to, and interest in, the biological health of the Mississippi River Basin, it maintains the Nahant Marsh Education Center for research, environmental, energy, and conservation technology learning experiences. More than 5,800 people participated in Nahant Marsh educational activities during 2009 alone. Center users include homeschooled children, elementary and secondary school students, community college and university students, energy technicians, and the general public. The center's research on rare plants and animals provides early indications of ecosystem changes in the river basin.

The ATEEC Fellows Institute utilizes the center as a laboratory to study flood control and contaminant flow in waterways. The construction of a zero-energy greenhouse, which is powered by a wind turbine and solar panels, provides energy efficiency and renewable energy technology experiences for fellows in a working research station.



COLLEGE INSTRUCTORS GATHER MACRO INVERTEBRATES AS THEY LEARN TO EVALUATE THE HEALTH OF A STREAM DURING A PROFESSIONAL DEVELOPMENT PROGRAM.



Society has changed. We used to want the basement cooler, 50° or so for canned goods and coal storage. Now people utilize their basements for living. It changes the way we build and retrofit our homes.



JASON ABRAMOWSKI - PARTICIPANT
2010 GREEN ENERGY EFFICIENCY WORKSHOP





A TECHNICIAN
TROUBLESHOOTS
A COMPONENT
AT IBERDROLA
RENEWABLES
WIND ENERGY
FACILITY.



ATEEC Informs Technicians and Educators

ATEEC collaborates with colleges, nonprofit organizations, businesses, and government agencies to build a global workforce dedicated to creating a sustainable future. Each year more than 4,000 people participate in ATEEC education programs. Professional development opportunities include Fellows Institutes for college and high school science instructors, Brownfields Job Training for reclamation of abandoned and contaminated industrial and commercial areas, college courses, and regional and international learning experiences for students interested in environmental and energy technology fields. Technician education includes certificate and associate degree programs.

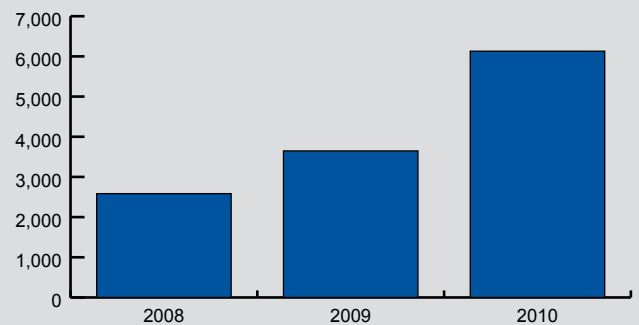
“It is critical for our workforce to seek out education in today’s competitive market,” says Chrysti Gilbreth, Environmental Safety and Health Officer at PB Leiner. The company encourages its technicians to use an Eastern Iowa Community College Health, Safety, and Environmental Technology program that combines online learning with traditional programming to make it easier for students with work and family obligations to obtain the skills they need to succeed.

All the educators who attended the 2009 Tribal College Fellows Institute added hands-on water analysis techniques to the science courses they teach. The professional development program instigated new collaborations between tribal colleges and state universities. A unique partnership was also developed between a tribal college and a state natural resources agency. One participant used what she learned to help the tribal college where she teaches and the state college where she works as a lab coordinator to obtain significant grants that are encouraging STEM learning among undergraduates and tribal community members. The National Partnership for Environmental Technology Education of South Portland, ME, organizes the Tribal College Fellows Institute in partnership with ATEEC with support from a National Science Foundation Advanced Technological Education project grant.

ATEEC’S ELECTRONIC ENVIRONMENTAL AND ENERGY RESOURCES LIBRARY (eERL) IS FOR STUDENTS, INSTRUCTORS, AND TECHNICIANS. DURING 2010, IT HAD MORE THAN 12,000 UNIQUE USERS INCLUDING PEOPLE FROM 16 FOREIGN COUNTRIES.



eERL Collection Growth





**AGRICULTURAL, ENERGY,
& ENVIRONMENTAL TECHNOLOGIES**

12

CREATE

CALIFORNIA REGIONAL CONSORTIUM
FOR ENGINEERING ADVANCES IN
TECHNOLOGICAL EDUCATION
www.create-california.org



COLLEGE OF THE CANYONS
SANTA CLARITA, CA



CREATE Renewable Energy Regional Center offers wind, solar, and energy management education. It specializes in

- » Curriculum Development
- » Faculty Development
- » 2+2+2 Career Education Pathways, Outreach, and Articulation
- » Assessment
- » Dissemination

Students Get Energized Following Career Paths in Renewable Energy Fields

The colleges in CREATE's consortium are demonstration sites for regional technical workshops that develop and test curricula, delivery systems, and other innovative professional development programs. Professional development for technical educators is a focus area. Since 1999, more than 25,000 students have completed at least 1 for-credit course developed by CREATE. Between 2010 and 2014, approximately 8,000 undergraduate students and 9,000 pre-college students are expected to be affected by the new CREATE Renewable Energy Regional Center, which is based on the mechatronics foundation of the previous CREATE ATE center.

Through strong partnerships with the consortium's partner colleges, renewable energy employers, state agencies, and other renewable energy programs and organizations across the nation, CREATE will help meet the demonstrated demand for a diverse and gender-balanced workforce of highly skilled renewable energy technicians.

DAMIEN JACOTIN - INSTRUCTOR
SIERRA SANDS UNIFIED SCHOOL DISTRICT



I was so excited about the workshop that I modified some of my curriculum to use what I learned there. My students loved building their own wind turbines.



EDUCATORS
BRAINSTORM
AND
IMPLEMENT
THEIR
ORIGINAL
WIND POWER
IDEAS AT
KID WIND
WORKSHOPS.





TECHNICIANS
PLACE A
SOLAR
THERMAL
COLLECTOR
ON A ROOF
STRUCTURE.



Businesses Benefit from Expanded Partnerships

CREATE is a joint effort among high schools, California State universities, 9 community colleges, and more than 50 large high-tech engineering and technology employers.

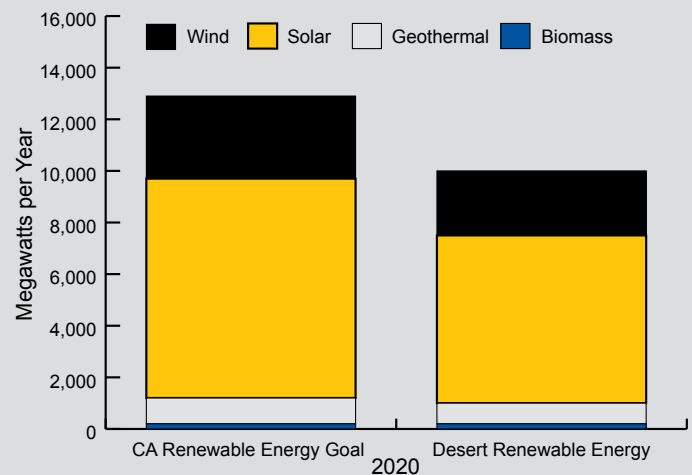
CREATE offers a regional approach to educating renewable energy technicians. Its goal is to educate the future workforce in a wide range of emerging and high-demand fields. CREATE colleges work with each other and in conjunction with regional employers to provide students with high-quality, industry relevant educational options. Students who are exploring renewable energy employment opportunities, upgrading industry relevant skills, or planning to continue their education at a 4-year university can all benefit from a renewable energy education at a CREATE partner institution.

CREATE works closely with industry to develop programs that teach students the skills they need to succeed. In December 2009, CREATE hosted the Southwestern U.S. Energy Employer Summit, which brought utilities such as Pacific Gas and Electric, the Los Angeles Department of Water and Power, and Sempra Energy together with solar, wind, and education representatives to discuss their future needs for employees in the Southwestern U.S. This meeting was 1 of 7 regional conversations on energy technician education sponsored by the National Science Foundation. In November 2010, CREATE sponsored a Development of Curriculum (DACUM) industry panel on wind technician jobs across California. Representatives of California wind companies provided an in-depth analysis of the skills they seek in wind technicians. The analysis will be used to validate the American Wind and Energy Association's skills set and to conduct a gap analysis of existing curricula.

CREATE PREPARES TECHNICIANS FOR PROPOSED DESERT RENEWABLE ENERGY FACILITIES THAT ARE CRITICAL FOR CALIFORNIA TO REACH ITS RENEWABLE ENERGY GOALS.



By 2020 Desert Facilities Are Expected To Provide Most Renewable Energy in California



Source: Center for Energy Efficiency and Renewable Technologies

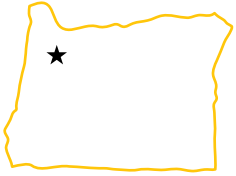


13

NCSR

NORTHWEST CENTER FOR
SUSTAINABLE RESOURCES

www.ncsr.org



CHEMEKETA
COMMUNITY COLLEGE
SALEM, OR



A BRANT GOOSE EGG IS MEASURED IN
A STUDY OF AVIAN FLU TRANSMISSION.



NCSR enhances the workforce by

- » Creating ecosystem management instructional materials.
- » Emphasizing economic benefits and sustainability of resources.
- » Focusing technical programs on managing complex ecosystems.
- » Identifying best practices for restoring damaged ecosystems.
- » Providing faculty professional development opportunities.
- » Providing teachers approaches to increase science literacy.

Educators Recognize Quality of NCSR Materials

NCSR holds a unique position within the natural resource education community thanks to its rigorous curriculum development process. NCSR bases its materials on scientific knowledge of ecosystem structure, function, and interrelationships to encourage students' thinking about natural resources on a sustainable basis. The scientific accuracy and pedagogical effectiveness of its modules on forestry, wildlife, and other environmental science topics have led to NCSR's recognition as a reliable source of excellent classroom-ready materials. The center's emphasis on sustainable management of complex ecosystems is another key to its success.

The center's outreach to K-12 educators spurred requests for materials in 2008. More recently, the addition of the *NCSR Marine Fisheries Series* has accelerated interest in the center's materials. In the first 8 months of 2010, the 3,584 requests NCSR received for its free instructional materials nearly doubled the center's 2009 dissemination activities. The oil spill in the Gulf of Mexico and other news events continue to drive interest in the marine fisheries series and the center's new wetland mitigation series.



Great things are happening—thanks to NCSR—at Wenatchee Valley College. I'm teaching a year-long environmental science sequence, and we are developing a constructed wetland on campus.



DAN STEPHENS - BIOLOGY PROFESSOR
WENATCHEE VALLEY COLLEGE





A WILDLIFE
TECHNICIAN
PREPARES TO
BAND A BIRD
AS PART OF A
LONG-TERM
MIGRATION
STUDY.



NCSR Prepares Technicians for Natural Resources Frontline

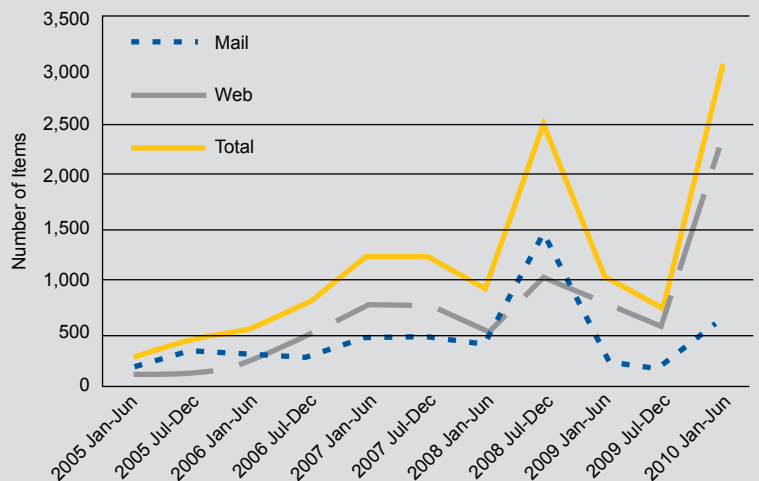
Faculty teaching in more than 700 associate and bachelor's degree natural resource programs use NCSR materials. These programs supply the technicians who manage forests, watersheds, wetlands, marine resources, and wildlife for the government and other organizations. The natural resources workforce will play a critical role in America's socioeconomic well-being during the next 40 years when the world population is expected to grow from 6.8 to 9.3 billion people.

The use of the *NCSR Marine Fisheries Series* to instruct the monitors who began working in 2010 on the new at-sea fisheries monitoring program along the Northeast coast exemplifies the relevance of NCSR materials. Bristol Community College, which developed the 10-day instructional program for the National Marine Fisheries Service, incorporated NCSR's materials to teach the monitors about fisheries management, safety, species identification, conflict resolution, and computer reporting requirements. In addition to gathering data about commercial fishermen's catches, the monitors document interactions with protected species such as marine mammals and sea turtles.

Oregon's Ocean Policy Advisory Council also uses NCSR materials to educate citizen advisory groups it has formed to oversee the establishment of marine reserves off the Oregon coast.

THE OIL SPILL AND NCSR'S OUTREACH TO K-12 PROGRAMS PUSHED REQUESTS FOR MATERIALS IN 2010.

NCSR Dissemination 2005-2010



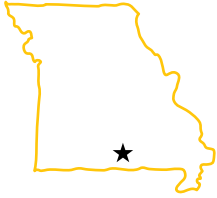


14

VESTA

VITICULTURE AND ENOLOGY SCIENCE
AND TECHNOLOGY ALLIANCE

www.vesta-usa.org



MISSOURI STATE
UNIVERSITY
SPRINGFIELD, MO

- » Validates a database of grape and wine industry workforce skill standards.
- » Provides an educational career pathway with certificate, associate degree, and bachelor's degree programs in viticulture and enology.
- » Coordinates delivery of online and field practicum courses.
- » Provides an electronic clearinghouse of viticulture and enology resources.
- » Develops problem-based learning activities.

**VESTA Helps Students
Succeed in Growing Industry**

VESTA provides students access to a cadre of nationally recognized expert instructors who provide online courses and participate in the design and implementation of local field practicums. These courses are designed to provide students the scientific, mathematical, and technological skills that are needed for a solid foundation in viticulture and enology. Through its expanding partnership and utilizing its groundbreaking distance education model, VESTA makes it possible for students interested in employment in the grape and wine industry to access knowledge and skill development programs that are not readily available to place-bound individuals.

The VESTA program has enabled us to begin fulfilling the needs of our industry. Through education we can create partners in our workplace.

ANDREW G. MEGGITT - VITNER
ST. JAMES WINERY

VESTA STUDENTS LEARN TO ANALYZE
WINE DURING PRODUCTION.



VESTA Improves the Workforce

VESTA utilizes highly qualified scientists from across the nation to provide students advanced instruction in the science of viticulture and enology. These learning opportunities include access to an expanding portfolio of courses and field experiences that support certificate and degree programs. They also expose students to the latest technologies being developed to enhance grape and wine production.

The center promotes and supports viticulture and enology education through dynamic interactive online courses that address the needs of the workforce in a greatly expanding industry. VESTA began in 2003 with 3 college partners; its partnership expanded to 12 colleges in 2010. This strong team of Midwestern 2-year colleges and their close alliances with vineyards and wineries across the nation provide a network for educating potential and current employees and entrepreneurs. Their combined efforts help ensure the continued growth and success of the industry.

VESTA collaborates closely with industry representatives to assure that industry skill standards are identified, validated, and reviewed on an ongoing basis. Industry representatives provide up-to-date competencies for online courses, field practicums, and internships. VESTA adds structure to viticulture and enology career pathways by establishing articulation agreements between 2-year, 4-year, and post-graduate degree programs.

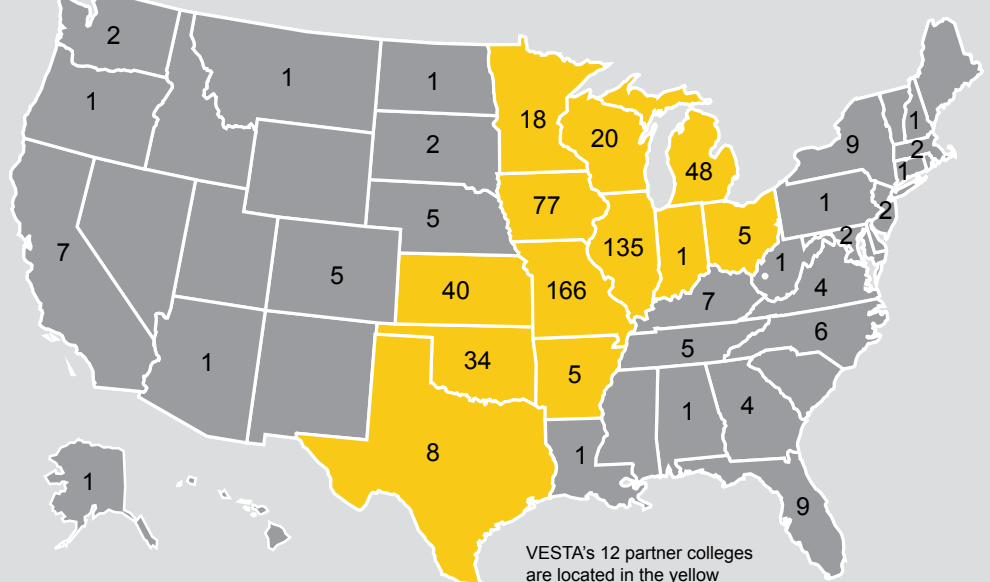


TECHNICIANS SPRAY PESTICIDES IN VINEYARDS.



IN 2010, 640 STUDENTS IN 38 STATES AND ITALY UTILIZED VESTA'S DISTANCE EDUCATION COURSES AND THE ON-SITE PROGRAMS OFFERED AT 12 PARTNER COLLEGES.

VESTA's National Reach





BIOTECHNOLOGY AND CHEMICAL PROCESSES



- 15 **Bio-Link** - Next Generation National ATE Center for Biotechnology and Life Sciences - www.bio-link.org
- 16 **CAPT** - Center for the Advancement of Process Technology - www.capttech.org
- 17 **NBC²** - Northeast Biomanufacturing Center and Collaborative - www.biomanufacturing.org
- 18 **[npt]²** - National Network for Pulp and Paper Technology Training - www.npt2.org

**600+ NEW BIOLOGIC MEDICINES ARE IN DEVELOPMENT
TO TREAT CANCER, HIV/AIDS, ALZHEIMER'S DISEASE,
AND OTHER RARE CONDITIONS**

600+

**PROCESS TECHNICIANS FROM PTEC™ PROGRAMS SAVE EMPLOYERS
MONEY BY REDUCING**

TRAINING COSTS



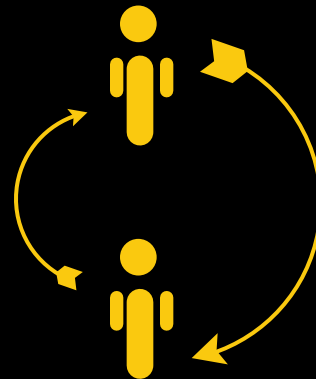
by 40%

SAFETY INCIDENTS



by 37%

EMPLOYEE TURNOVER



by 50%

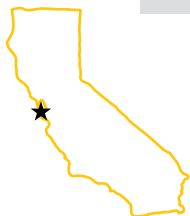


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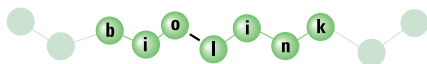
Bio-Link

NEXT GENERATION NATIONAL ATE CENTER
FOR BIOTECHNOLOGY AND LIFE SCIENCES

www.bio-link.org



CITY COLLEGE OF
SAN FRANCISCO
SAN FRANCISCO, CA



- » Shares curriculum and instructional materials.
- » Provides faculty with professional development.
- » Hosts a National Summer Fellows Forum.
- » Distributes donated equipment.
- » Prepares students for technical careers in biotechnology and life sciences.

Bio-Link Supports Student Success

Each year approximately 300 educators participate in Bio-Link professional development programs. Those educators then teach about 29,000 students the new skills they learned from Bio-Link. This focus on biotechnology skills helps students gain entry to high-skill, high-wage careers. The stories that community and technical college graduates share at the Faces of Success Panel during the annual BIO International Conference indicate that the entry-level technician jobs lead to rewarding careers with opportunities for advancement.

Bio-Link Scales Up Bridge to Biotech

Bio-Link is working with several colleges to scale up the Bridge to Biotech (B2B) program it started at City College of San Francisco (CCSF) to increase access to biotech careers. B2B integrates biotech laboratory skills into developmental math, science, and language classes. The contextualized curricula and peer support have led to high completion rates among students who are predominantly low-income and from underrepresented populations. There are on average 30 to 40 students per semester who are enrolled in the B2B at CCSF. A significant majority of those who complete the program enroll in college courses that lead to certificates and degrees.



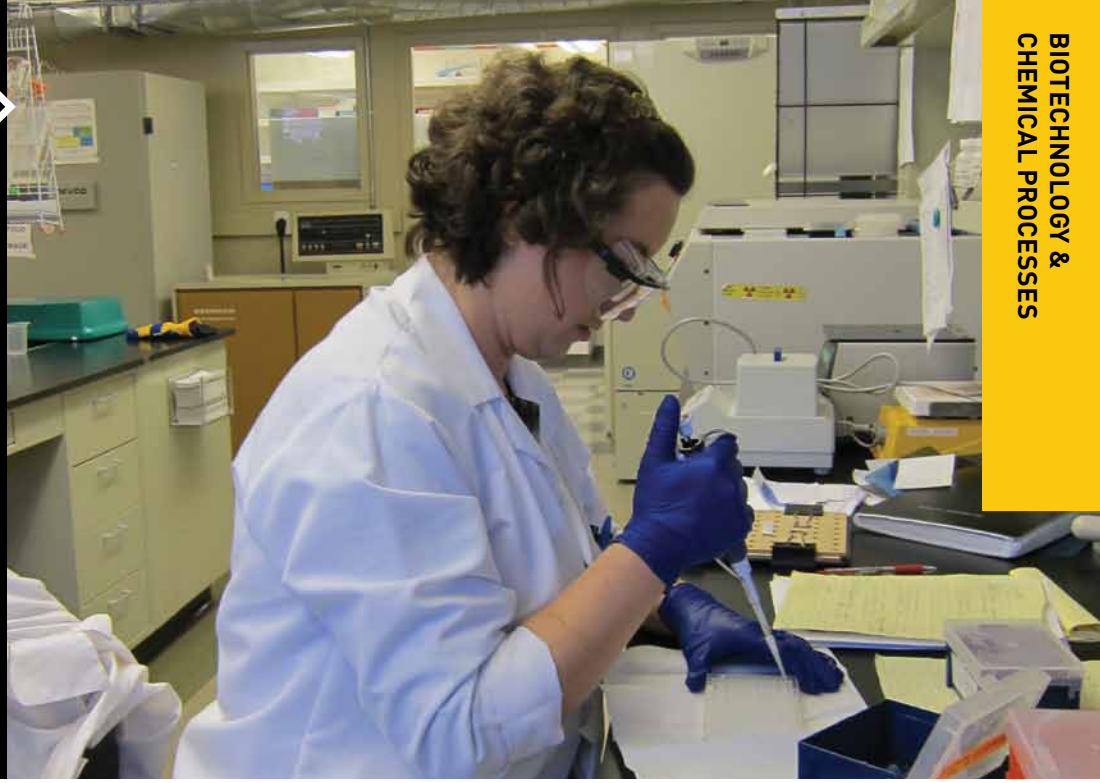
Internships provide real industry settings for students to gain skills, techniques, and hands-on training that ultimately increase their confidence and prepare them for the workforce.

A STUDENT EXAMINES A PROTEIN SAMPLE FOR GEL ELECTROPHORESIS.

JEANETTE WRIGHT - BIOTECHNOLOGY STUDENT
CITY COLLEGE OF SAN FRANCISCO



»»
A BIOTECHNICIAN
PIPETTES
PROTEIN
SAMPLES FOR
ASSAY ANALYSIS.



Biotech Companies Increasingly Hire Technicians

Biotechnology companies increasingly recognize the quality of community and technical college students who have specialized in biotechnology. This is significant in an industry where workplace expectations are high because a single mistake can damage many products and the finances of the company. Biotech start-ups, in particular, rely on community and technical colleges' flexible programs to meet their emerging needs. Frequently, when biotech companies hire individuals with credentials from community and technical college programs, it sets off a ripple effect that leads incumbent technicians to enroll in these programs to learn the additional skills they need for promotions.

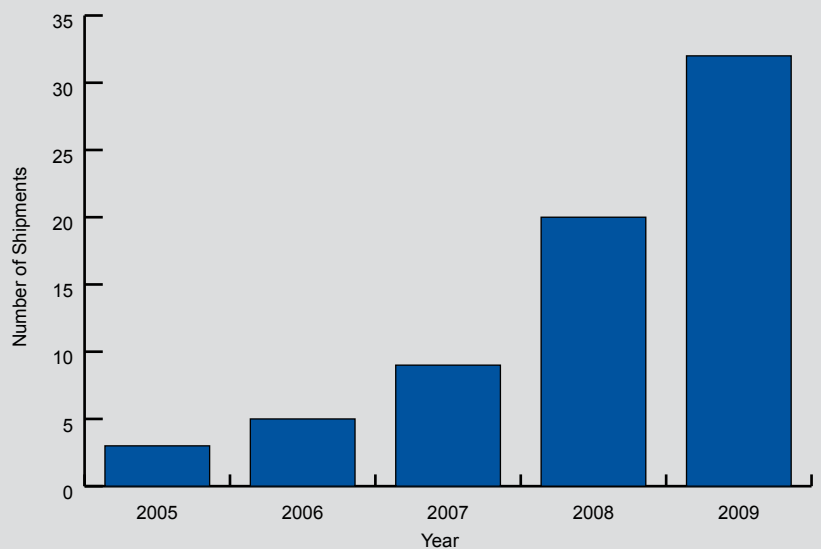
Bio-Link Internships Enhance Career Pathways

As more companies partner with Bio-Link-affiliated community and technical college programs, they are also learning the value of internships that provide students with actual industry experience. Companies also appreciate the opportunity to have potential employees working in a learning mode at their sites.

B2B's internship program is an example. It places economically disadvantaged individuals who are enrolled in biotech-focused developmental courses in internships. Of the 50 City College of San Francisco students who completed B2B internships between fall 2007 and summer 2010, 40% were hired immediately by the research laboratories where they interned. Most of the other B2B students transitioned from the vocational program into biotech certificate programs before pursuing employment.

THE BIO-LINK EQUIPMENT DEPOT ORGANIZES AND DISTRIBUTES DONATED EQUIPMENT AND SUPPLIES FOR SCHOOLS TO USE.

Bio-Link Equipment Depot Distributions





**BIOTECHNOLOGY &
CHEMICAL PROCESSES**

16

CAPT

CENTER FOR THE ADVANCEMENT
OF PROCESS TECHNOLOGY

www.capttech.org



COLLEGE OF
THE MAINLAND
TEXAS CITY, TX

- » Develops industry-sanctioned process technology curricula for nationwide distribution and use.
- » Establishes and fosters partnerships between the process industries and education.
- » Validates student and worker knowledge through the administration of a national exam developed by education and industry.

CAPT Builds Capability for Students and Industry Partners

CAPT is the only national organization of its kind, bridging education and the process technology industry for the direct benefit of both. The impact of CAPT's successes in process technology education has been felt around the country by more than 4,200 students who have earned process technology (PTEC™) associate degrees from 56 CAPT partner colleges.

Since the inception of CAPT in 2002, process technology graduation rates have steadily increased. For example, there were 725 process technology graduates in the 2008-2009 academic year alone.

With a majority of companies requiring entry-level technicians to have a PTEC™ associate degree or equivalent experience, the highly skilled and well-educated graduates of CAPT-affiliated programs are in demand. Industry's recognition of the quality of CAPT programs provides opportunities that students can build upon throughout their careers.



STUDENTS OPERATE A GLASS-DISTILLATION TRAINING UNIT.



The CAPT programs are a vital part of the talent supply to an industry that faces unprecedented challenges...I am delighted that CAPT has provided the structure and curriculum to enable a systemic approach to these issues and facilitate an ongoing dialog between academia and industry.



**JULIAN C. DALZELL - VICE PRESIDENT OF HUMAN RESOURCES
SHELL OIL PRODUCTS U.S.**



CAPT GRADUATES WORK AT REFINERIES AND OTHER ENERGY FACILITIES.

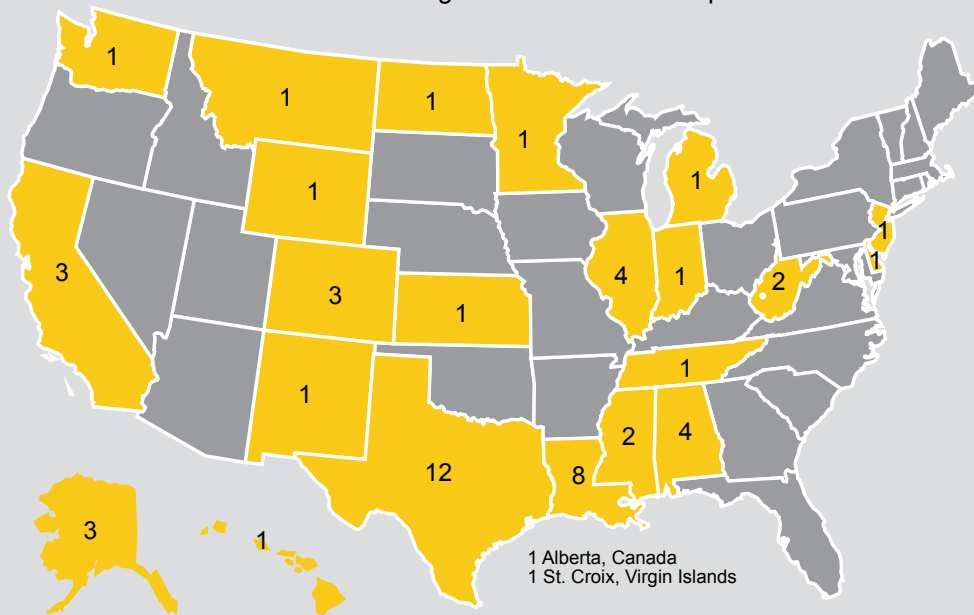
CAPT Readies Process Technician Workforce

The significance of the petrochemical and refining sector and other process industries to a healthy economy cannot be understated. *Fueling Prosperity*, a 2005 study, reported that the petrochemical and refining sector in Texas generated business expenditures of \$123.6 billion. This business activity required 103,976 permanent jobs, which created almost \$11 billion in personal income. The income benefitted workers and others through the multiplier effect of spent income flowing back into the economy.

The Bureau of Labor Statistics (BLS) states that there are 12 million jobs in production-related occupations in the United States. More than 150,000 of those jobs are directly related to chemical, petroleum, and gas process technicians. BLS data indicate that the chemical, petroleum, and gas sectors will fill 17,000 new or replacement jobs through 2016.

Through its standardized PTEC™ curriculum and its collaborative work with industry and other educators, CAPT supports the development of a highly skilled, well-educated, and diverse process technician workforce. The center and its partner colleges ensure that there are qualified technicians available to fill the positions created by natural attrition and the mass exodus anticipated as the “baby boomer” generation moves toward retirement.

CAPT's Growing Education Partnership



CAPT'S EDUCATION PARTNERSHIPS GREW TO 56 INSTITUTIONS IN 2010.



17

NBC²

NORTHEAST BIOMANUFACTURING
CENTER AND COLLABORATIVE

www.biomanufacturing.org



MONTGOMERY COUNTY
COMMUNITY COLLEGE
BLUE BELL, PA



- » Communication hub links students, graduates, faculty, teachers, and industry.
- » Suite of biomanufacturing curricula uses the latest pedagogical technologies.
- » BIOMAN conferences and Protein Is Cash workshops inform faculty and teachers.
- » Web site www.biomanonline.org—provides support for biomanufacturing curricular products.
- » Curricula prepare technicians to meet the needs of the maturing biotechnology industry.

NBC² Adds Fuel to Growth of Biomanufacturing Programs

Services from NBC² are fueling the growth of biomanufacturing education programs nationally.

More than 2,700 students were enrolled in 47 biotechnology degree programs in 17 states in fall 2009. Thirty-four of these biotechnology programs had at least 1 NBC² biomanufacturing course within their degree program.

More than 100 high school teachers participated in professional development opportunities at 6 Protein Is Cash workshops that were held in 6 states during 2010. Approximately 10,800 high school students benefited from the instruction their teachers received.

Five community colleges, 5 high schools, and 1 university in 8 states used NBC²'s expertise and biomanufacturing curricular materials during 2010 to develop and grow their new programs to support local and regional biomanufacturers.



TEACHERS AT A WORKSHOP PURIFY
GREEN FLUORESCENT PROTEIN.



In my biomanufacturing apprenticeship at Great Bay Community College, I helped set-up a model company within a high school to make plasmid DNA kits and distribute them to other local high schools...

My training was not hypothetical. It was real.



DAVID HADDAD - RESEARCH TECHNICIAN
MILLENNIUM PHARMACEUTICALS
JUNIOR - HARVARD UNIVERSITY EXTENSION SCHOOL



Graduates of NBC² Programs Break Barrier

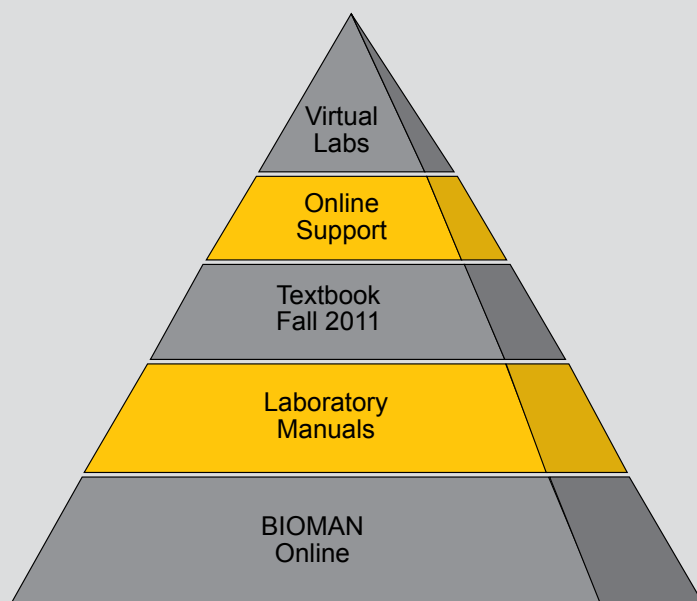
NBC²'s outreach to industry has helped the graduates of 2-year technical programs attain technician positions at biomanufacturing companies that were previously limited to bachelor's degree holders. The graduates of NBC² community college programs are employed at many small biomanufacturers as well as at these global companies: Pfizer Inc., Genentech, Inc., Roche, Life Technologies Corporation, Shire plc, Millennium Pharmaceuticals, Inc., Rohm and Haas Company, Celltech Group plc, EMD Serano, Inc., Repligen Corporation, Alexion Pharmaceuticals, Inc., Millipore, Human Genome Sciences, Inc., MedImmune, LLC, Merck & Co., Inc., Eli Lilly and Company, Centocor Ortho Biotech Inc., Johnson & Johnson Services, Inc., Genencor, Bristol-Myers Squibb, Genzyme Corporation, Amgen Inc., Biogen Idec, Lonza Biologics, Inc., GlycoFi, Novartis, Baxter International Inc., and Cook Pharmica.

Biomanufacturers Plan to Hire More Technicians

In a 2009 survey of 23 biomanufacturers, 70% of the 19 responding companies projected that in the near future they would be hiring cell culture technicians, purification technicians, and quality control microbiology technicians. A smaller percentage of companies indicated they would be looking for quality control chemistry technicians, instrumentation or calibration technicians, facilities technicians, validation specialists, and documentation coordinators.

The survey results indicate that more than 200 biomanufacturing technicians will be needed in 2011 and approximately 840 in 2013. As the industry grows and matures, it is expected to produce not only biopharmaceuticals, but also biofuels, industrial enzymes, bioplastics, and replacement tissues and organs through the use of regenerative medicine techniques.

NBC²'s Complete Suite of Products



NBC² HAS WORKED FOR 6 YEARS WITH BOTH INDUSTRY AND EDUCATORS TO CREATE BIOMANUFACTURING CURRICULAR MATERIALS FOR MULTIPLE AUDIENCES, UTILIZING THE LATEST IN PEDAGOGICAL TECHNOLOGY.

TECHNICIANS RUN BIOREACTORS TO GROW CELLS THAT MAKE AND SECRETE BIOPHARMACEUTICAL PROTEINS.

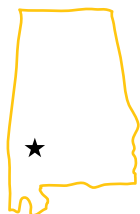


18

(npt)²

NATIONAL NETWORK FOR PULP
AND PAPER TECHNOLOGY TRAINING

www.npt2.org



ALABAMA SOUTHERN
COMMUNITY COLLEGE
THOMASVILLE, AL



- » Recruits and retains students in pulp and paper technology degree programs.
- » Places pulp and paper technology students in internships that often lead to employment upon graduation.
- » Informs high school students about pulp and paper career opportunities.
- » Increases faculty knowledge with professional development opportunities for elementary, secondary, and college educators and advisors.
- » Develops instructional materials including laboratory exercises, online modules, and textbooks.
- » Establishes national skills standards.

Recruitment Essential for Creating Globally Competitive Workforce

The National Network for Pulp and Paper Technology Training, an alliance of 10 community colleges, 4 universities, and TAPPI, provides critical education services for individuals who want to work in forest product industries. TAPPI is the worldwide association for the pulp, paper, packaging, and converting industries. Through its education and industry partnerships, (npt)² is developing a globally competitive, technology-savvy workforce. This workforce development begins with recruiting new, well-qualified candidates to (npt)² associate degree programs.

To attract more teenagers, the center offers summer programs throughout the nation for high school students. The programs blend hands-on experiences in workplaces with classroom instruction of theoretical concepts.

To inform more adults about the changing needs of paper and allied industries and the career opportunities that industry provides for technicians, (npt)² tailors its outreach efforts for parents, students, K-12 school faculty and advisors, and community career service centers.



**A STUDENT MONITORS A DISTILLATION SIMULATION
WHILE OTHER STUDENTS WORK IN THE LAB.**



The industry needs a technologically advanced workforce (TAW) to be able to move ahead and stay current; the U.S. needs it to remain a forerunner. TAW is not a static thing; it is something to strive for continually.



CURTIS A. SEARS - DIRECTOR OF MANUFACTURING EXCELLENCE
MEADWESTVACO CORPORATION



(npt)² Impact Measures



Faster Time to Job Qualification

(npt)² graduates achieve technician-level qualification in 9 months rather than the 27 months it typically takes non-degreed new hires.

Greater Proficiency

The return on investment study found that (npt)² graduates' knowledge and skills equal 4.5 years of job experience.

Better Safety Performance

Employers report (npt)² graduates have significantly fewer work-related injuries due to the program's world-class safety instruction.

EMPLOYERS FIND (npt)² GRADUATES IMPROVE THE EFFICIENCY OF THEIR OPERATIONS.

(npt)² Measures Its ROI

To determine the financial return on investment (ROI) of its programs, the center commissioned an analysis of its impact on the measures employers value. By converting these measures to monetary terms, analysts concluded that for every dollar a company invests in (npt)² scholarships and related support, \$5.65 is returned to the company—after recovering for the cost of tuition, books and fees—from savings on internal employee education and increased productivity. Program graduates entering the workforce possess the theoretical and technical skills equal to 4.5 years of job experience, achieving technician-level certification in 9 months, on average, compared to 27 months for non-degreed new hires. They also sustain fewer work-related injuries because of the program's world-class safety instruction, hands-on training, and internships. All of these impact measures were key determinants of the outstanding ROI of (npt)².

Retirements Create Huge Need for Skilled Technicians

Over the next 4 years more than 25,000 skilled pulp and paper employees are expected to retire. To address the urgent need for technicians, (npt)² has engaged industry in the education process. Industry has responded by making the National Network for Pulp and Paper Technology Training part of the technologically advanced workforce (TAW) platform supported by the industry's association, TAPPI, and the American Forest and Paper Association's special project group, Agenda 2020. These education-industry partnerships are committed to attracting and retaining high-quality students who will enter the workforce ready to use their skills and education. By working together, the center and industry are creating a new workforce capable of competing in the global pulp and paper market.

(npt)² RETURNS \$5.65 IN VALUE TO COMPANIES FOR EVERY DOLLAR THEY INVEST IN PULP AND PAPER EDUCATION PROGRAMS.

(npt)² ROI = 565%

Return on Investment Calculation

$$\frac{\text{Benefits} - \text{Costs}}{\text{Costs}} \times 100 = \text{ROI}$$

Return on Investment

$$\frac{\$74,100 \text{ (Benefits)} - \$11,000 \text{ (Cost of Scholarship)}}{\$11,000 \text{ (Cost of Scholarship)}} = \frac{\$62,100}{\$11,000} \times 100 =$$

565%
Return on
Investment

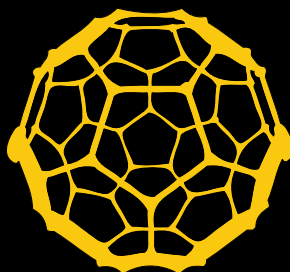
ELECTRONICS, MICRO- AND NANOTECHNOLOGIES



-
- 19 MATEC NetWorks - National Resource Center - www.matecnetworks.org
 - 20 NACK - National Center for Nanotechnology Applications and Career Knowledge - www.nano4me.org
 - 21 Nano-Link - Midwest Regional Center for Nanotechnology Education - www.nano-link.org
 - 22 NEATEC - Northeast Advanced Technological Education Center - www.rcsne.org
 - 23 SCME - Southwest Center for Microsystems Education - www.scme-nm.org
-

BY 2015

15%



50%

**GLOBAL MANUFACTURED
GOODS WILL INCORPORATE
NANOTECHNOLOGY**

**NEW ADVANCED TECHNOLOGY
PRODUCTS WILL INCORPORATE
NANOTECHNOLOGY**

1/2



5 MILLION

**U.S. NANOTECHNOLOGY
WORKERS WILL FILL NEARLY
HALF OF THE 2 MILLION
NANOTECHNOLOGY JOBS
ANTICIPATED WORLDWIDE**

**NANOTECHNOLOGY WILL
GENERATE 5 MILLION NEW
JOBS IN SUPPORT FIELDS
AND INDUSTRY**



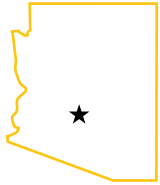
**ELECTRONICS, MICRO-
& NANOTECHNOLOGIES**

19

MATEC NetWorks

NATIONAL RESOURCE CENTER

www.matecnetworks.org

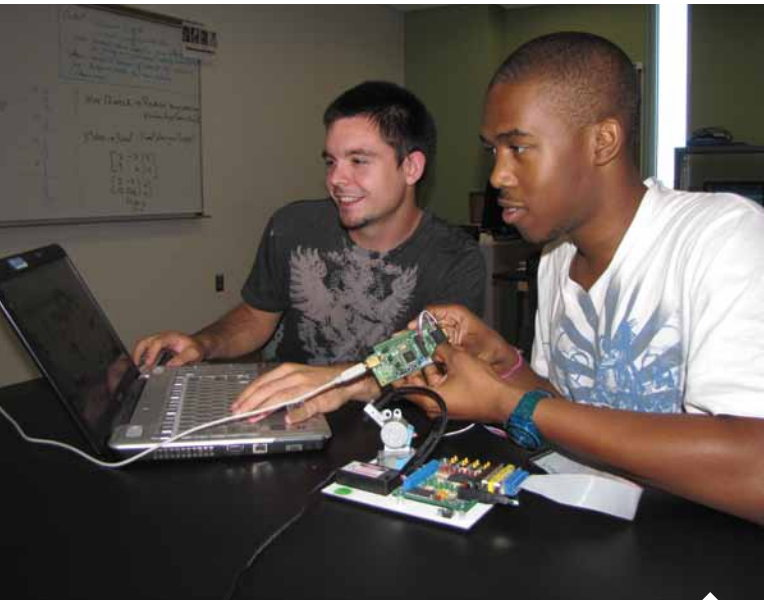


MARICOPA COMMUNITY
COLLEGES
PHOENIX, AZ

- » A premier source of quality instructional materials used by educators and industry trainers in the areas of electronics, semiconductor manufacturing, automation and energy utilization technologies.
- » A provider of timely, relevant professional development opportunities in the form of an internationally attended webinar series.
- » A sponsor of opportunities for education and industry partners to work as a community that advances learning and establishes new models for student achievement and success.



NETWORKS



STUDENTS AT THE MARICOPA COMMUNITY COLLEGES EXPERIMENT WITH A FIELD-PROGRAMMABLE GATE ARRAY ACTIVITY OBTAINED FROM THE NETWORKS DIGITAL LIBRARY.

Industry-Relevant Learning Resources Ensure Student Success in the Classroom

With the information explosion, discovering and using new library materials can be a daunting task for high school teachers and college faculty. MATEC NetWorks has developed a unique digital library of classroom-ready technology and pedagogy resources such as curricula, lesson plans, videos, learning objects, and hands-on laboratory activities. These resources are easy to obtain and incorporate into existing courses, saving instructors time while improving the content of their lessons.

The materials in the digital library are pre-screened and tagged to yield good results via customized searches. MATEC NetWorks provides a personalized experience and a trusted network for educator access. Fifty-three percent of 125 surveyed users updated existing topics and 38% indicated they added new, emerging technology topics to their curricula on the basis of the resources they accessed.

Students at the Maricopa Community Colleges always make an impressive showing at the Avnet Tech Games, an event where they have an opportunity to win scholarships and enhance the skills they need to succeed in the business world.



ROY VALLEE - CHAIRMAN OF THE BOARD AND CEO
AVNET, INC.





TECHNICIANS
AT AVNET
ELECTRONICS
OPERATE
A FLASH
PROGRAMMER.



Internationally Attended Webinar Series Provides Timely, Relevant Professional Development

MATEC NetWorks' webinars help educators grow professionally in their knowledge of the subject matter they teach and in the methods they use to encourage student learning. The focused webinars are delivered for free via the web on advanced technologies, teaching and learning, program building, and other technician education topics. These highly interactive, short duration programs provide a cost-effective approach for faculty and their colleges to make sure students acquire the skills they and their future employers want and need.

During a 15-month period beginning in September of 2009, MATEC NetWorks produced or co-produced 52 webinars with 3,084 total registrants. Teachers, college faculty, industry personnel, and students from 49 states, the District of Columbia, and 13 countries participated in the live webinar sessions.

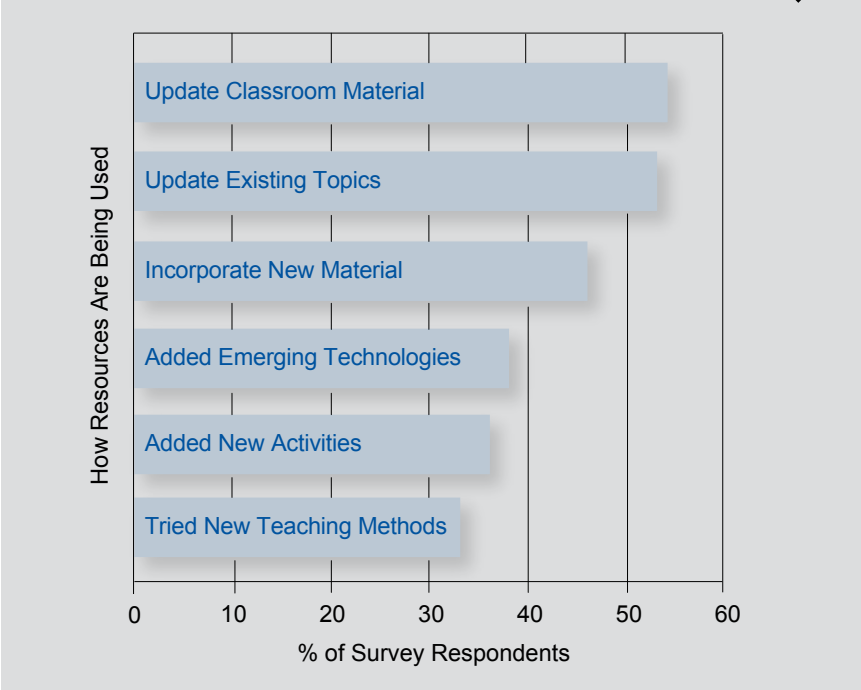
In a follow-up survey of 111 webinar participants, 51% reported that they had updated topics and instructional materials based on what they learned from a webinar. Forty-four percent reported using webinar content to add information about new and emerging technologies into their courses.

MATEC NetWorks Builds Future STEM Workforce

MATEC NetWorks partners with industry's SEMI Foundation to encourage high school students to pursue high technology careers. Together they produce and deliver High Tech U, a 3-day career awareness experience where industry presenters guide students through experiential STEM learning activities that emphasize teamwork. When 72 high school seniors were surveyed 2 years after they attended High Tech U, 88% reported feeling that High Tech U influenced their career and education choices.

A survey of 18 teachers whose students attended High Tech U found additional evidence of the program's positive impact on students. In the survey, 91% of the teachers reported seeing new confidence in students who attended High Tech U; 77% observed that the High Tech U participants are more interested in the applications of their math and science studies; and 71% of the teachers said High Tech U influenced their students' education and career plans.

EDUCATORS USE RESOURCES FROM MATEC NETWORKS' DIGITAL LIBRARY IN MULTIPLE WAYS, ACCORDING TO A SURVEY OF 125 INSTRUCTORS WHO DOWNLOADED MATERIALS.





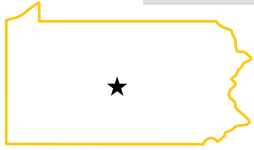
**ELECTRONICS, MICRO-
& NANOTECHNOLOGIES**

20

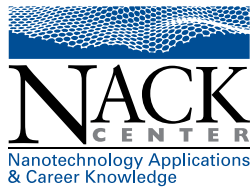
NACK

NATIONAL CENTER FOR NANOTECHNOLOGY
APPLICATIONS & CAREER KNOWLEDGE

www.nano4me.org



PENN STATE UNIVERSITY
UNIVERSITY PARK, PA



NACK RESOURCES ALLOW STUDENTS TO EXPLORE
THE APPLICATION OF NANOTECHNOLOGY
CONCEPTS IN MANY INDUSTRIES.

- » Supports the development, constant up-dating, and enrichment of 2-year degree programs in micro- and nanotechnology across the nation.
- » Emphasizes attention to the full range of micro- and nanotechnology applications.
- » Provides free online access to an extensive library of nanotechnology educational resources including videos and PowerPoint presentations.
- » Delivers nanotechnology webinars to classrooms across the country.
- » Offers real-time remote access to state-of-the-art cleanroom equipment for teaching via the Internet.
- » Provides national coordination of micro- and nanofabrication workforce development programs and activities.

NACK Prepares Students for Careers in High-Tech Economy

NACK provides foundational and broad micro- and nanotechnology education that students can build upon for the rest of their careers. The 6 second-year level nanotechnology courses, also known as capstone courses, assembled by nanotechnology researchers at Penn State may be taught as a set or in separate units. The courses' PowerPoint presentations and video materials, as well as NACK's modules, lectures, hands-on laboratories, recruiting materials, and webinars are available at www.nano4me.org. Through 2010, NACK's

- Education resources have been downloaded by more than 800 U.S. educators.
- Webinars have been attended by 767 registrants.
- Nanotechnology Course Resources Workshops, which cover materials in the 6 courses, have been attended by 84 educators from 16 states and Puerto Rico.

We're a young high-tech company. Every employee impacts our success. The NACK Center at Penn State is our source for technically skilled employees who are professionally mature and who enthusiastically adapt to the demands of a high-tech environment.

DEAN ANDERSON - DIRECTOR OF OPERATIONS
STRATEGIC POLYMER SCIENCES INC.

Industry Values Employees with Micro- & Nanotechnology Skills

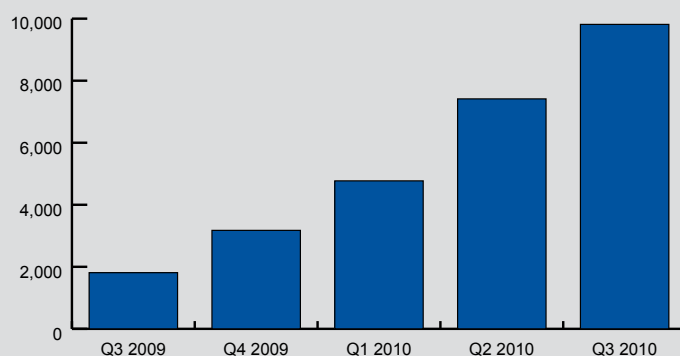
Companies across the country appreciate the value of hiring technician-level employees who have been educated in the key micro- and nanotechnology skill areas of fabrication, synthesis, and characterization. At least 13 states and Puerto Rico have implemented micro- and nanotechnology programs at the associate degree level. The program in Puerto Rico is modeled directly on NACK's program. Many of the other programs are utilizing NACK's downloadable materials, webinars, and workshops, as well as advice from NACK staff members. NACK personnel are also helping many other programs that are in development. Employers are finding that graduates of these 2-year degree programs have the knowledge and skills to be involved in research and development, manufacturing, sales, or product support.

As of December 2010, more than 800 people have graduated from associate degree nanotechnology programs across the United States. A 2008 survey of 405 NACK graduates reported that all 180 respondents were either employed in nanotechnology or enrolled in baccalaureate or graduate level programs. NACK graduates are employed by more than 100 companies ranging in size from multinational conglomerates to start-ups. Many of these companies have hired multiple NACK graduates.

NACK Creates National Alumni Network

The NACK Alumni Network (www.nano4me.org/alumni) informs graduates of associate level nanotechnology programs throughout the nation, about professional development and other educational opportunities, and connects them with other nanotechnicians via social networking groups.

Cumulative Downloads of Nano4me.org Educator Materials



NACK COURSES TEACH MICRO- AND NANOTECHNOLOGY CHARACTERIZATION APPROACHES.

WEBINARS ARE DRIVING EDUCATORS' INTEREST IN NACK'S MANY EDUCATIONAL MATERIALS AS SHOWN BY CUMULATIVE, QUARTERLY DATA.





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Nano-Link

MIDWEST REGIONAL CENTER FOR
NANOTECHNOLOGY EDUCATION

www.nano-link.org



DAKOTA COUNTY
TECHNICAL COLLEGE
ROSEMOUNT, MN



- » Enables community colleges and high schools to infuse nanotechnology into curricula in easy stages.
- » Creates self-contained, complete, and technically sound topical and contextual modules.
- » Coordinates career path options with student abilities, industry needs, and university programs.

Nano-Link Modules Meet Needs at Various Levels

Nano-Link's modular packaging of nanotechnology content allows educators and students to implement specific aspects of nanotechnology appropriate to their discipline. For example, modules can be inserted into environmental, biotech, electronic, and energy curricula at the community college level.

A specific set of modules addresses incumbent workers' needs. Nano-Link currently is working with the precision manufacturing industry in Minnesota, a paper products company, and an electronics company to educate current employees about nanoscience advances in these industries.

The completeness of each contextual module allows it to be easily integrated with traditional high school science curriculum as well. Each module includes background information, presentation materials, activities, quiz materials, and experiments. More than 3,000 high school students have learned about nanotechnology with Nano-Link's modular approach.



Not only does this program give us valuable assistance, but I really enjoy working with the students and seeing them grow as scientists.



NANO-LINK MODULES ALLOW STUDENTS
TO APPLY NANOSCIENCE TOOLS IN AN
ARRAY OF INDUSTRY SETTINGS.



WAYNE MAHONEY - RESEARCH
MATERIALS LABORATORY SCIENTIST
3M COMPANY



A NANO-LINK GRADUATE USES A FOCUSED ION BEAM MACHINE IN HIS WORK AS A RESEARCH TECHNICIAN AT THE UNIVERSITY OF MINNESOTA.

Nano-Link Provides Technicians to Wide Range of Employers

Nano-Link develops “nano-savvy” individuals who understand the big ideas of nanotechnology and nanotechnology’s applications in various disciplines as well as the knowledge to apply these skills in many industry sectors.

In addition to the modules it has developed for a broad range of audiences, Nano-Link has more than 180 college students enrolled in its associate in applied sciences (AAS) degree programs. While a significant percentage of the AAS degree program graduates choose to continue their educations at 4-year institutions, the majority are finding jobs involving nanotechnology in electronics, materials research, coatings, quality assurance, testing, and biotechnology.

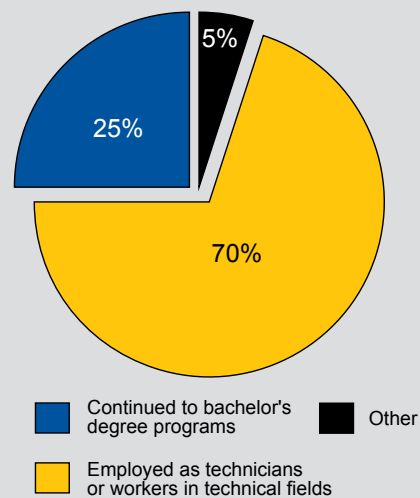
Nano-Link’s program content and hands-on experiences are constantly evolving to keep up with industry requirements. More than 75 companies advise Nano-Link about the skills, knowledge, and abilities their technicians need.

Nano-Link Takes Nanoscience To High School Teachers & Students

Nano-Links’ professional development courses have informed more than 250 high school teachers about nanotechnology. As a result of these courses, more than 2,000 high school students are learning not only about nanotechnology but also about the application of science, technology, engineering, and math in various careers.

IN A 2010 SURVEY OF 75 NANO-LINK GRADUATES, 95% REPORTED THAT THEY ARE EITHER EMPLOYED IN A TECHNICAL FIELD OR PURSUING A BACHELOR’S DEGREE.

Nano-Link Program Graduates





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NEATEC

NORTHEAST ADVANCED
TECHNOLOGICAL EDUCATION CENTER

www.rcsne.org



HUDSON VALLEY
COMMUNITY COLLEGE
TROY, NY



- » Educates the general public about nanotechnology and semiconductor technology.
- » Enables individuals from populations underrepresented in science, technology, engineering and math (STEM) to pursue educational opportunities that lead to technological careers.

- » Analyzes and identifies the technical skill sets needed to develop and maintain high-tech industries in the Northeast.
- » Enhances, develops, and expands 2-year nanoscale science, engineering, and semiconductor technology curricula and delivery methodologies to ensure student success.
- » Augments educators' skills to teach NEATEC's advanced technology curricula.
- » Establishes experiential learning opportunities for both students and teachers with industrial and university partners.



NEATEC PREPARES TECHNICIANS FOR CAREERS IN THE TECHNOLOGICALLY ADVANCED SEMICONDUCTOR MANUFACTURING FACILITIES EXPANDING IN THE NORTHEAST.

NEATEC Offers Paths to Nanotechnology & Nanoelectronics Manufacturing Careers

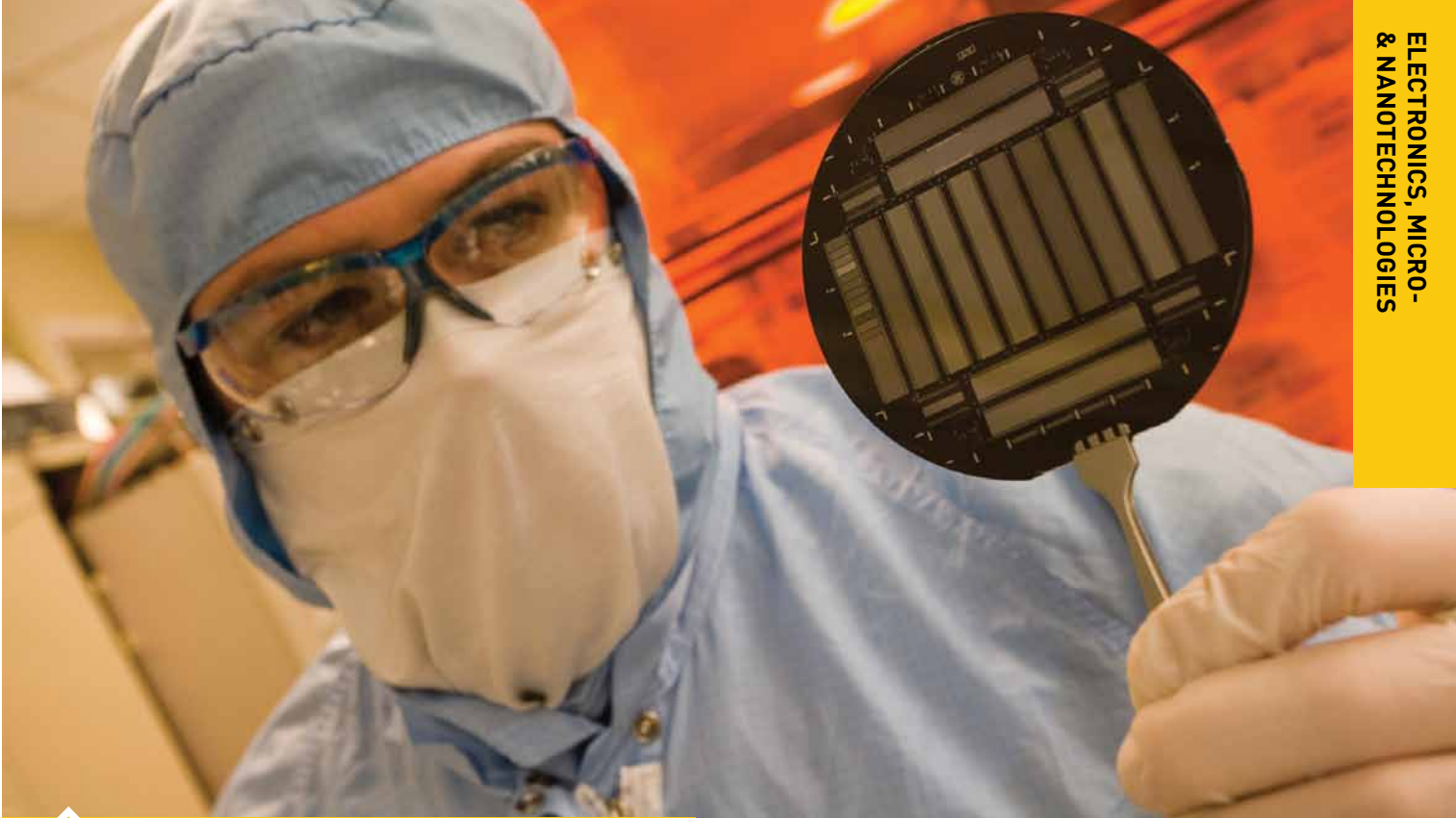
NEATEC has assembled extraordinary opportunities for community college and secondary school students to engage in cutting-edge nanotechnology and nanoelectronics education programs. The center provides students with hands-on learning opportunities in semiconductors and photovoltaics (PV) at Hudson Valley Community College's (HVCC's) TEC-SMART facility. It also offers internships and cooperative learning opportunities at the University of Albany's College of Nanoscale Science and Engineering's (CNSE) NanoTech Complex. Learning and working in the 300mm Wafer NanoFab facility within the complex will add to students' technical qualifications and career preparation.

Outreach programs for students and educators at NEATEC community colleges and Rensselaer Polytechnic Institute (RPI) allow students to explore careers in a variety of nanotech fields through associate degree programs. HVCC's Semiconductor Manufacturing Technician (SMT) program and NEATEC's capstone semester at CNSE's NanoFab facility directly feed the resurgent nanotechnology manufacturing sector.



We are working closely with the community colleges and other partners in the region to educate the skilled technicians needed to drive the next wave of innovation in the global semiconductor manufacturing industry. The NEATEC regional center provides a unique focal point for education and workforce development in our area.





AN HVCC GRADUATE EMPLOYED AS A RESEARCH TECHNICIAN AT GENERAL ELECTRIC INSPECTS A PROCESSED WAFER.

NEATEC'S PERIODIC SKILL ASSESSMENTS ARE PART OF A BROAD STRATEGY TO ENSURE THAT TECHNICIANS' SKILLS MATCH THE SEMICONDUCTOR INDUSTRY'S NEEDS.



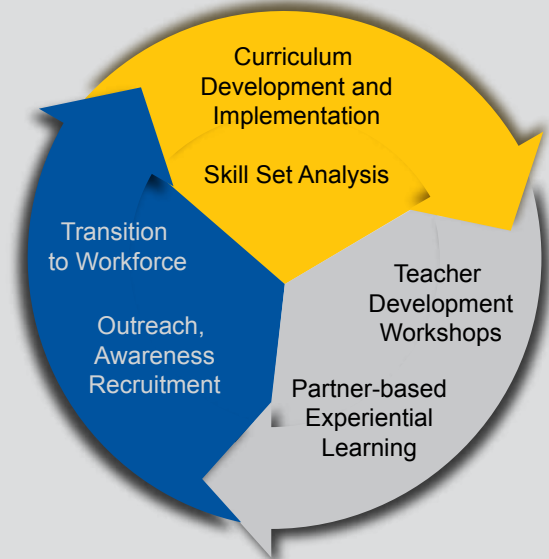
New Center Makes Immediate Workforce Impact

In its inaugural year, NEATEC assembled key capabilities for direct and immediate impact on the nanotech and nanoelectronics workforce in New York and Western New England. Through HVCC's TEC-SMART facility, NEATEC has access to a teaching cleanroom for Integrated Circuit IC lithography and device fabrication. HVCC's infrastructure also accommodates instruction in the latest advances in PV and PV installation. NEATEC's partnership with Fulton-Montgomery Community College gives NEATEC's electrical technology students access to metrology equipment in that college's new teaching cleanroom.

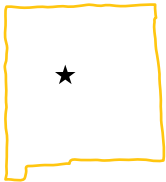
NEATEC has also established cooperative learning (co-ops) and internship opportunities with CNSE and its partners, including IBM and International Sematech. At CNSE's 300mm Wafer NanoFab facility, NEATEC students have unprecedented hands-on learning opportunities. NEATEC is the first National Science Foundation ATE center to provide students with direct access to cutting-edge fabrication tools in a state-of-the-art nanoelectronics prototyping facility. The first group of students from HVCC's SMT program began co-ops at CNSE in January 2011. HVCC had 15 students in associate degree programs in 2010-2011.

NEATEC's development of new curricula and leveraging of existing modules for semiconductor

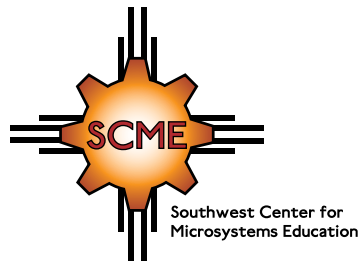
NEATEC's Strategy for Workforce Development



fabrication, PV, and alternative energy technologies will substantially impact the readiness and capabilities of the nanotechnology workforce in the Northeast, given the great number of semiconductor and nanotechnology companies that are moving to the region. In addition to its host institution, NEATEC's partners include Mohawk Valley Community College, Schenectady County Community College, Fulton-Montgomery Community College, Rochester Institute of Technology, Springfield Technical College, and RPI.



UNIVERSITY OF
NEW MEXICO
ALBUQUERQUE, NM



- » Offers technician education enrichment programs to support microsystems research, design, fabrication, and commercialization.
- » Provides professional development opportunities ranging from 1-day introductory workshops to 1-week micro-sensor and actuator fabrication experiences in a research grade microsystems clean room.
- » Creates and promulgates educational materials and models for microsystems and STEM education.
- » Collaborates with synergistic educational, government, and industry organizations to identify and meet emerging technology workforce needs.

SCME Engages Students with MEMS

SCME provides educational resources to excite and engage students about microsystems and microelectromechanical systems (MEMS) technology. The use of MEMS in consumer products is pushing demand for well-prepared technicians to design, manufacture, and integrate these devices for fast-growing, multidisciplinary enterprises. SCME's curricula catches students' attention by making them aware of where microsystems are used and how they are made. By raising students' awareness of MEMS, the center encourages science, technology, engineering, and mathematics (STEM) learning in general.

Manufacturing technology students and graduates of Central New Mexico (CNM) Community College, SCME's community college partner, have performed successfully as interns and technologists for companies and government laboratories. Employers of technicians from CNM's associate degree program with a MEMS concentration include Intel Corporation, Sandia National Laboratories, University of New Mexico's Manufacturing Training Technology Center, TPL, Inc., Emcore Corporation, AgilOptics, Thunder Scientific Corporation, and Avago Technologies. Many of the CNM alumni are continuing their education at UNM's School of Engineering.



HANDS-ON KITS CREATED BY SCME ALLOW EDUCATORS TO SHOW STUDENTS VARIOUS STEM APPLICATIONS IN MICROTECHNOLOGY MANUFACTURING PROCESSES.

Sandia National Laboratories has worked with the SCME program since its inception...Sandia has also hired SCME students and graduates, as interns and as employees, and has been extremely satisfied with their preparation to work on microsystems.

KEITH ORTIZ - MEMS TECHNOLOGY DEPARTMENT MANAGER
SANDIA NATIONAL LABORATORIES

PHOTOLITHOGRAPHY IS A CRITICAL PROCESS THAT TECHNICIANS USE TO CREATE MEMS DEVICES IN SENSORS AND OTHER PRODUCTS.



SCME Kits Put MEMS Lessons in Instructors' & Students' Hands

SCME enhances industry's capacity to integrate MEMS in mass market and specialized devices by preparing technicians for careers in research and the production of high-tech products. A key way the center develops technicians is by teaching community college instructors and high school teachers about MEMS fabrication.

The center has created hands-on microsystems kits that make it possible for educators to show students the wide array of STEM applications involved in MEMS production. Anisotropic etching, cantilever dynamics, crystallography, pressure sensors, and gene chips are among the dozen topics educators can teach with the kits.

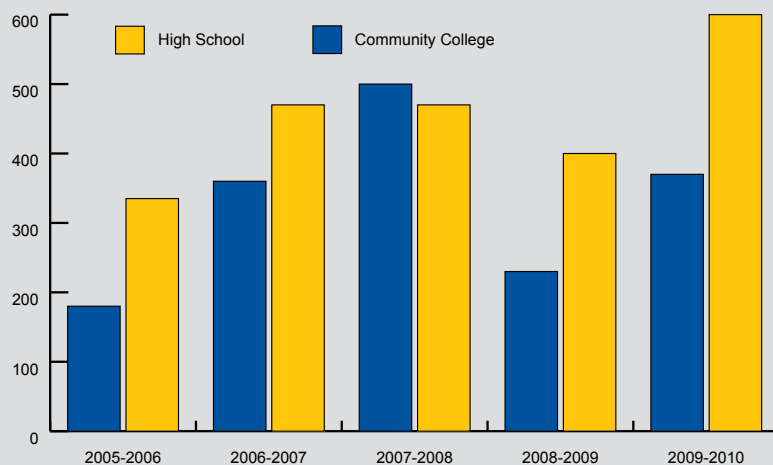
SCME's professional development programs provide the foundation from which educators can customize the center's materials to meet the needs of their students and local employers. More than 300 educators from across the nation have participated in SCME's week-long workshops or 1-day, conference-based professional development programs. The workshops give educators firsthand experience fabricating MEMS devices in a university clean room. The secondary and postsecondary educators return to their classrooms with hands-on microsystems kits, educational learning modules, assessments, and educational animations to integrate into their curricula. The innovative educators who have attended SCME's programs have reported back to SCME that they have taught about MEMS to more than 1,600 secondary and 1,500 postsecondary students. Altogether SCME workshops have added more than 80,000 hours of MEMS instruction to U.S. students' classroom experiences.

SCME Helps Start-Ups

SCME also assists small, start-up companies that research, develop, and manufacture MEMS devices at SCME's home institution—the University of New Mexico's Manufacturing Training Technology Center (MTTC) within the mechanical engineering program.

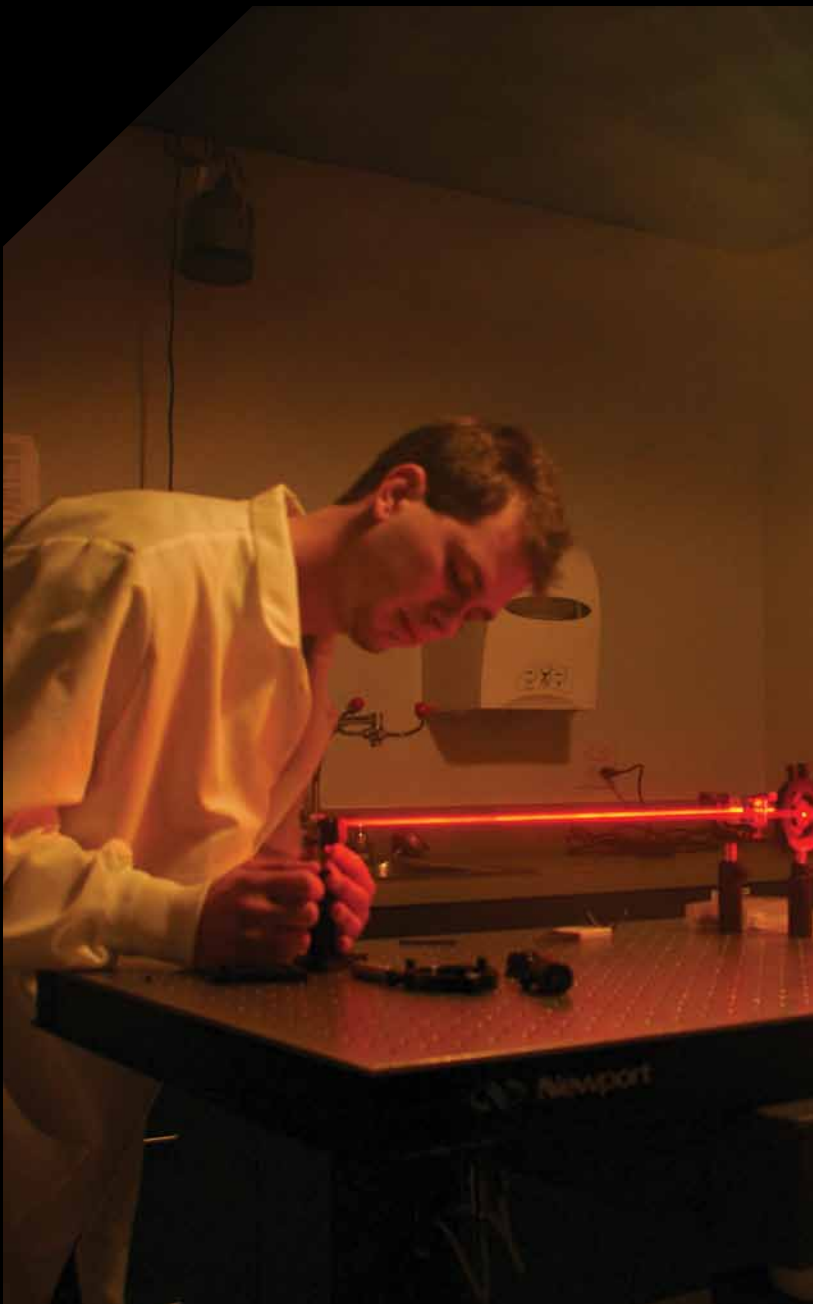
SCME'S PROFESSIONAL DEVELOPMENT PROGRAMS PROVIDE EDUCATORS WITH KITS AND ONLINE RESOURCES TO TEACH HIGH SCHOOL AND COLLEGE STUDENTS ABOUT MEMS.

Number of Students Learning About MEMS Technology



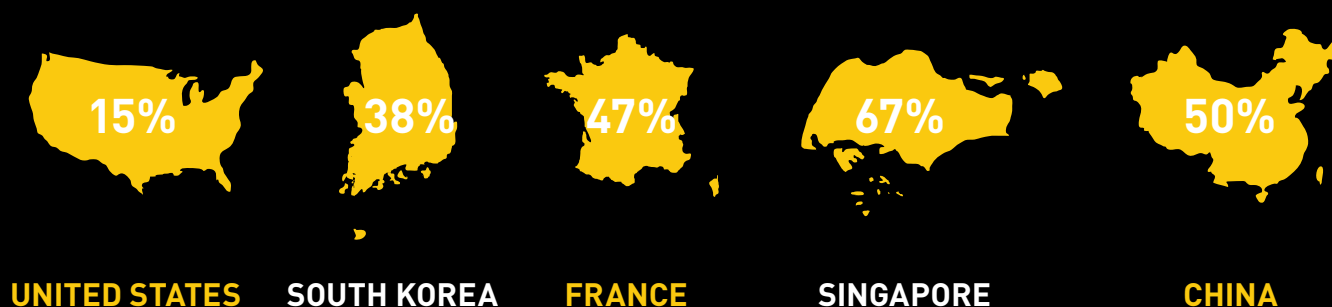


ENGINEERING TECHNOLOGIES



- 24 MATE - Marine Advanced Technology Education Center - www.marinetech.org
- 25 MatEd - National Resource Center for Materials Technology Education - www.materialseducation.org
- 26 OP-TEC - National Center for Optics and Photonics Education - www.op-tec.org
- 27 SMART - Southeast Maritime And Transportation Center - www.maritime-technology.org
- 28 SpaceTEC - National Resource Center for Aerospace Technical Education - www.spacetec.org

THE PROPORTION OF U.S. GRADUATES EARNING DEGREES IN NATURAL SCIENCES AND ENGINEERING IS SMALL COMPARED TO GRADUATES IN OTHER COUNTRIES



OF ALL THE ENGINEERING TECHNICIANS WORKING IN 2008, 33% WERE ELECTRICAL AND ENGINEERING TECHNICIANS; 34% WORKED IN MANUFACTURING; AND 25% WORKED IN PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICE INDUSTRIES.

ELECTRICAL AND ELECTRONIC ENGINEERING TECHNICIANS	164,000
CIVIL ENGINEERING TECHNICIANS	91,700
INDUSTRIAL ENGINEERING TECHNICIANS	72,600
MECHANICAL ENGINEERING TECHNICIANS	46,100
ENVIRONMENTAL ENGINEERING TECHNICIANS	21,200
ELECTRO-MECHANICAL TECHNICIANS	16,400
AEROSPACE ENGINEERING AND OPERATIONS TECHNICIANS	8,700
ENGINEERING TECHNICIANS, EXCEPT DRAFTERS, ALL OTHER	76,600



24

MATE

MARINE ADVANCED
TECHNOLOGY EDUCATION CENTER
www.marinetech.org



MONTEREY
PENINSULA COLLEGE
MONTEREY, CA



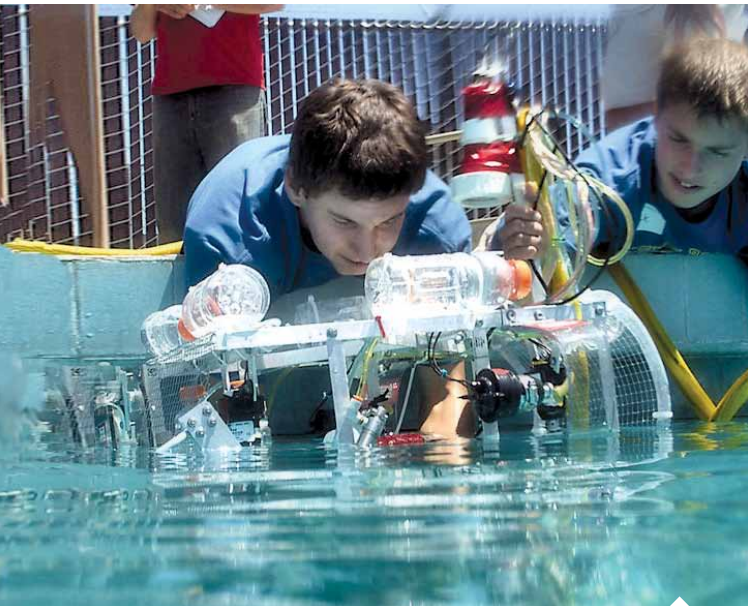
- » Develops and disseminates marine occupational guidelines and researches ocean workforce trends.
- » Organizes 1 international and 20 regional underwater robotics competitions each year.
- » Offers interdisciplinary, technology-rich professional development for faculty.
- » Coordinates at-sea technical internships.
- » Maintains www.OceanCareers.com, a one-stop shop for ocean career information.
- » Published *Underwater Robotics: Design, Science & Fabrication*, a 780-page textbook.

Students Apply Classroom Learning To Solve Ocean Workplace Problems

MATE’s competitions, which require students to design, build, and operate underwater robots known as remotely operated vehicles (ROVs), simultaneously challenge and motivate students. During the ROV competitions, students apply the physics, math, electronics, and engineering skills they are learning in the classroom to solve practical problems from the ocean workplace.

In addition to technical skills, students develop project management, technical writing, communication, and teamwork skills as they prepare technical reports, posters, and engineering presentations. The experience of delivering these presentations to working professionals exposes students to career opportunities and solidifies their connection to real-world industry practices.

The competition is now expanding into middle schools. Ninety-five percent of the 98 middle school students surveyed indicated that they are more excited about taking courses in math, science, computer science, engineering, and other hands-on classes as a result of their ROV projects.



ROV COMPETITIONS MOTIVATE STUDENTS TO LEARN MATH AND SCIENCE AND APPLY THEIR ACADEMIC SKILLS IN REAL-WORLD SETTINGS.



It is a costly endeavor to train technicians to the level we need prior to sending them into the field. The MATE Center allows us to shorten our in-house training programs permitting us to place our technicians in the field in an expedited manner.



FRANK L. KLEIN - MANAGER WORLD WIDE ROV TRAINING AND DEVELOPMENT
OCEANEERING INTERNATIONAL, INC.



MATE Leads Development of Ocean Workforce

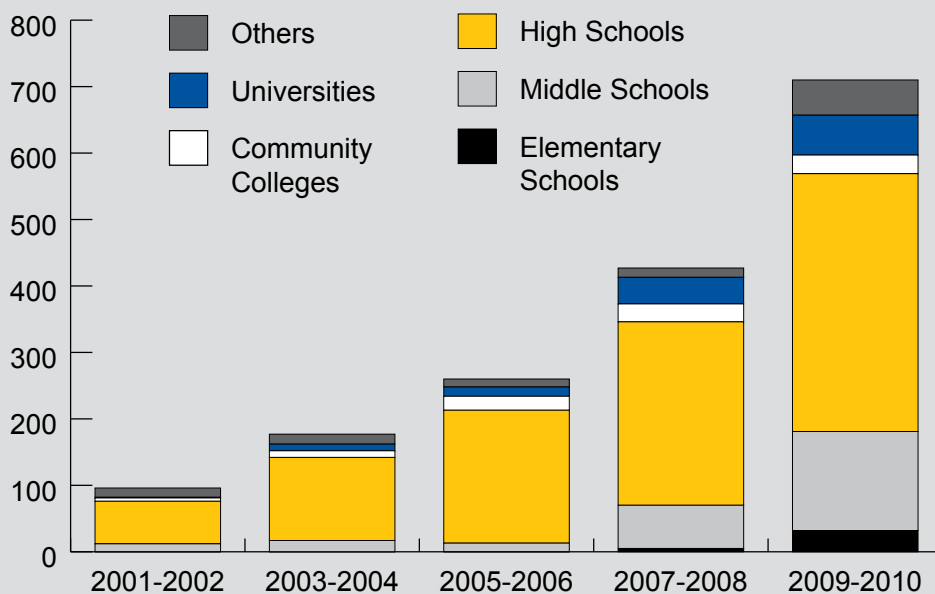
MATE's programs and activities represent unique approaches to engage students in science, technology, engineering, and mathematics (STEM) learning experiences that encourage interest in ocean-related fields.

The center leads marine technical education efforts by defining the current and future ocean workforce; identifying the knowledge and skills this workforce needs; placing this information in the hands of educational institutions at all levels; working to ensure that curricula and programs at colleges across the country reflect current workforce needs; coordinating at-sea internships to provide real-world experiences; creating a set of distinctive approaches to engage educational and industry organizations in collaborative activities; and developing tools to help students learn about and explore career opportunities.

MATE actively collaborates with more than 500 educational institutions and 200 companies and agencies across the country. Over the past 10 years approximately 6,000 students have enrolled in marine technology-related programs at MATE Center partner colleges. MATE Center's industry partners provide employment opportunities for these students in positions that support offshore oil and gas industries; seafloor surveying for telecommunications and safe navigation; environmental assessment and monitoring; marine fisheries and mariculture; recreation and tourism; and basic and applied research among other ocean-related fields.



MATE ROV Competition Team Participation 2001-2010



TECHNICIANS PREPARE TO LAUNCH AN OCEANOGRAPHIC BUOY.

PARTICIPATION IN MATE ROV COMPETITION GROWS STEADILY.

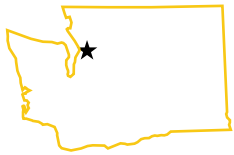


25

MatEd

NATIONAL RESOURCE CENTER FOR MATERIALS TECHNOLOGY EDUCATION

www.materialseducation.org



EDMONDS COMMUNITY COLLEGE
LYNNWOOD, WA

MatEd advances materials technology education nationally. It serves as the focal point where the materials community, industry, and education collaborate to meet the needs of the materials technology workforce. MatEd provides easy and direct access to Web-based resources, professional development opportunities, and industry-approved and industry-accepted core competencies.

MST Degree Program Grows

MatEd works closely with Edmonds Community College on its Materials Science Technology (MST) degree program, the only 2-year degree program of its kind in the State of Washington. Through recruitment activities supported by MatEd, the program has grown steadily. In 2009 and 2010, 38 students earned 25 certificates and/or 13 degrees. Some students earned both certificates and degrees.

High Job Placement Rate

MatEd recently surveyed students who had completed its program by earning either a certificate or a degree. Thirty-six of the 37 respondents, or 97%, are currently working in the field of materials science with their monthly salaries ranging from \$2,000 to \$4,000.

Successful Completion of Internship Program Leads to Employment

MatEd was instrumental in the design and implementation of a unique, replicable educational internship model. By collaborating with the Edmonds Community College MST degree program and industry partners, MatEd created an internship that exposes students to high-tech materials testing and research labs over 2 summers. Employers and students give high ratings to the internship model. Thirteen students were hired directly from their internships; several of these graduates are continuing their education in bachelor's degree programs.



A STUDENT INTERN CHECKS TO SEE IF A SAMPLE HAS BEHAVED AS EXPECTED IN A DESTRUCTIVE TESTING PROCEDURE.



I learned about the MST Program during my senior year of high school. I like working with my hands and wanted to go to college, so the program fit me. This past year I graduated from the MST Program with a degree and an internship experience with the Boeing Company on my resumé.



ALEX BIRD - MST GRADUATE
EDMONDS COMMUNITY COLLEGE



MatEd Prepares Technicians Who Understand the “Science of Stuff”

MatEd’s collection of modules, labs, and demonstrations informs a national network of educators who are preparing technicians to understand a broad array of materials and their diverse uses. Successful product design relies on the proper selection of materials and raises the demand for technicians who understand the “science of stuff.”

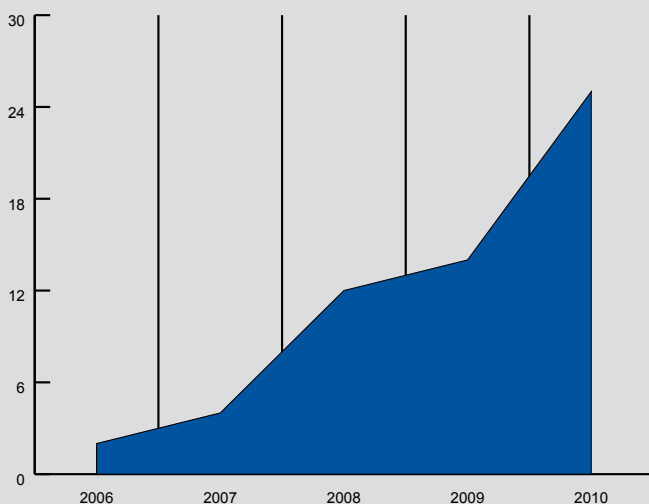
The center established the core competencies that materials science technicians need to know in consultation with partners in industry, secondary schools, community and technical colleges, and universities. These competencies guide the development of MatEd’s modules and technician education courses. MatEd’s modules and courses pass a formal peer review process before they are disseminated via a database that is fully searchable by key words. MatEd continuously expands modules to cover emerging areas of materials science.

MatEd’s National Educators Workshop serves 2- and 4-year college instructors, K-12 teachers, and industry representatives. The workshop features hands-on teaching and learning of materials science with presentations of classroom experiments, labs, and other demonstrations.

The center’s mentoring and instructional materials are helping colleges around the country add materials science to technician education programs. Patricia Taylor, Dean of Engineering Science and Allied Health at Thomas Nelson Community College, explains how MatEd assisted her college: “Thomas Nelson Community College has greatly enhanced its engineering technology program in mechanical engineering by adding a polymers and composites course to the program. The suggestions provided in curriculum content, lab activities, and recommendations for lab equipment were invaluable in our own course development.”

THE NUMBER OF CERTIFICATES AND DEGREES IN MATERIALS SCIENCE TECHNOLOGY AT EDMONDS COMMUNITY COLLEGE INCREASED EACH YEAR FROM 2 IN 2006 TO 25 IN 2010.

Number of Certificates and/or Degrees Awarded



A TEACHER TESTS GLUE BONDING PROPERTIES IN A MatEd MATERIALS AND ADDITIVE MANUFACTURING WORKSHOP.



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OP-TEC

NATIONAL CENTER FOR OPTICS AND PHOTONICS EDUCATION

www.op-tec.org



UNIVERSITY OF CENTRAL FLORIDA
WACO, TX

- » Meets the urgent need for optics and photonics technicians in the U.S. workforce.
- » Strengthens education-employer-industry partnerships.
- » Improves photonics instruction by rescuing declining photonics programs and starting new programs.
- » Provides curriculum, tools, and technical assistance for colleges and high schools.
- » Supplies technical assistance and professional development for educators, administrators, and incumbent workers.



LABORATORY WORK PROVIDES STUDENTS EXPERIENCE IN REQUIRED INDUSTRY SKILLS.

OP-TEC Facilitates Student Success

OP-TEC impacts student success through curriculum, faculty development, and program improvement initiatives that include

- Employer-validated curriculum materials for high schools, 2-year colleges, and the retraining of adult workers.
- *Mathematics for Photonics Technicians* textbook.
- Math tutorial text supplements and videos.
- E-book development.
- Twelve-week online faculty development courses with 3-day laboratory capstone sessions.
- New Open Entry/Open Exit faculty development courses.
- Mentoring of college faculty and administrators.
- Fellowships for faculty to attend the High Impact Technology Education Conference.
- Photonics Information Workshops to assist educators in considering new programs.
- Five Program Planning Guides (PPG).
- High school PPG and lab manual with inexpensive lab equipment list.
- Mini-grants to new and developing photonics programs.
- Secondary and postsecondary career pathways and dual-credit courses.
- Comprehensive regional clusters that foster college and employer interaction and cooperation.
- Recruiting assistance.

OP-TEC is filling a very critical need that has been unmet until now.



WILLIAM BURGESS - VICE PRESIDENT OF OPERATIONS
POWER TECHNOLOGY, INC.





PHOTONICS TECHNICIANS MOVE LASER RESEARCH INTO APPLICATIONS IN MANUFACTURING, MEDICINE, AND TELECOMMUNICATIONS.

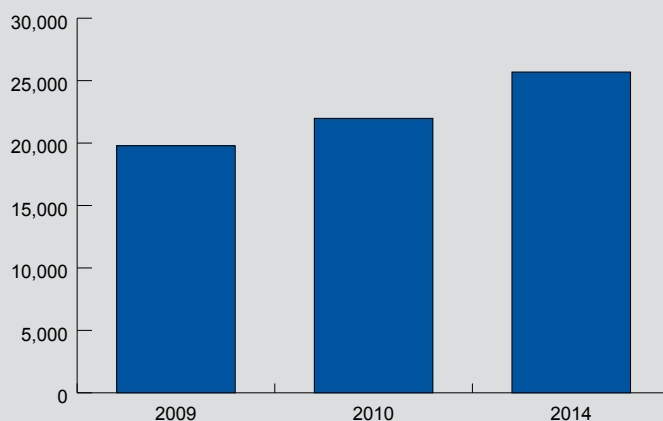
OP-TEC CREATES NEW PHOTONICS PROGRAMS AND STRENGTHENS EXISTING PROGRAMS TO MEET DEMAND FOR TECHNICIANS.

OP-TEC Addresses Photonics Workforce Needs

OP-TEC's recent employer study revealed a national demand for more than 2,100 new photonics technicians in 2009. In each succeeding year through 2014, U.S. employers will need 1,200 new photonics technicians. However, 2-year colleges are currently producing fewer than 250 graduates annually. Although almost 50% of photonics employers surveyed prefer to hire technicians with associate degrees, they are increasingly forced to hire underprepared or overqualified applicants and recruit on a national level to fill their need for technicians. To help meet the urgent workforce need, the center and its partners are growing new photonics programs and strengthening existing ones by creating secondary-to-postsecondary "pipelines" to increase the number and diversity of students who enter and complete associate degrees in photonics.

Through its interactions with colleges and employers, OP-TEC has concluded that regional and local capacity-building efforts are most effective. The center and its partner colleges are collaborating with existing regional photonics employer clusters and industry associations to develop 4 regional photonics clusters which will

Five-Year Projection Estimate of U.S. Industry-wide Employment Demand for Photonics Technicians



more effectively engage colleges with employers in their service areas. The benefits of these clusters include more internships and job opportunities for graduates, better placement rates, additional access to equipment, supplemental funding opportunities, and larger adjunct faculty pools for colleges. Benefits for employers include the opportunity to provide advice, adjunct faculty, and support for the 2-year colleges that prepare their workforces, provide customized incumbent worker training programs, create a larger pool of skilled applicants, and lower training expenditures.

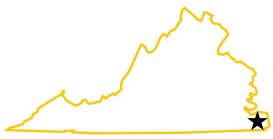


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SMART

SOUTHEAST MARITIME AND TRANSPORTATION CENTER

www.maritime-technology.org



TIDEWATER COMMUNITY COLLEGE VIRGINIA BEACH, VA

- » Consolidates education criteria for specific maritime occupations.
- » Develops career pathways and education programs.
- » Facilitates the portability of credentials among employers.
- » Lays the groundwork for future industry-developed certifications.
- » Promotes awareness of careers in maritime, transportation, and logistics among students attending high schools, community colleges, and 4-year institutions.

Curricula Will Serve as National Model

SMART Center—a consortium of community colleges, business and industry, led by Tidewater Community College—will serve as a regional education resource and an economic model for preparing a sustainable, globally prepared maritime and transportation workforce for the 21st century. Going forward, maritime and transportation knowledge will be critical for careers in shipbuilding, ship repair, seamanship, port management, and logistics.

The center will link registered journeyman and apprentice programs with academic credentials. In this way students earning career studies certificates, which will be embedded in degree programs, can accumulate credits toward associate and baccalaureate degrees.



STUDENTS ATTENDING MARITIME ACADEMY CHARTER HIGH SCHOOL IN PHILADELPHIA ARE INSTRUCTED IN VESSEL AND BARGE SAFETY.



The SMART Center is exactly the sort of initiative we need to address the needs for a highly skilled maritime workforce and to sustain this industry’s growth and viability with a focused maritime industry-education partnership.



BRAD MASON - DIRECTOR OF OPERATIONS NORTHROP GRUMMAN CORPORATION



»»

AN APPRENTICE
AND HIS MENTOR
REVIEW THE
REPAIR PLANS
FOR A U.S. NAVY
CARGO SHIP AT
BAE SYSTEMS.



SMART Center Prepares Maritime & Transportation Workforce

As a critical engine for the U.S. economy, the maritime industry accounts for \$2 trillion worth of domestic and international cargo. To prepare the future workforce responsible for handling cargo in the nation's ports, SMART Center will integrate curriculum and program development with the promotion of advanced technological careers in the maritime and transportation industries. It will focus on preparing technicians for employment at the specialist and trainer levels. Individuals who work at these levels are highly skilled and are able to mentor co-workers.

The center intends to work with industry to address current workforce shortages, improve the efficiency of small U.S. shipyards, complete critical hydrographic surveys and chart programs, and fill the expected vacancies in the maritime workforce in the near future.

SMART Center Builds Career Pathways

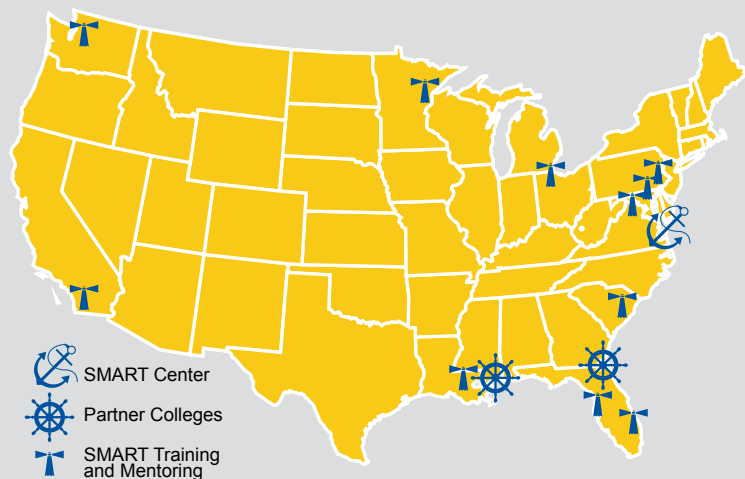
The center plans to generate awareness about maritime and transportation careers and work with the industries to improve linkages between their employee education efforts and college programs. SMART Center will offer workshops to inform K-12 teachers about maritime and transportation careers, and the skills employers require. Workshops will also be held for industry partners to learn how to start apprenticeship programs that mesh with colleges' academic credentials.

SMART Center Programs Encompass New Technologies

Among its proactive strategies for emerging technologies, the center plans to develop programs for technicians who will work at offshore wind farms, in research and development, in nuclear energy, and in marine composite material construction and maintenance. The center also plans to develop programs to raise awareness of other new maritime and transportation technologies.

SMART CENTER DEVELOPS A NATIONAL VISION FOR MARITIME AND TRANSPORTATION EDUCATION WITH PROFESSIONAL DEVELOPMENT PROGRAMS AND MENTORING.

SMART Center Outreach in 2011



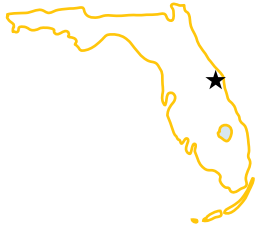


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SpaceTEC

NATIONAL RESOURCE CENTER FOR AEROSPACE TECHNICAL EDUCATION

www.spacetec.org



BREVARD COMMUNITY COLLEGE
COCOA, FL



A CO-OPERATIVE STUDENT WORKS WITH A NASA TECHNICIAN ON THE FIRST FLIGHT TEST ARTICLE SIMULATOR OF THE ORION CREW EXPLORATION VEHICLE.

- » Operates a repository of aerospace-related education materials and best practices.
- » Supports student recruitment and outreach activities to foster interest in aerospace and STEM.
- » Maintains and expands a sustainable national network of aerospace partners.
- » Promotes professional development opportunities for educators and practitioners.
- » Manages a national skill-based credentialing program for aerospace stakeholders.

Enrollment in SpaceTEC partner college programs grew 10% in 2010 to 154,000 students. The majority of those are in active-duty military assignments, taking courses through the Community College of the Air Force. During 2010 more than 250 people took credentialing exams monitored by SpaceTEC examiners at sites across the nation, and more than 60 people passed the rigorous SpaceTEC Core Certification exam.

During 2010, aerospace programs at SpaceTEC’s partner colleges resulted in a number of students being named as National Community College Scholars chosen to attend workshops at the NASA Johnson Space Center in Houston, TX, and the NASA Space Ops 2010 International Conference. In a “real life” aerospace operation stressing workplace skills, Doña Ana Community College placed 5 students as interns with UP Aerospace Inc. in New Mexico, and the payload they processed was launched from the New Mexico Spaceport in May 2010.

For the first time since its Aerospace Core Certification was initiated in 2004, the SpaceTEC certification examination was adopted by NASA in 2010 as the standard for entry into their Cooperative Student Program at Langley Research Center in Virginia. In fall 2010, 5 Thomas Nelson Community College graduates passed the SpaceTEC Core Certification examination, qualifying them to work as paid co-operative students and opening the pathway for permanent employment at NASA when they complete their baccalaureate degrees.

Although I have bachelor’s and master’s degrees, I had a deep desire to get out of the office and do hands-on work on Florida’s Space Coast. The aerospace technician program is a perfect vehicle for me to build a ‘bridge’ to an entry-level position in the aerospace industry.



CYNTHIA RAYEN - AEROSPACE TECHNICIAN - THE BOEING COMPANY
2009 BREVARD COMMUNITY COLLEGE GRADUATE





SpaceTEC Provides Veterans With Career Pathways

During the 2009-2010 school year, SpaceTEC partner colleges placed more than 150,000 students in aerospace-related jobs. Reflecting the changing aerospace landscape for workers, nearly all of those placements came through the Community College of the Air Force (CCAF) in support of active-duty military personnel. CCAF also established a Web-based clearinghouse for credentialing and education information similar to the Army COOL and Navy COOL Web sites, providing educational career tracks and certification through SpaceTEC.

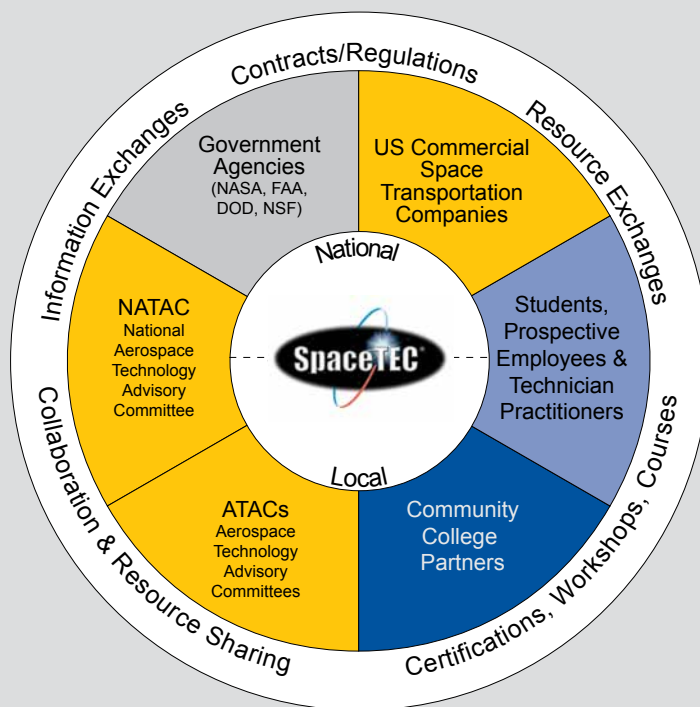
SpaceTEC Expands Credentialing Resources

In the face of increasing competition in the job market, obtaining nationally recognized professional certifications has become a focus for many new graduates and transitioning aerospace workers. In response to this need and recognizing that our nation's space program is now emphasizing commercial space transportation, the Community College of the Air Force, Antelope Valley College, Brevard Community College, Calhoun Community College, and SpaceTEC headquarters expanded the availability of readiness course materials and increased the use of both the Core Certification exam and exams covering advanced concentrations in aerospace vehicle processing, aerospace manufacturing, and composites. To maintain the capacity to support a growing demand for credentialing services, SpaceTEC examiners were offered professional development courses to maintain their status as certified examiners.

A CANDIDATE FOR SPACETEC CORE CERTIFICATION WORKS ON A SPACE SHUTTLE ORBITER MAIN ENGINE.

SPACETEC LINKS NATIONAL AGENCIES, COLLEGES, AND INDUSTRY GROUPS TO STUDENTS, FACULTY, AND EMPLOYEES.

The SpaceTEC Connection





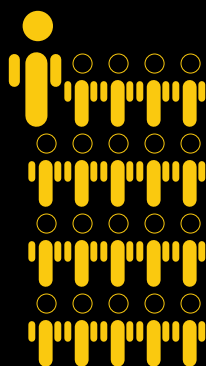
INFORMATION, GEOSPATIAL, AND SECURITY TECHNOLOGIES



- 29 BATEC - Boston area Advanced Technological Education Connections - www.batec.org
- 30 CSEC - Cyber Security Education Consortium - www.cseconline.org
- 31 CSSIA - National Resource Center for Systems Security and Information Assurance - www.cssia.org
- 32 CTC - Convergence Technology Center - www.greenITcenter.org
- 33 CyberWatch - Creating the Next Generation of Cybersecurity Professionals - www.cyberwatchcenter.org
- 34 GeoTech Center - National Geospatial Technology Center of Excellence - www.geotechcenter.org
- 35 ICT Center - Information and Communications Technologies Center - www.ictcenter.org
- 36 MPICT - Mid-Pacific ICT Center - www.mpict.org

**THE ICT WORKFORCE
REPRESENTS 1 IN 20
U.S. JOBS**

**BY 2018 EMPLOYMENT IN
THE INFORMATION SECTOR
IS EXPECTED TO INCREASE**

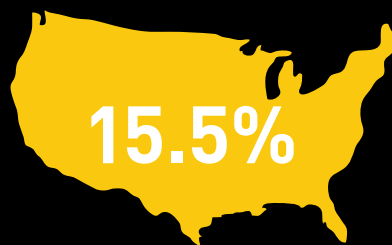


+4%

NEW JOBS

118,100

**15.5% OF DEAF AND
HARD-OF-HEARING
INDIVIDUALS WORK IN
STEM OCCUPATIONS
COMPARED TO 17.9% OF
HEARING INDIVIDUALS**

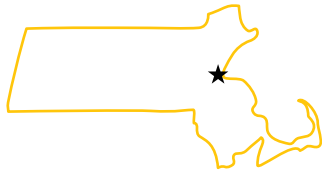




BATEC

BOSTON AREA ADVANCED
TECHNOLOGICAL EDUCATION CONNECTIONS

www.batec.org



UNIVERSITY OF
MASSACHUSETTS BOSTON
BOSTON, MA



- » Provides curricula and pedagogy to ensure that information technology (IT) education meets the needs and demands of the 21st century workplace.
- » Establishes articulation and transfer agreements to build a seamless educational experience.
- » Educates diverse populations of students who can meet the challenges of emerging technologies.
- » Facilitates partnerships that support career development, lifelong learning, and regional economic growth.



STUDENTS RECEIVE ONE-ON-ONE COLLEGE AND CAREER ADVICE AT BATEC'S HIGH-TECH COLLEGE FAIR.



**BATEC Helps Students
Discover IT Opportunities**

By offering a variety of career pathways and a wide array of student programs, BATEC helps students of all ages discover opportunities in information technology (IT) and IT-dependent fields.

All 147 of the Boston public high school students who have participated in BATEC's Tech Apprentice program, which places students in technology-focused internships, have enrolled in college after graduation. Technical majors were chosen by 75% of the Tech Apprentices.

BATEC's college recruitment strategy includes 3 levels of engagement for technology-focused high school students: a Regional High-Tech College Fair that serves sophomores and juniors; community college fairs that target juniors and seniors; and mini-tech fairs that provide interactive college visits for high school seniors. Altogether these events connect more than 1,500 students each year with higher education opportunities, admissions counseling, and career information.

BATEC's Bridge to Community College program for adult learners combines credit-bearing technology courses with English and mathematics tutoring and workshops on college admissions, financial aid, course registration, and advising. Delivered through local community-based organizations, this program in the last 3 years has served more than 200 students who have not had any prior college experience. By fall 2010, more than 100 BATEC Bridge students had taken additional courses toward certificates and/or degrees.



In this program we had to build on things that we knew. We had to work on industry problems so I had to combine communication, teamwork, and presentation skills along with my technical knowledge. Instead of being just a college student, I was thinking at a professional level.



KARL KIZER - STUDENT
TRANSFERRED FROM BUNKER HILL COMMUNITY COLLEGE
TO UNIVERSITY OF MASSACHUSETTS BOSTON

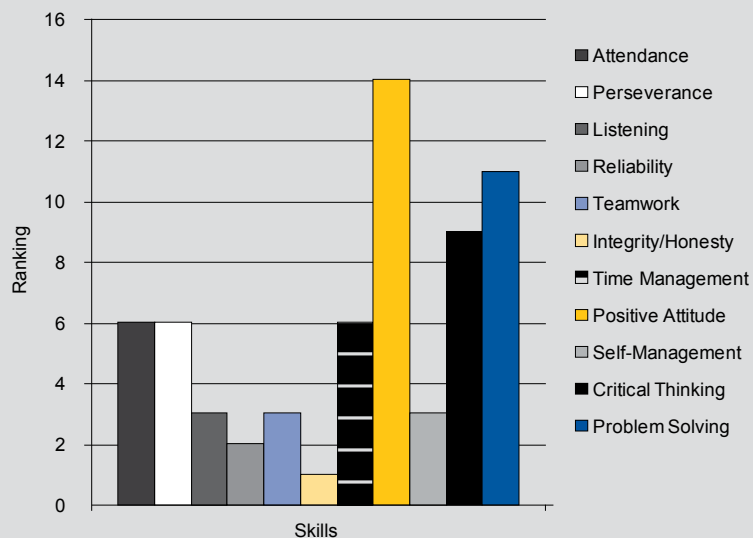
BATEC Bridges Education & Industry for Student Success

BATEC's IT Workforce Skills Study includes input from workers, hiring managers, and strategic planners across the country. The report concluded that employability skills (communication, collaboration, resourcefulness, and teamwork) and contextual skills (ability to apply skills in a real-world environment) are "every bit as important as any technical skill element an employee may possess."

Guided by BATEC's broad vision of IT education and with the input of BATEC's industry partners, BATEC's regional partner institutions have designed IT programs that are relevant, rigorous and reflective of industry needs. BATEC has transformed more than 100 courses and updated the content knowledge and pedagogical skills of more than 400 IT educators. As a result of these curricula and professional development activities, more than 12,000 students from high school through 4-year college programs have benefited from BATEC-informed courses.

When it revamps courses, BATEC works collaboratively online and in-person with faculty to share curricular materials, model teaching methods, connect them with industry partners, and update their technical skills. BATEC's guidance ensures that students are active participants in classrooms that mirror the world of work. Skill standards and employability skills are merged with authentic and challenging problem-solving and higher-order thinking skills. Using a modular, open-source approach to designing and sharing curricular assets, BATEC provides faculty with access to high-quality materials that can be repurposed, modified, and combined according to class size, academic rigor, student interests, and needs.

Industry Partners Identify Important Employability Skills



BATEC INDUSTRY PARTNERS REPORT THAT THEY WANT ENTRY-LEVEL IT TECHNICIANS WITH POSITIVE ATTITUDES, PLUS PROBLEM-SOLVING AND CRITICAL-THINKING SKILLS.

AN IT TECHNICIAN TRACKS EYE MOVEMENTS ON A MONITOR TO ENHANCE USERS' INTERACTIONS WITH COMPUTER INTERFACES.

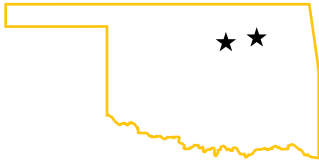


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CSEC

CYBER SECURITY
EDUCATION CONSORTIUM

www.cseconline.org



UNIVERSITY OF TULSA (TU)
TULSA, OK
OKLAHOMA DEPARTMENT OF
CAREER & TECHNOLOGY EDUCATION
STILLWATER, OK

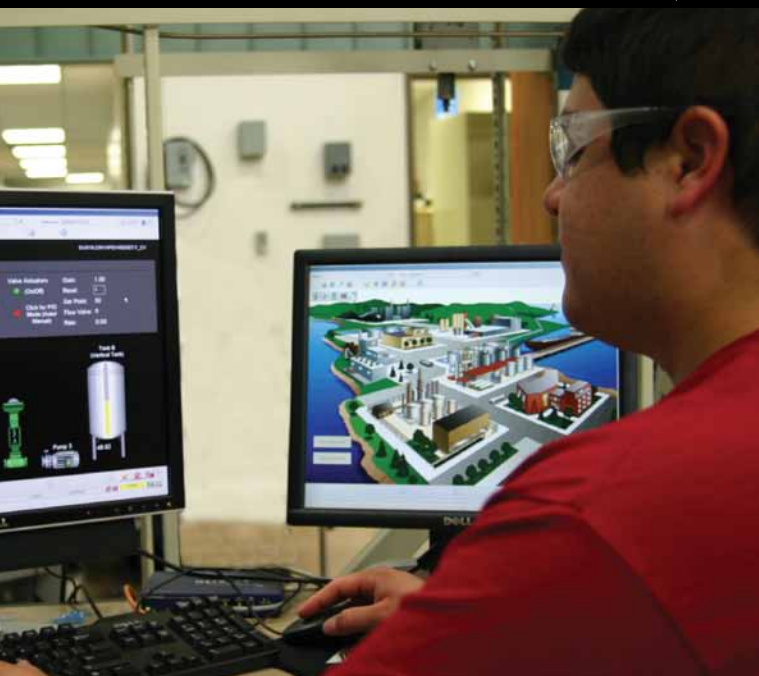


Rose State College and OSUIT's partnership allowed me to obtain my associate and bachelor's of technology degrees simultaneously at a community college near my home.



GRANT KATUS - STUDENT
OKLAHOMA STATE UNIVERSITY INSTITUTE OF TECHNOLOGY

A STUDENT IMPLEMENTS SECURITY ON A POWER-GENERATING STATION'S CONTROL SYSTEM.



- » Forty-four member institutions in 8 states offer or plan to offer CSEC core curriculum that is aligned to Committee on National Security System (CNSS) standards.
- » Strategic centers of excellence in secure coding, automation and control systems, and mobile communications devices address national homeland security concerns.
- » Model faculty development programs and virtual laboratories promote wide-scale dissemination and program replication—already educating 182 instructors.

CSEC Fuels Economic Development in 8 States

CSEC's goal is to bring jobs to its 8-state region where the quality of life is good and costs are low. CSEC is a cohesive partnership of community colleges and career and technology centers in Oklahoma, Arkansas, Colorado, Kansas, Louisiana, Missouri, Tennessee, and Texas, and the University of Tulsa.

CSEC has a 3-fold mission:

- (i) Develop and disseminate cybersecurity curricula for 2-year institutions;
- (ii) Offer professional development to instructors and help them build programs; and
- (iii) Design and implement workforce development programs that contribute to economic development and national homeland security efforts.

CSEC Offers Many Options for Acquiring Cybersecurity Credentials

In spring 2010, CSEC institutions had 1,396 students enrolled in degree programs and 602 students enrolled in certificate programs or non-degree security courses. Since 2004, 402 CSEC students have received associate degrees, 136 students have received bachelor's degrees, and 765 students have received cybersecurity certifications. CSEC institutions have also issued 919 CNSS certificates since 2004, with many students receiving multiple certificates.

During the 2009-2010 academic year alone, CSEC institutions served 466 military, industry, or incumbent workers who attended symposia, workshops, courses, or degree programs.

Nearly 200 Faculty Teach CSEC's Cybersecurity Core Courses

CSEC offers a comprehensive 25-day faculty certification course for instructors who intend to teach its 5 core courses: Information Assurance Principles, Secure Electronic Commerce, Network Security, Enterprise Security Management, and Digital Forensics. To increase capacity, CSEC offers this certification in all 8 states using its cadre of master instructors. By mid-2010, 182 faculty members were prepared to teach CSEC's core curriculum.

As a result, CSEC institutions currently offer 104 core cybersecurity courses and 4 new centers of excellence courses. Mature CSEC institutions have established 25 associate of applied science and associate of science degree programs. To date, 44 2-year institutions offer or are preparing to offer cybersecurity courses based on CSEC's core curriculum. One CSEC institution now offers a bachelor's of technology degree and has established articulation agreements with 2 other member institutions. Two CSEC members earned the prestigious Center of Academic Excellence designation in the National Security Agency's National IA Education and Training Program. They are cascading their program models throughout the consortium.

In 2010, CSEC launched a series of automation and control systems security workshops that provide instructors with the core knowledge and skills required to offer courses in control systems security. Automation and control systems are used in the nation's critical infrastructure. Securing them is vital to national security, public health, and safety. CSEC is also launching mobile communications device and secure coding centers of excellence.

CSEC Informs State Employees About Latest Security Issues

CSEC offers an annual Cyber Security Seminar, sponsored by the Oklahoma Office of Homeland Security and Office of State Finance, for information security professionals employed by state government agencies. CSEC members in other states are planning to replicate this seminar to bring the latest security information to government workers.



A TECHNICIAN TROUBLESHOOTS A PROGRAMMABLE LOGIC CONTROL SYSTEM AND ASSESSES ITS CYBERSECURITY ATTACK VULNERABILITIES.

THE NUMBER OF INDIVIDUALS ENROLLING IN CYBERSECURITY PROGRAMS AND EARNING COLLEGE CREDENTIALS CONTINUES TO GROW IN CSEC'S 8-STATE REGION.

CSEC Creates a Cybersecurity Workforce

Since 2004
Degrees Earned **402** Associate Degrees
136 Bachelor's Degrees

2010
Enrolled in Degree Programs **1,396**

Since 2004
Received Certificates or Certifications **765** Cybersecurity Certifications
919 CNSS Certifications

2010
Enrolled in Certificate Programs or Non-Degree Security Courses **602**



MORAIN VALLEY
COMMUNITY COLLEGE
PALOS HILLS, IL

- » Provides students with real-world learning experiences in information assurance and network security through expanding and enhancing cybersecurity skills events and competitions.
- » Builds a national infrastructure to deliver faculty workshops and establish mentoring programs for secondary teachers and postsecondary faculty.
- » Operates national infrastructure models for skills and learning events based on the creation of scalable and affordable remote virtual laboratory environments.



CYBERSECURITY STUDENTS DEPLOY ROUTING,
SWITCHING, AND VIRTUAL PRIVATE NETWORKING.

CSSIA Instructs Cybersecurity Educators

Since 2004, CSSIA has instructed more than 2,000 teachers and college faculty in cybersecurity. Surveys show that 73% or 1,460 are already using or plan to use curricula and instructional materials provided at the professional development programs. In follow-up interviews, most of the educators reported that learning how to implement hands-on, complex laboratory exercises was the most valuable aspect of the workshops.

CSSIA Directly Impacts Students

CSSIA's impact on student success has been extraordinary. Carlos Marquez, Jr., an information technology (IT) graduate from Moraine Valley Community College, is an example of a successful student. He explains, "As a high school graduate in 2005, I was accepted to many universities, but Moraine Valley's Center for Systems Security and Information Assurance had the right staff and equipment. CSSIA gave me the opportunity to enhance my skills, have an internship, and participate in the [Collegiate] Cyber Defense Competition. If it was not for CSSIA, I would not be where I am today: employed by Secureworks, Inc."

CSSIA has enabled me to get the real-world experience I needed to further my education and future career.



JUSTIN VALENTINO - IT GRADUATE
MORAIN VALLEY COMMUNITY COLLEGE



CCDCs Give Students Experience With Real-World Security Challenges

CSSIA operates the Midwest Collegiate Cyber Defense Competitions (CCDC) providing students with hands-on cybersecurity experiences. Since organizing the first Midwest competition in 2006, CSSIA has consistently held both state and regional competitions. In 2008, CSSIA formed the Competition Industry Advisory Board, which has increased industry participation and added more real-world workplace experiences to the competitions. Recently, the center created and now administers the CSSIA Virtualization Data Center (CVDC), a remote virtual laboratory environment to enhance the quality and quantity of competitions nationwide.

A total of 872 students participated in the competitions from 2006 to 2010. In post-competition surveys, 83% of the students indicated that the competitions were an accurate test of their technical and soft skills. The students also report that the competitions make them more certain that IT careers are right for them. More than 90% of the respondents plan to enter IT careers. Other career affirmation sometimes comes from the employers who volunteer at the competitions—employers have been known to invite participants to interview for jobs on the spot. More than 300 students are registered to participate in CSSIA's competitions during 2011.

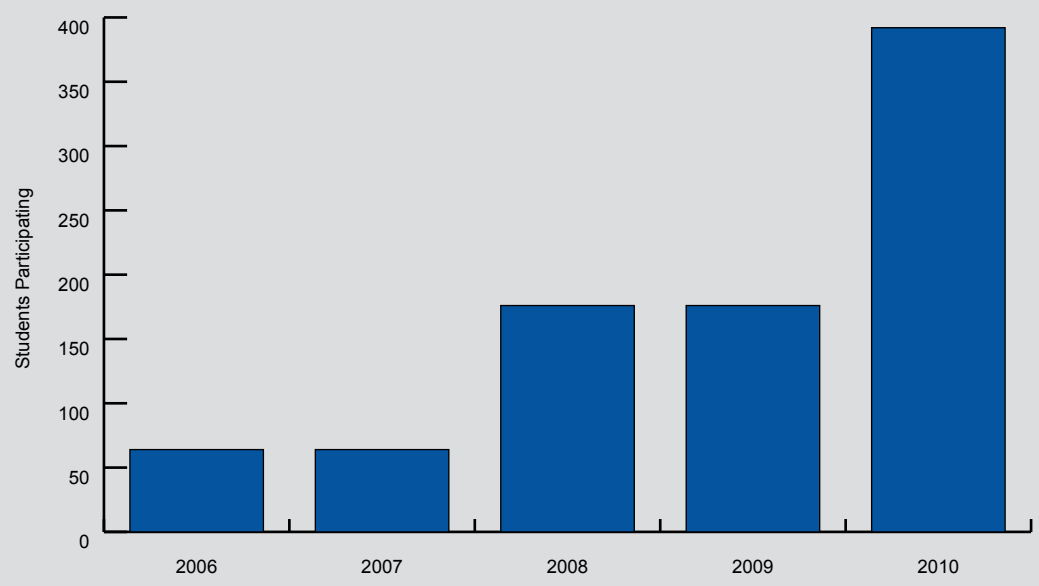
CSSIA has also sponsored 3 annual Cyber Defense and Disaster Recovery Conferences where more than 600 industry, government, and academic professionals have gathered to enhance the technical expertise of the cybersecurity workforce.



A CSSIA GRADUATE MAINTAINS AND SECURES A DATA CENTER.

MOST STUDENTS WHO HAVE PARTICIPATED IN CSSIA'S CYBER DEFENSE COMPETITIONS REPORT THAT THE MOCK INFILTRATIONS OF WORKPLACE NETWORKS ACCURATELY TEST THEIR TECHNICAL AND SOFT SKILLS.

Student Participation in CSSIA's Midwest Collegiate Cyber Defense Competitions





32

CTC

CONVERGENCE TECHNOLOGY CENTER

www.greenITcenter.org



COLLIN COLLEGE
FRISCO, TX



CTC's

- » Strategic business engagement and business partnerships drive its programs.
- » Low-cost, high-return college mentoring launches new courses, certificates, and degrees.
- » Green Information Technology and mobile convergence curriculum, and professional development are cutting edge.
- » Recruiting strategies attract underserved populations, specifically Hispanic populations.

CTC Impacts Student Success Via Faculty Education & Mentoring

Through initiatives launched by CTC:

- Thirty-eight students from 2 CTC partner colleges—Collin College and El Centro College of the Dallas County Community College District—have transferred into the Bachelor of Arts in Information Technology degree program offered at the University of North Texas, the third CTC partner institution. This new degree incorporates innovative components and accepts a large number of transfer hours from CTC's convergence curriculum.
- Five hundred faculty from community colleges around the country have attended weeklong intensive educational programs at Working Connections IT Faculty Development Institute, sponsored by CTC. This professional development has prepared attendees to teach over 4,000 students in these specific topic areas.
- Forty-one new programs have been launched as a result of Working Connections Faculty Development Institute.
- Seventeen colleges mentored by CTC have implemented new certificate and degree programs resulting in enrollments of 4,017 new students in 2008, and 5,091 new students in 2009.



CONVERGENCE TECHNOLOGY STUDENTS WORK WITH
CURRENT AND LEADING-EDGE DEVICES TO CREATE
SOLUTIONS TO AUTHENTIC BUSINESS PROBLEMS.

VoIP [Voice over Internet Protocol] and unified communication are no longer the future; they are here and now, with mobile convergence on the horizon...Just search Facebook or Twitter for 'Convergence Technology Center,' and you'll find a program where you can get hands-on experience in a hurry.



COREY KIRKENDOLL - TECHNICAL MARKETING ENGINEER
CISCO SYSTEMS, INC.



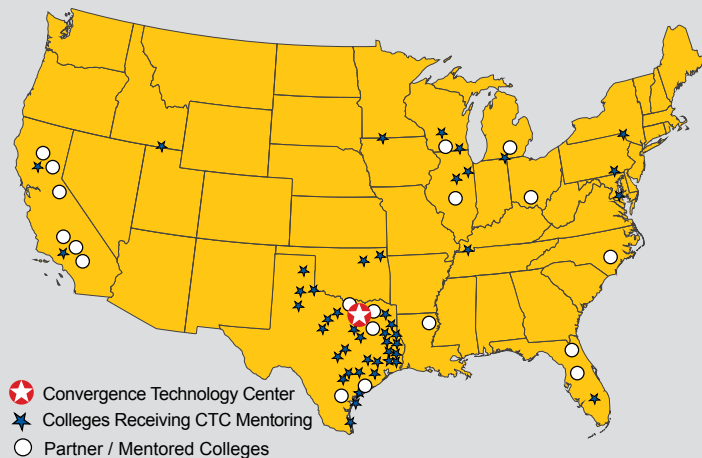


AN IMPORTANT EMPHASIS OF THE CONVERGENCE TECHNOLOGY PROGRAM IS THE SUCCESSFUL INTEGRATION OF CROSS-PLATFORM NETWORK TECHNOLOGIES AND DEVICES.

CTC PARTNERS INFLUENCE IT PROGRAMS BY MENTORING COLLEGES AND OFFERING CUTTING-EDGE PROFESSIONAL DEVELOPMENT TO FACULTY NATIONWIDE.



Convergence Technology Center Program
Mentoring and Training for Community Colleges



CTC Heeds Business Advice For Well-Prepared Graduates

It is no exaggeration to say that the work of the Convergence Technology Center is and has been owned by the broad range of engaged business people on its Business Advisory Council (BAC). Post 9-11 when IT employment dropped, the center used a modified, development-of-curriculum industry-panel process to identify the knowledge and skills that the BAC members predicted would be needed in the next round of network support professionals they would hire. These skills were then cross-referenced to existing courses, and new curricula were developed. The BAC continues to meet quarterly to advise CTC colleges and refine the job skills list to reflect emerging demands that faculty then incorporate in curricula. As a result, the job skills list includes new topics such as unified communication, virtualization, and Green IT.

Because of the BAC's involvement, graduates of 2-year degree programs affiliated with CTC readily find employment with median incomes between \$43,000 and \$48,000.

CTC has also worked integrally with North Central Texas InterLink, Inc., a nonprofit consortium of businesses and educational entities, to characterize

the emerging job category of convergence technician. InterLink considers convergence technician a defined category and provides regular employment forecasts for it. Based on responses from 347 business people, InterLink reported that 400 convergence technicians had been hired in the region during 2010. InterLink forecasts that 1,400 additional technicians will be hired in North Texas within 5 years. Further, the Texas Workforce Commission projects at least 1,410 Texas job openings due to growth and 1,000 replacements by 2016.

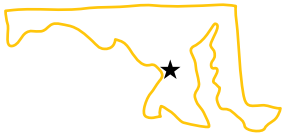


33

CyberWatch

CREATING THE NEXT GENERATION
OF CYBERSECURITY PROFESSIONALS

www.cyberwatchcenter.org



PRINCE GEORGE'S
COMMUNITY COLLEGE
LARGO, MD



CYBERWATCH SECURE IT LETS K-12 STUDENTS
EXPLORE COMPUTER TROUBLESHOOTING,
NETWORKING, AND SECURITY.

CyberWatch increases the quantity and quality of the information assurance (IA) workforce by:

- » Developing IA curricula with degree and certificate programs, model courses, articulation agreements, and career pathways.
- » Providing faculty professional development with CyberWatch workshops and graduate school tuition subsidies.
- » Mentoring faculty as they map courses to national training standards.
- » Developing the IA skills of students at all levels with competitions, internships, job fairs, student clubs, and after-school and summer-school programs.
- » Promoting public cybersecurity awareness of cyber ethics, safety, and security.

CyberWatch Workforce Development Encompasses Elementary Through Graduate School Programs

CyberWatch improves the IA workforce with activities for students from kindergarten through graduate school and professional development for faculty. Students enrolled in IA programs at CyberWatch's 54 member institutions gain direct access to the cybersecurity workforce through CyberWatch's strong connections to the National Security Agency (NSA), Department of Homeland Security (DHS), industry associations, and private cybersecurity enterprises.

CyberWatch Leads Multidiscipline Efforts At 2-Year Colleges

Working with NSA, DHS, and the National Science Foundation, CyberWatch played a key role in developing and implementing the National Centers of Academic Excellence in Information Assurance 2-Year Education program known as CAE2Y. CyberWatch mentors all aspiring CAE2Y community colleges, helping them refine and document their IA programs to meet the stringent requirements for CAE2Y established by the NSA.

CyberWatch and the community backing them really jump started my career in information security. Hands-on labs, competitions and those already firmly established in the field gave me so much knowledge and experience that I wouldn't have gotten otherwise.



BRANDON DIXON - INFORMATION SYSTEMS SECURITY ENGINEER - G2, INC.
COMMUNITY COLLEGE OF BALTIMORE COUNTY AND CAPITOL COLLEGE GRADUATE



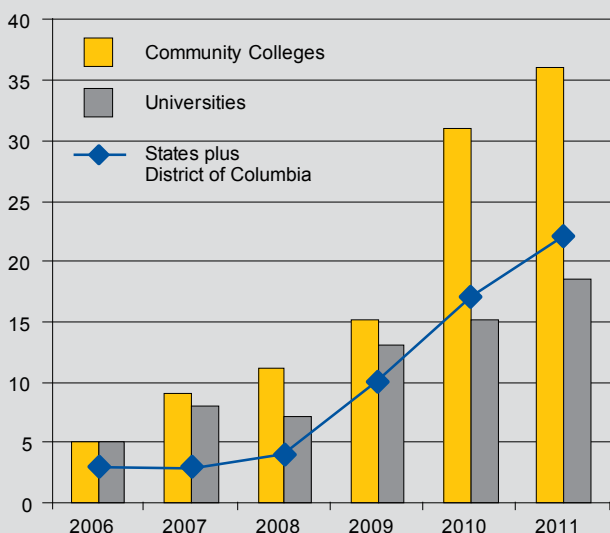
CyberWatch Branches Out to Develop IA Workforce

Since its inception in 2005 as a consortium of 10 educational institutions in the Washington, D.C., metropolitan area, CyberWatch has

- Grown to 54 member institutions—36 community colleges and 18 universities—across 21 states plus the District of Columbia.
- Acquired more than 30 partners among businesses, government agencies, and professional associations.
- Developed model IA curricula, including complete courses for associate in applied science and associate in science degrees and for 2 IA certificates.
- Assisted both 2-year and 4-year educational institutions in mapping their IA courses to the Committee on National Security Systems (CNSS) 4011 and/or 4013 national IA training standards.
- Mentored the 6 community colleges eligible to apply to NSA for the CAE2Y designation through the application process; all 6 CAE2Y applications were approved in 2010.
- Educated more than 450 faculty through CyberWatch workshops and sponsored courses at member institutions.
- Created a robust IA program for K-12 students, including a new IA curriculum track for high schools, summer camps, after-school programs, security awareness days, student contests, and workshops for counselors.
- Built the Montgomery College Virtual Lab, the University of Maryland Digital Forensics Lab, and the Bowie State University CyberWatch Underground Tunnel System. CyberWatch's Virtual Lab 2.0 is now in the preliminary design stage.



CyberWatch Membership



↑↑ DURING CYBER COMPETITIONS, TECHNICIANS PLAY THE ROLE OF HACKERS SO STUDENTS LEARN WHAT IS INVOLVED IN THEIR WORK AS PROFESSIONAL PENETRATION TESTERS.

←← CYBERWATCH MEMBERSHIP HAS DOUBLED SINCE 2009 TO 54 EDUCATIONAL INSTITUTIONS IN 21 STATES PLUS THE DISTRICT OF COLUMBIA.



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GeoTech Center

NATIONAL GEOSPATIAL TECHNOLOGY
CENTER OF EXCELLENCE

www.geotechcenter.org



DEL MAR COLLEGE
CORPUS CHRISTI, TX



GEOSPATIAL TECHNOLOGIES ENABLE STUDENTS
TO VISUALIZE THE WORLD IN NEW WAYS.

GeoTech Center's accomplishments include

- » Assisting the U.S. Department of Labor in creating a national Geospatial Technology Competency Model (GTCM).
- » Establishing national common core competencies for geographic information systems (GIS) technicians.
- » Facilitating installation of remote desktop application access technology at 10 colleges and supporting use at secondary and middle schools.
- » Increasing enrollment in geospatial technology programs at partner colleges.
- » Updating the geospatial technology skills of teachers and technicians.

Students Access Geospatial Technologies Thanks to GeoTech Center

GeoTech Center's work on remote desktop application access technology makes it possible for students in middle and secondary schools to gain direct access to the most current geospatial application software. By eliminating the need for complicated installation and maintenance of application software, GeoTech Center facilitates direct access to the latest geospatial technology by students who might not otherwise experience it.

The new Geospatial Technology Competency Model (GTCM), which the center helped the U.S. Department of Labor develop, clarifies how geospatial educators should align their curricula with new national standards. The GTCM may also lead to professional certification that will document graduates' expertise to employers.

The GIS general education course developed by GeoTech Center partners is another example of the innovations it is pursuing to help students transfer geospatial technology courses from community colleges to universities. It is contributing to the growth of geospatial technology programs at 2-year colleges.

“My students worked on a hurricane relief project simulation which is as close to an authentic, real-world task as I have ever seen. This is rigorous and provides my students the opportunity to explore and learn about this emerging advanced technology.”



KATHY MELLETTE - COORDINATOR OF DIRECTED STUDIES
NORTH HALL MIDDLE SCHOOL



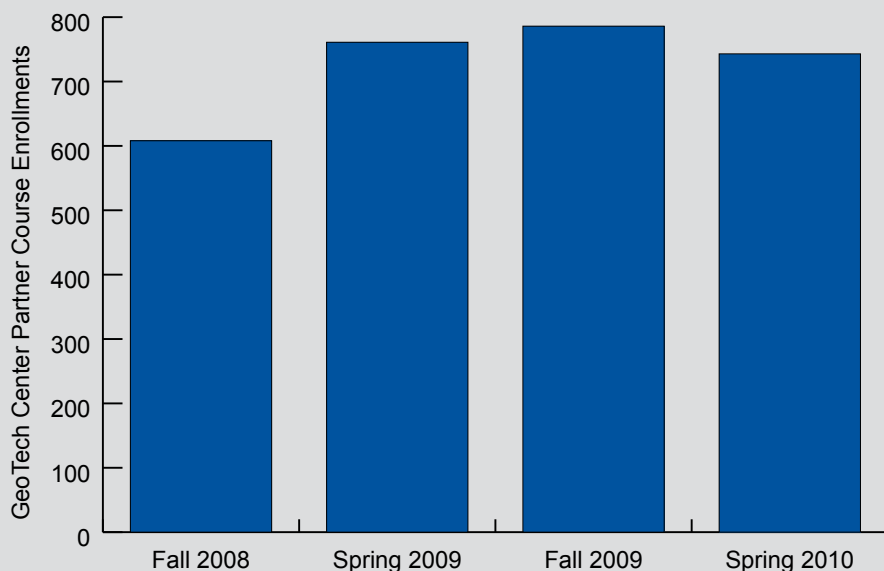
GeoTech Center Helps Industry, Education With National Competency Model

GeoTech Center assisted the Department of Labor in completing the new Geospatial Technology Competency Model (GTCM) now published in its Employment and Training Administration model clearinghouse. This national model of critical worker skills and competencies provides the industry with a definition of its cross-cutting, common core competencies as well as its specialized industry sector segments. Before the GTCM and the resulting Standard Occupation Codes, there was no common definition of the industry or its sectors.

With the GTCM, managers and human resource officers can now better define the skills and abilities required by the 10 distinct occupations supported by the GTCM. This boosts efforts to improve the alignment of academic curricula and workforce education with workplace needs and demands. No longer do educators or employers need to puzzle about what should be taught to whom in the industry. From its research, GeoTech Center has created new tools for educators to assess their own courses and programs of study to see how well they align with the national standard and to perform critical gap-analysis between their programs and courses and the GTCM. New professional standards for certification and recognition in the industry are being developed as a result of the research GeoTech Center has performed for the GTCM. These include the GIS Certification Institute's new competency-based exam for its GIS Professional certification.



GeoTech Center Partner Course Enrollments
Fall 2008 to Spring 2010



TECHNICIANS
USE GEOSPATIAL
TECHNOLOGIES
TO MANAGE
THE EARTH'S
RESOURCES.



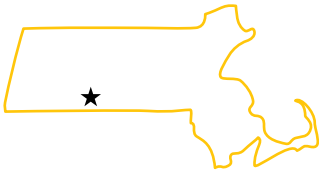
GEOTECH CENTER
PARTNER
COLLEGES
HAVE SEEN
ENROLLMENT
IN THEIR
GEOSPATIAL
COURSES
INCREASE BY 19%
FROM FALL 2008
TO SPRING 2010.



ICT Center

INFORMATION AND COMMUNICATIONS
TECHNOLOGIES CENTER

www.ictcenter.org



SPRINGFIELD TECHNICAL
COMMUNITY COLLEGE
SPRINGFIELD, MA



- » Disseminates innovative, effective, and current information and communications technologies (ICT) curricula.
- » Makes the knowledge of subject-matter experts readily accessible to industry and academia.
- » Provides information and education for ICT students and technicians to meet industry needs.
- » Shares strategies to include underrepresented populations in the ICT field.
- » Pioneers the use of social media and emerging technologies in education.

ICT Center Builds Community of Practice

In 2007, the National Center for Telecommunications Technologies (NCTT) formed an Information and Communications Technologies Community of Practice (ICT COP) to provide community colleges with program assistance, a forum for the exchange of ideas, an interactive workspace, and a dynamic library. Three years later, the organization adopted a new name—Information and Communications Technologies Center (ICT Center)—and expanded its role as a resource center to become the hub of a vibrant, growing ICT COP.

As it has redefined what an Advanced Technological Education (ATE) resource center does, ICT Center has found a unique niche among the ATE community. By hurdling traditional barriers of information-sharing and utilizing emerging technologies to reach, support, and educate students, faculty, business, and industry throughout the United States, ICT Center makes content on current and emerging trends and information from subject-matter experts readily available.

The ICT Center provides an invaluable network for industry and academia to collaborate and partner with one another to educate students.

**KIM YOHANNAN - ACADEMIC ALLIANCE MANAGER
EMC CORPORATION**

ICT STUDENTS LEARN TO TROUBLESHOOT
NETWORK CONNECTIVITY PROBLEMS.





AN ICT
TECHNICIAN
CONFIGURES
AN INTERNET
PROTOCOL
NETWORK.



ICT Center Engages Community Via New Media Technologies

ICT Center is a leader in the utilization of new media technologies to disseminate technician education information. The information, once disseminated, is used by thousands of individuals who view the information and use it to teach or to enhance their personal technical knowledge. During 2010, ICT Center reached more than 400,000 users through blogs, Twitter, Facebook, YouTube videos, and podcasts. As a National Science Foundation ATE Resource Center, ICT Center staff members share their expertise in new media technologies with the ATE community and other community college educators. Their hands-on presentations at conferences throughout the country have prompted many educators, students, and members of the technical workforce to utilize social media tools.

Twitter is a particularly powerful outreach tool for ICT Center. Klout.com has referred to the ICT Center principal investigator's Twitter network as "large and highly engaged." With nearly 7,000 subscribers, the center's tweets are estimated to reach approximately 1,800 active followers. The center's 1,000 tweets per year translate into 1.8 million contacts of ICT-related content per year.

Twitter and the other Web-based technologies the center uses transform monologues on ICT content and issues into dialogues. They enable audience members to transition from content consumers to content producers. They facilitate real-time exchanges of expert knowledge, and they are reaching diverse U.S. and international communities.

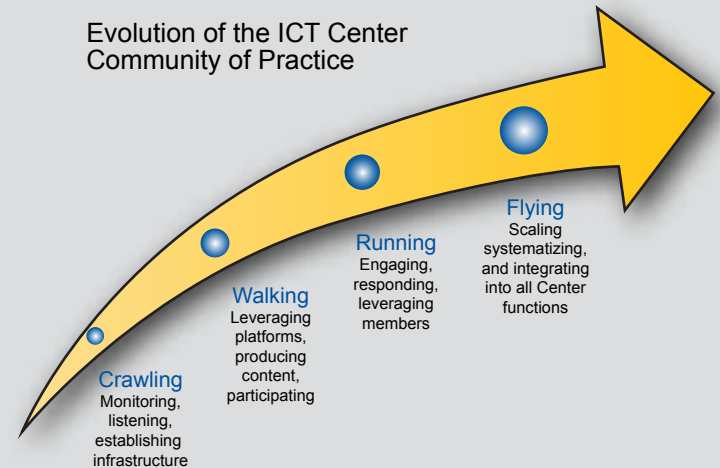
Conferences Enhance Faculty ICT Knowledge

Conferences are another way ICT Center engages with its COP. During 2010, ICT Center shared curriculum development materials and technical information

ICT CENTER'S IMPACT HAS GROWN EXPONENTIALLY
WITH THE CENTER'S USE OF SOCIAL MEDIA.



Evolution of the ICT Center Community of Practice



directly with 1,048 conference and workshop participants. Faculty participation in these activities has impacted the education of more than 50,000 students.

Ninety-one percent of the 132 attendees at the 2010 ICT Winter Conference reported 6 months later that they are continuing to network with other participants. Fifty-four percent indicated they were "extremely likely" to implement the ideas and concepts they learned at the conference in their classrooms.

Center Continues Incumbent Workforce Instruction

Since 1995, the center has provided curriculum development and education for more than 6,900 Verizon technicians in New York and the New England region. Since 2008, the center has worked with Comcast in Connecticut to develop a pilot program to bring current technology education to its technicians. In 2011, the pilot expands into Massachusetts.



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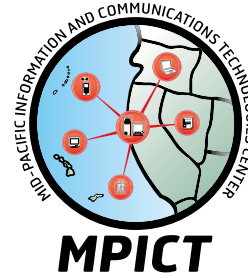
MPICT

MID-PACIFIC ICT CENTER
www.mpict.org



CITY COLLEGE OF
SAN FRANCISCO
SAN FRANCISCO, CA

MPICT coordinates, improves, and promotes information and communications technologies (ICT) education. It focuses on community colleges in northern California, northern Nevada, southern Oregon, Hawaii, and the Pacific Territories. Improving the ICT workforce positively impacts most organizations, all industries, and the U.S. economy.



MPICT Improves ICT Student Success

In the information and knowledge economies of the 21st century, people increasingly depend on information and communications technologies (ICT). The ICT term is used worldwide to encompass all rapidly emerging, evolving, and converging computer, software, networking, telecommunications, Internet, programming, and information systems technologies. ICT enables individual and organizational productivity in all industries.

Community colleges are the most cost-effective vehicle for pushing ICT knowledge and skills into American communities and workforces. MPICT directly serves 70 community colleges in 4 states and 3 territories through research, conferences, faculty development, community building activities, business and industry interactions, best practice dissemination, and resource sharing. MPICT efforts potentially affect thousands of students.



ICT STUDENTS LEARN TO MAKE COMPUTING AND COMMUNICATIONS SYSTEMS WORK FOR ALL KINDS OF ORGANIZATIONS.



We believe information and communications technologies are an important foundation on which much of modern productivity and current knowledge and information economies depend. We need competent technicians to make our economies and enterprises efficient.



JIM DOLGONAS - PRESIDENT AND CEO
CORPORATION FOR EDUCATIONAL NETWORK INITIATIVES IN CALIFORNIA (CENIC)





ICT TECHNICIANS IMPLEMENT AND MAINTAIN ICT SYSTEMS THAT ENABLE PERSONAL AND ORGANIZATIONAL PRODUCTIVITY.

CALIFORNIA COMMUNITY COLLEGES HAVE MORE THAN HALF A MILLION ICT COURSE ENROLLMENTS ANNUALLY.

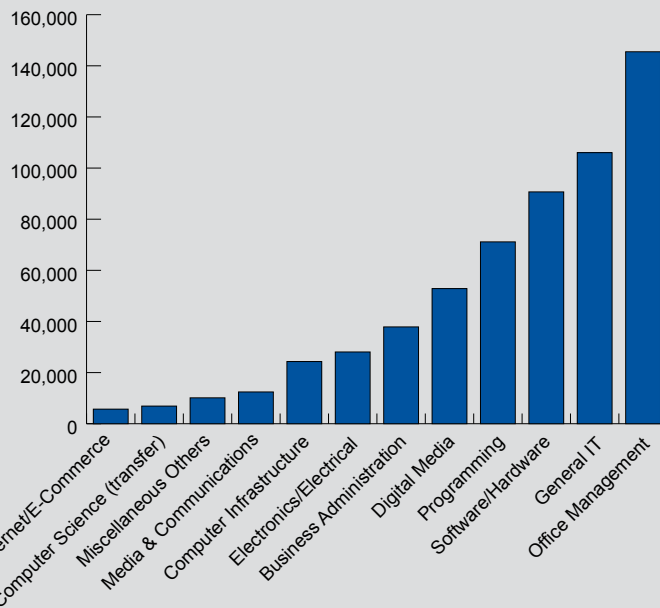
Developing a Skilled ICT Workforce

MPICT, as the representative of ICT programs at 70 community colleges, engages business and industry representatives more effectively than most individual programs can achieve on their own. MPICT does this by creating leveraged education and business interactions to improve ICT education, workforce development, and placement.

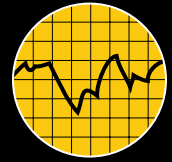
MPICT's annual Winter ICT Educator Conference brings together more than 150 community college faculty members and industry representatives to share quality practices and resources. This event alone impacts 15,000 to 25,000 students annually. MPICT's annual Summer Faculty Development Week helps 50 to 75 educators keep up with rapidly changing technologies, learn new course material, and practice effective pedagogies for teaching ICT. Educators also learn ways to use technology to improve student engagement and outcomes. These summer events affect the education of thousands of students annually. The improved student outcomes influenced by these events enhance the ICT workforce.

Through ongoing studies and publication of its assessments of ICT workforce needs, MPICT has positioned itself as a major participant in the important task of identifying trends and guiding the

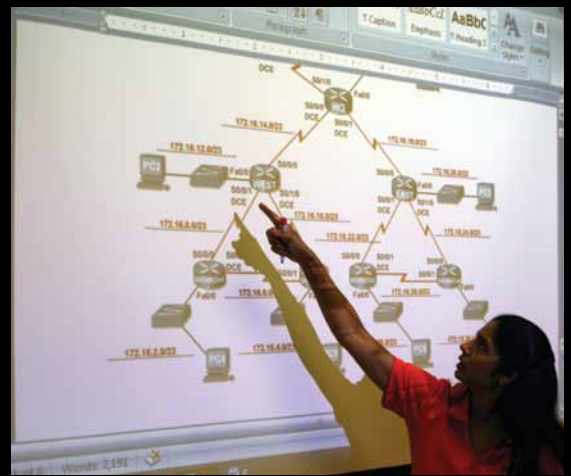
California Community College ICT Course Enrollments



curriculum-improvement efforts of its community college members. For example, a recent MPICT study surveyed more than 600 employers to quantify ICT industry and employment issues in California. The study found that the ICT workforce represents 1 in 20 U.S. jobs. This analysis of industry trends and demands provides MPICT's 70 community college partners with more valuable information than they could readily obtain through local advisory groups or from existing secondary data sources.



LEARNING, EVALUATION, AND RESEARCH



- 37 ATE Central - Advanced Technological Education Centers Central - www.atecentral.net
- 38 EvaluATE - Evaluation Resource Center for Advanced Technological Education - www.evaluate.org
- 39 SC ATE - SC ATE Center of Excellence - www.scate.org / www.TeachingTechnicians.org

U.S. COMMUNITY COLLEGES ENROLL
43% OF ALL U.S. UNDERGRADUATES
40% OF FIRST-TIME FRESHMEN
52% OF NATIVE AMERICAN UNDERGRADUATES
45% OF ASIAN/PACIFIC ISLANDER UNDERGRADUATES
45% OF BLACK UNDERGRADUATES
53% OF HISPANIC UNDERGRADUATES



61% WOMEN



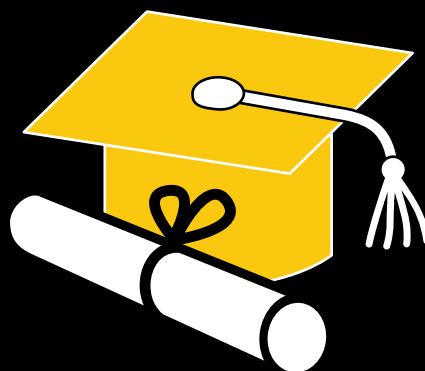
39% MEN

**COMMUNITY
COLLEGE STUDENTS**

**TO MEET 2020 NATIONAL
GOALS FOR EDUCATING THE
POPULATION, U.S. COMMUNITY
COLLEGES WANT TO INCREASE
THE NUMBER OF STUDENTS
WHO EARN DEGREES AND
CERTIFICATES BY**



**WORKERS WITH COLLEGE
DEGREES HAD THE LOWEST
UNEMPLOYMENT RATES OVER
THE PAST 3 YEARS**





LEARNING, EVALUATION,
& RESEARCH

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ATE Central

www.atecentral.net



ATECENTRAL

INTERNET SCOUT,
UNIVERSITY OF WISCONSIN-MADISON
MADISON, WI

JEANETTE MOWERY - CLEARINGHOUSE DIRECTOR
BIO-LINK



We highly recommend the CWIS [Collection Workflow Integration System] software and ATE Central project services to anyone seeking to develop a searchable resource clearinghouse.



- » Acts as an information hub and archiving service for the ATE community.
- » Provides access to the full depth and breadth of ATE resources and initiatives.
- » Fosters collaboration through access to information about all ATE centers and projects.
- » Offers training, software, and documentation related to digital library collection building and maintenance.

ATE Central Connects Faculty To Full Array of ATE Resources

The tools and services in ATE Central connect faculty to a diverse collection of ATE resources and efforts designed to enhance student learning, a wide range of professional development opportunities, and an array of links to colleagues and programs in the ATE community.

By providing a pathway to the full spectrum of ATE resources and bringing together materials from multiple centers and projects in a single searchable location, ATE Central encourages cross-disciplinary learning and helps highlight the cross-disciplinary nature of today's technician education programs.

ATE Central also supports the creation of new faculty collaborations and mentoring through an interactive interface. This interface guides users to ATE projects in their region or allows users to find all ATE centers and projects in their fields of interest.



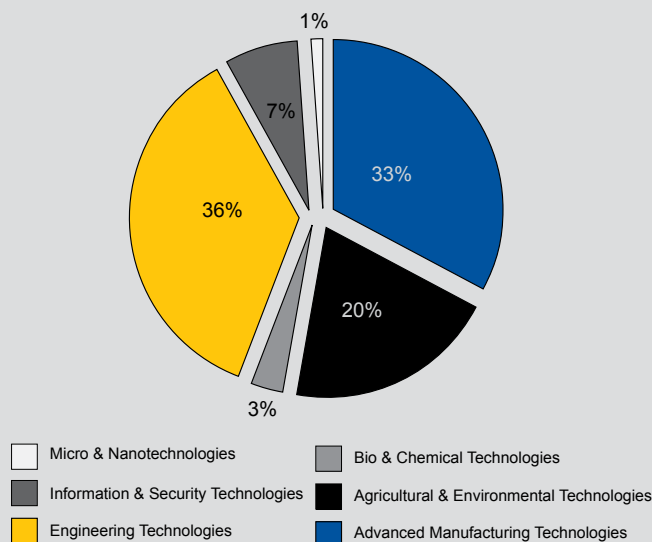
FACULTY AND STUDENTS CAN ACCESS ATE RESOURCES THAT SUPPORT RICH INTERACTIVE LEARNING THROUGH ATE CENTRAL.



ATE CENTRAL SUPPORTS THE WIDE DISSEMINATION OF ATE TOOLS AND MATERIALS THAT LEAD STUDENTS TO A VARIETY OF SATISFYING CAREER PATHS.

MATERIALS AT ATE CENTRAL SUPPORT CROSS-DISCIPLINARY LEARNING.

ATE Central Resources by Discipline



ATE Central Amplifies ATE Program Efforts

In a multitude of ways, ATE Central showcases the aggregate impact of the ATE program for those within the ATE community as well as for those from industry, education, and the general public. It does this by supporting cross-programmatic collaborations within the ATE community and across National Science Foundation program areas.

ATE Central also provides ATE center and project personnel with a rich array of resources and tools to make their own programs more robust. ATE Central’s open source software, Collection Workflow Integration System (CWIS), makes it easy to build searchable collections of materials, access best practice documentation for digital library creation and maintenance, and use tools that help track data about the usage and impact of ATE materials.

As an information hub for technical educators and ATE grant recipients, ATE Central provides an overview of events offered by centers and projects. ATE Central supports national dissemination efforts for ATE centers and projects through the creation and sharing of resource records in the ATE Central portal. These

records, which describe the valuable resources created and collected by centers and projects, are harvested by the National Science Digital Library (NSDL) and the Applied Math and Science Education Repository (AMSER). These 2 National Science Foundation-supported portals to free educational resources and services make ATE materials more accessible to a broad range of educators, librarians, and researchers nationwide.



LEARNING, EVALUATION,
& RESEARCH

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EvaluATE

EVALUATION RESOURCE CENTER FOR
ADVANCED TECHNOLOGICAL EDUCATION

www.evalu-ate.org



Evalu|ate
EVALUATION RESOURCE CENTER for
advanced technological education

WESTERN MICHIGAN
UNIVERSITY
KALAMAZOO, MI

EvaluATE promotes the goals of the ATE program by partnering with centers and projects to

- » Strengthen the program's evaluation knowledge base.
- » Expand the use of exemplary evaluation practices.
- » Support the continuous improvement of technician education throughout the nation.



The EvaluATE webinars are a cornerstone and huge resource for our project to help us create deep and meaningful change in the way ATE centers engage with the education community.



TERRYLL BAILEY AND JOYCE LATULIPPE - INNOVATION COACH LEADERS
SYNERGY PROJECT



EvaluATE's Resources Help to Build Evaluation Capacity in the ATE Community

With an eye on accountability and improvement, ATE centers and projects need and want to demonstrate their impact on students. EvaluATE assists ATE grantees and their evaluators with this task in a variety of ways. Webinars and workshops, attended by more than 350 individuals since July 2009, are helping the ATE community to design evaluations that ultimately advance and enhance technological education. EvaluATE's Web-based resource library contains practical materials that are especially pertinent to evaluation in the ATE context.

There is evidence that ATE grantees' focus on evaluation is growing. The percentage of ATE grantees using external evaluators has grown from 88% in 2008 to 95% in 2010. Effective formative evaluations are leading to program improvements. Summative evaluations are helping to identify best practices and models for dissemination.

STUDENT OUTCOMES ARE KEY
MEASURES IN ATE EVALUATIONS.





EVALUATIONS PROVIDE GUIDANCE THAT ULTIMATELY LEADS TO A BETTER PREPARED HIGH-TECH WORKFORCE.

WITH EVALUATE'S GUIDANCE, MORE ATE CENTERS AND PROJECTS USE EVALUATORS TO INFORM IMPROVEMENT STRATEGIES.

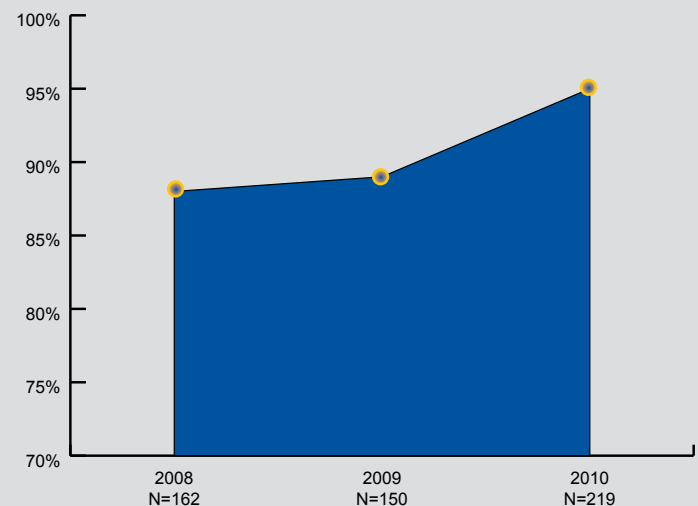
ATE Evaluation Community of Practice Connects ATE Stakeholders

EvaluATE is building and nurturing an ATE evaluation community of practice that connects center and project staff, evaluators, and other stakeholders. Through EvaluATE's listserv, webinars, workshops, and quarterly newsletter, this community is expanding its knowledge base, problem solving around common evaluation challenges, and sharing materials and best practices. The synergy resulting from an effective and sustainable community of practice is leading to richer and more valuable evaluations that are, in turn, advancing the ATE program.

EvaluATE's key role is developing a community of educators who conduct, use, and value evaluation as a tool for maximizing students' success and for addressing community and workforce needs. The center helps ATE grantees connect with qualified evaluators and build evaluation into their project designs at the proposal stage and beyond. EvaluATE's webinars, workshops, and newsletters showcase ATE grantees and evaluators who have had success in designing and using evaluation to enhance their project outcomes. With involvement from project staff and evaluators from about 20 other ATE centers and projects, EvaluATE encourages grantees to learn from each other in order to advance evaluation knowledge and practice within the ATE program.

EvaluATE's ultimate goal is to enhance the ATE community's use of evaluation to support the improvement of technician education.

Percentage of ATE Grantees with External Evaluators





LEARNING, EVALUATION,
& RESEARCH

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SC ATE

SC ATE CENTER OF EXCELLENCE

www.scate.org / www.TeachingTechnicians.org



FLORENCE-DARLINGTON
TECHNICAL COLLEGE
FLORENCE, SC

SC ATE expands excellence in technician education by

- » Increasing the quantity, quality, and diversity of industrial and engineering technicians.
- » Improving college recruitment, retention, and graduation rates while reducing high school dropout rates.
- » Growing industry partnerships.
- » Promoting participation in faculty development.
- » Providing mentoring for technician educators.

SC ATE Programs Improve Graduation Rates

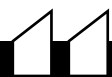
SC ATE's nationally acclaimed model programs are raising graduation rates, increasing the enrollment and persistence of minority students, and improving employer satisfaction. They are now used in 31 states, the District of Columbia, and Ontario, Canada. An independent study gave the models a rating of 4.0 on a 0-4.0 scale for "effectiveness in helping students learn the knowledge and skills and/or practices needed to be successful in the technical workplace."

At the high school level, SC ATE's Technology Gateway classes are improving the completion rates of at-risk students. From 2007 to 2010, 93.8% of 81 students in the White County High School Gateway program completed it and passed the math and science portions of the Georgia High School Graduation Test. At the 2-year college level, SC ATE's Technology Gateway provides an on-ramp to engineering technology programs for underprepared students who need to strengthen prerequisite skills.



A MECHANICAL ENGINEERING TECHNOLOGY STUDENT TERMINATES CONNECTIONS FOR A VEX ROBOT PRIOR TO PROGRAM TESTING.

LEE MCCOLLUM - COORDINATOR FOR POWER CAREERS PROGRAM
PROGRESS ENERGY CAROLINAS



Strong technical education programs are critical to the success and survival of industry today as it faces an aging technical workforce. The Power Careers Program interns enrolled in the SC ATE program are enabling us to address our skilled technician workforce gaps.





A ROBOT PRODUCTION TECHNICIAN COMPLETES A LAB EXERCISE IN ROBOT POSITIONING.



MORE EDUCATORS ARE ACCESSING PROFESSIONAL DEVELOPMENT RESOURCES VIA WWW.TEACHINGTECHNICIANS.ORG



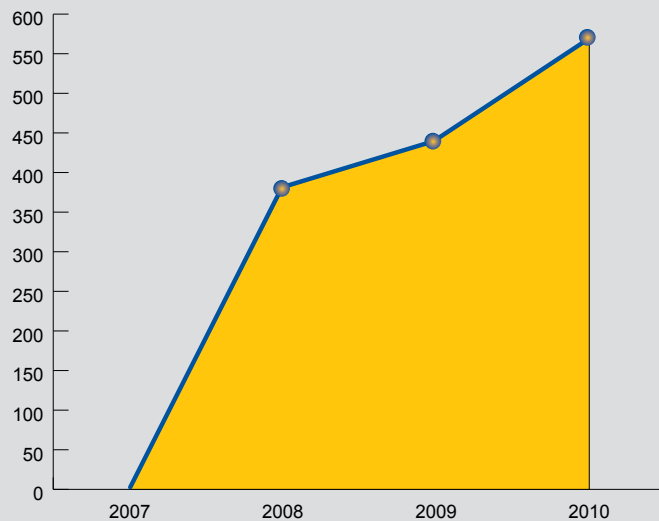
ATE Scholars, Interns & Scholarship Winners Pursue Engineering Technology Careers

ATE Scholars, the center's internship program, has posted 10 years of excellent results with the support of the 20 companies involved in its Industry Consortium. From 2000 to 2010, the program placed 107 interns at South Carolina manufacturing, energy, construction, engineering, and IT firms. Ninety-eight of 100 ATE Scholars have graduated and gone on to careers in the engineering technology field. Seven are currently enrolled in college and placed in internships. In addition to the scholarship component of the ATE Scholars program, SC ATE manages 2 other scholarship programs. Altogether, 186 students pursuing careers in industrial, engineering, or computer technology have benefitted from SC ATE facilitated scholarships.

SC ATE Helps Replication Efforts

SC ATE assists technician educators across the country with the adaptation of successful SC ATE project-based curricula and models, including ATE Scholars, Tech Stars, and Engineering Technology Career Ambassadors. Approximately 10,000 science, technology, engineering, and mathematics students have benefited from faculty development provided by SC ATE to high school teachers and 2-year college faculty in 14 states. SC ATE curricula impacts students by teaching soft skills to complement their technical skills. For instance, the SC ATE curriculum allows students to learn and practice conflict resolution and teamwork. This promotes workplace success and smooths students' transition to successful industrial project work when they are employed.

TeachingTechnicians.org Usage



SC ATE Impacts ATE Community

SC ATE's Web site www.TeachingTechnicians.org connects providers of more than 400 faculty development events with their target audience of technician educators.

The SC ATE team collaborates with subject matter experts from across ATE to develop new programs and curricula in response to industry needs. SC ATE's e-learning teaching materials and modules on robotics, nuclear engineering technology, and virtual reality stimulate interest in technical careers, engage new students in learning, and help grow the nation's workforce and economy.

FACES OF ATE



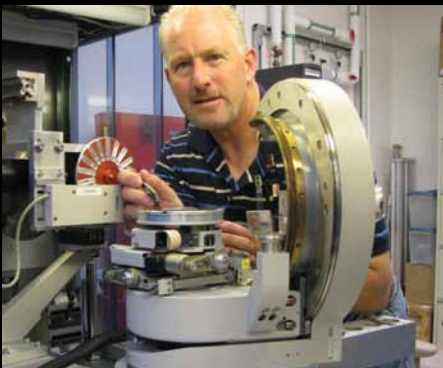
Three students who were part of the Long Beach City College team that won the 2009 International ROV [Remotely Operated Vehicle] Competition a year later piloted ROVs involved in the response to the Deepwater Horizon oil spill.



After completing his associate degree in biotechnology at Great Bay Community College in 2007, David Haddad was hired by Millennium Pharmaceuticals, Inc., in Cambridge, MA. He now works full time as a laboratory assistant and uses Millennium's tuition reimbursement program to take courses part time at the Harvard University Extension School.



Brandon Dixon graduated from information assurance (IA) programs at 2 Cyber-Watch member institutions. He earned an associate degree from the Community College of Baltimore County and a bachelor's degree from Capitol College. Dixon now works as an information systems security engineer at G2, Inc., in Columbia, MD. He currently works on virtualization, vulnerability, and exploits.



Justin Valentino considered several careers until he heard about the LAN [local area network] technician certificate program at Moraine Valley Community College in Palos Hills, IL. "It really sparked my interest because I had always enjoyed fixing and working

on computers" he said. As a Moraine Valley student Valentino earned 3 associate degrees and 7 certificates. He also completed 2 internships through the National Resource Center for Systems Security and Information Assurance (CSSIA).



Moraine Valley has helped me find my path, and CSSIA has enabled me to get the real-world experience I need to further my education and my future career.



INDEX



ADVANCED MANUFACTURING TECHNOLOGIES

- 01 **AMTEC** - Automotive Manufacturing Technical Education Collaborative
www.autoworkforce.org
Kentucky Community and Technical College System
-
- 02 **CAAT** - Center for Advanced Automotive Technology
www.macomb.edu/CAAT
Macomb Community College
-
- 03 **CARCAM** - Consortium for Alabama Regional Center for Automotive Manufacturing
www.carcam.org
Gadsden State Community College
-
- 04 **FLATE** - Florida Advanced Technological Education Center
www.fl-ate.org / www.madeinflorida.org
Hillsborough Community and St. Petersburg College, and the University of South Florida
-
- 05 **NCME** - National Center for Manufacturing Education
www.ncmeresource.org / www.meteconline.org
Sinclair Community College
-
- 06 **RapidTech** - National Center for Rapid Technologies
www.rapidtech.org
Saddleback College
-
- 07 **RCNGM** - Regional Center for Next Generation Manufacturing
www.nextgenmfg.org
Connecticut Community Colleges' College of Technology
-
- 08 **TIME Center** - Technology and Innovation in Manufacturing and Engineering
www.time-center.org
Community College of Baltimore County
-
- 09 **Weld-Ed** - National Center for Welding Education and Training
www.weld-ed.org
Lorain County Community College



AGRICULTURAL, ENERGY, & ENVIRONMENTAL TECHNOLOGIES

- 10 **AgrowKnowledge** - National Center for Agriscience and Technology Education
www.agrowknow.org
Kirkwood Community College
-
- 11 **ATEEC** - Advanced Technology Environmental and Energy Center
www.ateec.org
Eastern Iowa Community College District
-
- 12 **CREATE** - California Regional Consortium for Engineering Advances in Technological Education
www.create-california.org
College of the Canyons
-
- 13 **NCSR** - Northwest Center for Sustainable Resources
www.ncsr.org
Chemeketa Community College
-
- 14 **VESTA** - Viticulture and Enology Science and Technology Alliance
www.vesta-usa.org
Missouri State University
-
- 15 **Bio-Link** - Next Generation National ATE Center for Biotechnology and Life Sciences
www.bio-link.org
City College of San Francisco
-
- 16 **CAPT** - Center for the Advancement of Process Technology
www.capttech.org
College of the Mainland
-
- 17 **NBC²** - Northeast Biomanufacturing Center and Collaborative
www.biomanufacturing.org
Montgomery County Community College
-
- 18 **(npt)²** - National Network for Pulp and Paper Technology Training
www.npt2.org
Alabama Southern Community College



BIOTECHNOLOGY & CHEMICAL PROCESSES



ELECTRONICS, MICRO - & NANOTECHNOLOGIES

19 **MATEC NetWorks** - National Resource Center
www.matec.org / www.matecnetworks.org
Maricopa County Community College District

20 **NACK** - National Center for Nanotechnology Applications and Career Knowledge
www.nano4me.org
Pennsylvania State University

21 **Nano-Link** - Midwest Regional Center for Nanotechnology Education
www.nano-link.org
Dakota County Technical College

22 **NEATEC** - Northeast Advanced Technological Education Center
www.rcsne.org
Hudson Valley Community College

23 **SCME** - Southwest Center for Microsystems Education
www.scme-nm.org
University of New Mexico



ENGINEERING TECHNOLOGIES

24 **MATE** - Marine Advanced Technology Education Center
www.marinetech.org
Monterey Peninsula College

25 **MatEd** - National Resource Center for Materials Technology Education
www.materialseducation.org
Edmonds Community College

26 **OP-TEC** - National Center for Optics and Photonics Education
www.op-tec.org
University of Central Florida

27 **SMART** - Southeast Maritime and Transportation Center
www.maritime-technology.org
Tidewater Community College

28 **SpaceTEC** - National Resource Center for Aerospace Technical Education
www.spacetec.org
Brevard Community College



INFORMATION, GEOSPATIAL, AND SECURITY TECHNOLOGIES

29 **BATEC** - Boston area Advanced Technological Education Connections
www.batec.org
University of Massachusetts Boston

30 **CSEC** - Cyber Security Education Consortium
www.cseconline.org
University of Tulsa and the Oklahoma Dept. of Career and Tech. Education

31 **CSSIA** - National Resource Center for Systems Security and Information Assurance
www.cssia.org
Moraine Valley Community College

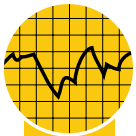
32 **CTC** - Convergence Technology Center
www.convergencetechnologycenter.org
Collin College

33 **CyberWatch** - Creating the Next Generation of Cybersecurity Professionals
www.cyberwatchcenter.org
Prince George's Community College

34 **GeoTech Center** - National Geospatial Technology Center of Excellence
www.geotechcenter.org
Del Mar College

35 **ICT Center** - Information and Communications Technologies Center
www.ictcenter.org
Springfield Technical Community College

36 **MPICT** - Mid-Pacific ICT Center
www.mpict.org
City College of San Francisco



LEARNING, EVALUATION, & RESEARCH

37 **ATE Central** - Advanced Technological Education Centers Central
www.atecentral.net
University of Wisconsin-Madison

38 **EvaluATE** - Evaluation Resource Center for Advanced Technological Education
www.evalu-ate.org
Western Michigan University

39 **SC ATE** - SC ATE Center of Excellence
www.scate.org
www.teachingtechnicians.org
Florence-Darlington Technical College

LEGEND



ADVANCED MANUFACTURING TECHNOLOGIES

- 01 AMTEC - VERSAILLES, KY
- 02 CAAT - WARREN, MI
- 03 CARCAM - GADSDEN, AL
- 04 FLATE - TAMPA, FL
- 05 NCME - DAYTON, OH
- 06 RapidTech - MISSION VIEJO, CA
- 07 RCNGM - HARTFORD, CT
- 08 TIME Center - BALTIMORE, MD
- 09 Weld-Ed - ELYRIA, OH



AGRICULTURAL, ENERGY, & ENVIRONMENTAL TECHNOLOGIES

- 10 AgrowKnowledge - CEDAR RAPIDS, IA
- 11 ATEEC - BETTENDORF, IA
- 12 CREATE - SANTA CLARITA, CA
- 13 NCSR - SALEM, OR
- 14 VESTA - SPRINGFIELD, MO



BIOTECHNOLOGY & CHEMICAL PROCESSES

- 15 Bio-Link - SAN FRANCISCO, CA
- 16 CAPT - TEXAS CITY, TX
- 17 NBC² - BLUE BELL, PA
- 18 (npt)² - THOMASVILLE, AL



ELECTRONICS, MICRO- & NANOTECHNOLOGIES

- 19 MATEC NetWorks - PHOENIX, AZ
- 20 NACK - UNIVERSITY PARK, PA
- 21 Nano-Link - ROSEMOUNT, MN
- 22 NEATEC - TROY, NY
- 23 SCME - ALBUQUERQUE, NM



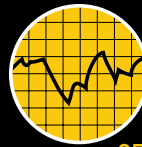
ENGINEERING TECHNOLOGIES

- 24 MATE - MONTEREY, CA
- 25 MatEd - LYNNWOOD, WA
- 26 OP-TEC - WACO, TX
- 27 SMART - VIRGINIA BEACH, VA
- 28 SpaceTEC - COCOA, FL



INFORMATION, GEOSPATIAL, & SECURITY TECHNOLOGIES

- 29 BATEC - BOSTON, MA
- 30 CSEC - TULSA, OK & SITLLWATER, OK
- 31 CSSIA - PALOS HILLS, IL
- 32 CTC - FRISCO, TX
- 33 CyberWatch - LARGO, MD
- 34 GeoTech Center - CORPUS CHRISTI, TX
- 35 ICT Center - SPRINGFIELD, MA
- 36 MPICT- SAN FRANCISCO, CA



LEARNING, EVALUATION, & RESEARCH

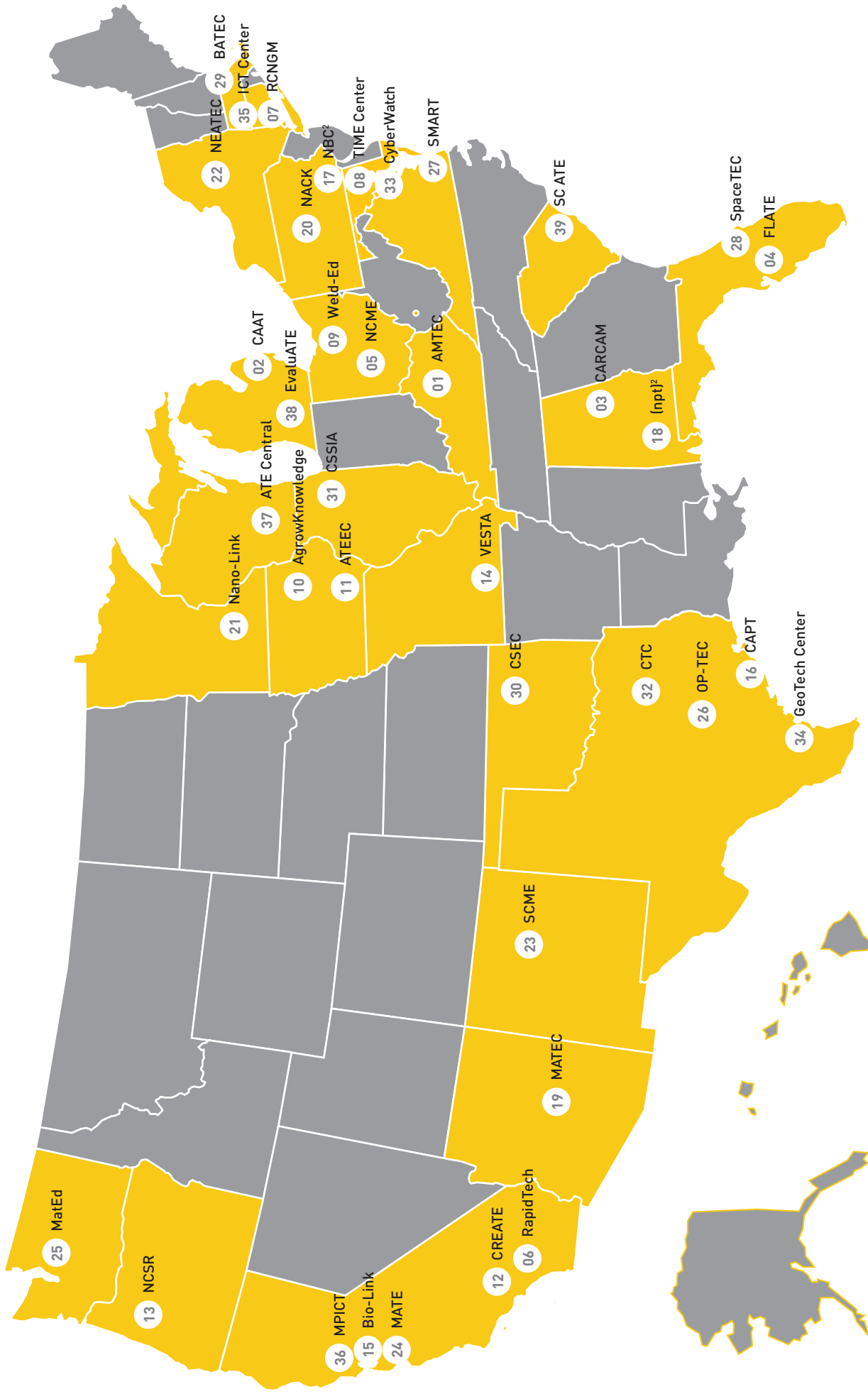
- 37 ATE Central - MADISON, WI
- 38 EvaluATE - KALAMAZOO, MI
- 39 SC ATE - FLORENCE, SC

NSF ATE Funding Opportunities

The ATE program promotes improvement in the education of science and engineering technicians at the undergraduate and the secondary school levels. Proposals are accepted in three major tracks: Projects, Centers, and Targeted Research in Technician Education. For complete details visit: www.nsf.gov/ate.



ATECENTERS



THERE ARE 39 ATE CENTERS LOCATED AROUND THE UNITED STATES OF AMERICA
FOLD OUT THE BACK COVER TO SEE THEIR LOCATIONS

AREAS OF STUDY

ADVANCED MANUFACTURING TECHNOLOGIES



AGRICULTURAL, ENERGY, AND ENVIRONMENTAL TECHNOLOGIES



BIOTECHNOLOGY AND CHEMICAL PROCESSES



ELECTRONICS, MICRO- AND NANOTECHNOLOGIES



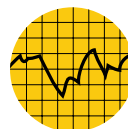
ENGINEERING TECHNOLOGIES



INFORMATION, GEOSPATIAL, AND SECURITY TECHNOLOGIES



LEARNING, EVALUATION, AND RESEARCH



www.atecenters.org