TECHcitement

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Advances in Technological Education

ATE Attuned to Global Competition

The Advanced Technological Education (ATE) program is part of an effort by the National Science Foundation (NSF) to build a world-class science and engineering workforce that includes what NSF Director Arden L. Bement Jr. calls a "stellar cadre" of technicians.

"Year by year, the economic imperative grows for broadening, empowering, and sharpening the skills of the *entire* U.S. workforce—just to remain competitive in the global community. This fresh talent is our most potent mechanism for technology transfer to our systems of innovation," Bement said in an agenda-setting speech to the Council of Scientific Society Presidents.[1]

The ATE program is the most significant technician education initiative in NSF's portfolio. Through the annual dispersal of $45 million in competitive grants, the independent federal agency gives educators the opportunity to test their ideas for improving the educational preparation of technicians and for enhancing the knowledge of the secondary school and college instructors who teach technicians. Faculty at community colleges, the nation's leading source of technician education, have received most of the grants awarded since the program began with Congress' passage of the Scientific and Advanced Technology Act of 1992.

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— Arden L. Bement, director of the National Science Foundation

The principal investigators of ATE projects and centers know from first-hand experience that every U.S. company, regardless of size, now competes in the global marketplace. They understand that the technicians need excellent competencies. This awareness is due in large measure to their ATE grants and the industry partnerships that NSF requires of ATE grant recipients. Productive, collaborative ATE-related activities put the leaders and staff members of ATE centers and projects in frequent, sometimes daily, contact with industry people. Depending on the scope of the ATE grant, this means community college faculty members and administrators are conversing regularly and working closely with local employers, national corporate leaders, and professional society representatives.

"Globalization is here now," says Keith Bird, chancellor of the Kentucky Community and Technical College System (KCTCS), as he listed international automakers with manufacturing facilities in Kentucky. Many of these automakers and their suppliers are partners in KCTCS's

AMERICAN ASSOCIATION OF COMMUNITY COLLEGES

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regional automotive manufacturing initiative. "We're already acting globally when we're acting locally," he says.

There were 264 active ATE grants in January 2006. Each grant represents an innovative approach to the complex challenges of how best to prepare technicians for work in fields of strategic importance to the nation. These fields include biotechnology; agriculture, chemical, and process technologies; engineering technologies; environmental technologies; information technologies; manufacturing; and nanotechnology.

The research proposals in ATE grants are unique but not isolated experiments. Principal investigators are required to share what they learn, and a high-level of collaboration is a hallmark of the ATE program. ATE projects are funded for one to three years, and they focus on enhancing specific aspects of technician education. ATE National Centers of Excellence, Regional Centers of Excellence, and Resource Centers are funded at higher levels for longer durations to accomplish broader, more comprehensive improvements.

As the examples cited here and elsewhere in this publication show, ATE-supported initiatives are substantial, thoughtful efforts to attract diverse students to advanced technology fields and to raise the competency of technicians and educators throughout the nation. ATE programs are educating technicians directly and influencing educational improvements and industry collaborations across many disciplines.

In Pennsylvania, for example, Stephen J. Fonash, principal investigator of the Regional Center of Nanofabrication Manufacturing Education at Penn State University, University Park, is working with a statewide partnership to develop the technicians needed to incorporate nanotechnology in products. "To compete globally, U.S. industry needs to bring nanotechnology quickly into products. Our center is developing the workforce required for this research-to-production-to-competitiveness edge," he says.

Derrick Jones, operating technician, monitors steel production from a control room at the Mittal Steel USA – Sparrows Point facility in Baltimore, Maryland.

In Maryland, the Technology and Innovation in Manufacturing Education (TIME) Center helps manufacturers transform from regional markets to worldwide competition. "The TIME Center's work on creating and improving postsecondary manufacturing programs, developing a series of lean manufacturing courses, and working with the Maryland State Department of Education to build a new statewide manufacturing program at the secondary [school] level will play a pivotal role in helping Maryland's manufacturers meet that challenge," says Ed Fangman, director of the TIME Center at the Community College of Baltimore.

In Massachusetts, the Boston Area Advanced Technological Education Connections (BATEC) Center focuses on the "value-added" for information technology businesses in the region. "Technical skills are no longer the silver bullet for employment; we must create the knowledge worker that can problem solve, innovate, and execute effectively. To this end, BATEC has focused on [providing] the professional skills needed for success and providing regular opportunities for educators to be exposed to business innovations through IT forums and company visits," says Deborah Boisvert, BATEC Center director at the University of Massachusetts–Boston.

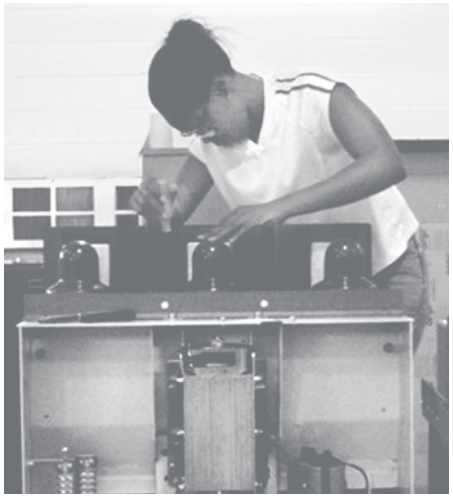
In Nebraska, the Midwest Center for Information Technology (MCIT) at the AIM Institute in Omaha, is increasing the quantity and quality of

the region's information technology workforce. It is accomplishing this by structuring its curriculum to meet businesses' needs, providing faculty members with professional development opportunities, reaching out to underserved student populations, and creating bridges among academic institutions in four states so students can move from one level of education to the next. William E. Spurgeon, an instructor at Western Nebraska Community College in Scottsbluff, says MCIT's initiatives have helped the students of his small, rural college. "Students benefit by being more capable, competitive, and better prepared to pursue more education, industry certification, or new job opportunities," he says.

In Tennessee, the Center for Information Technology Education (CITE) has used its problem-based case studies as the foundation for numerous activities that teach "technical skills in the context of the current world of business and industry while also developing the higher-order skills necessary for the 21st century," says CITE Director David McNeel. The use of case studies to teach technicians was initially an ATE project at Nashville State Community College, where the center is located.

"In a global economy powered by a global workforce, where math, science, and technical skills are readily available in abundant supply, technicians in the U.S. can differentiate themselves by having not only the requisite technical knowledge but also higher-order skills such as problem solving and critical thinking. Their ability to apply these skills as team members will ensure not only their individual success but also the global competitiveness of the industries in which they work," McNeel says.

At the South Carolina Advanced Technological Education Center (SC ATE), increasing the global competitiveness of employers has focused on cultivating teamwork and communications skills. In the model program developed at Florence-Darlington Technical College in Florence, classrooms are designed to mimic workplaces. Both instructors and students work in collaborative teams: the instructors coach and the students learn across disciplines. "Students solve industry-type problems that have multiple solutions and require just-in-time, inquiry-based learning and creativity," says SC ATE Director Elaine L. Craft.



Pamela Sansbury, engineering technician, works at ABB, Inc. in Florence, South Carolina. ABB, Inc. is a company that designs and manufactures low- and medium-voltage circuit breakers, load interrupter switches, and motor contactors.

Just as ATE centers and projects encourage flexibility and lifelong learning among their students, they have also had to adapt to changes in industry.

In Massachusetts, the National Center for Telecommunications Technologies (NCTT) at Springfield Technical Community College has expanded its programs and partnerships beyond the telecommunications service providers it initially targeted. "Over the last four years, ICT [information and communications technology] has matured and has become infused in all disciplines and [it] impacts almost every industry, including computers, semiconductors, transportation, energy, environmental sciences, entertainment, chemicals, and manufacturing," says Gordon F. Snyder Jr., executive director of NCTT. "Today's employer is now asking for more than rote skills. They want adaptive expertise, and students want to know that today's technical education will not preclude them from further study to advance their careers."

Developing the nation's adaptive, technical expertise is a goal that all ATE centers and projects share. ■

For more information, see www.aacc.nche.edu/atecenterimpact or view the ATE program solicitation at www.nsf.gov/pubs/2005/nsf05530/nsf05530.htm.

[1]Bement, Arden L. Jr. "Setting the Agenda for 21st Century Science." Address, Council of Scientific Society Presidents, Washington, D.C., December 5, 2005.

Materials Science Center Supplies Information on Often-Overlooked Field

Materials science students, Cliff Van Sickel and Rick Stilwell, work in a composite lab at Edmonds Community College in Lynnwood, Washington.

Materials—metals, plastics, ceramics, composites—surround us but are often taken for granted or misunderstood, even by people who work in the science, technology, engineering, and mathematics fields. Imelda Cossette, director of business and education for material sciences at Edmonds Community College in Lynnwood, Washington, says she frequently gets calls from industry people who have hired engineers "who don't have a clue what particular materials can do."

The problem is one of timing and faculty expertise. Undergraduate and high school science courses are so packed with required information that there is little time to delve into the structure and properties of materials. Without much background in the science of materials, many instructors skip or skim the subsets of the curriculum that cover materials.

Cossette intends for the National Resource Center for Materials Technology Education to make it easy for secondary school teachers and college instructors to teach modules on particular aspects of materials science as part of their traditional science courses. "We decided that by providing modules that can be integrated into different programs, then the [faculty at high schools] two-years and four-years can just pick what fits best for them," Cossette says. She is the center's principal investigator.

Since the center started in July 2005 with an ATE grant, its staff has been gathering curricula and other educational information for its modules. Edmonds Community College, where the center is located, previously used an ATE project grant to offer workshops for high school teachers, so the staff was not starting from scratch. Edmonds is a good source of information; it has the only associate degree program in materials science in the state of Washington.

During its first six months, the center held four focus groups with education and industry experts to establish core competencies for technicians. To be included on the center's Web site, the instructional materials gathered will have to teach to these core competencies. Reviewers from higher education and industry will evaluate the hands-on aspects of the lessons and their cross-discipline applications. After the cataloguing is done, the center will identify gaps in its offerings and work with other ATE centers to create new modules as needed. The Web site will be built and maintained with assistance from ASM International (formerly The American Society for Metals), an international professional society for people from industry and academe who work with metals and other materials.

The virtual clearinghouse fits with ASM's encouragement of lifelong learning, not only among its members but also among the college and secondary students it would like to attract to materials-related fields. The association has been involved in educational outreach for 50 years.

"We'd like to gather best practices to help everybody," says Mike Kenney, director of business development for ASM International in 2005. "We would like to see it

[materials education] happen at the high school and the early college level. There is a career for individuals who want to go into material engineering technician [jobs]," he says.

Cossette echoes Kenney, "We need to get more students into these fields." Her hope is that the modules will expose students to concepts of materials science when they are young and before they buy in to the idea that science is too difficult. "It starts to teach them physics in a very gentle form so that they get hooked on it and continue on," she says. ■

For more information see www.materialseducation.org.

Materials Science Technicians Sought by Many Industries

Edmonds Community College in Lynnwood, Washington, launched its advanced materials science degree in 2000 as part of a regional effort to convince the Boeing Company to build the 787 Dreamliner, a midsized commercial plane, in the state of Washington. But that was just the impetus, according to Jerrilee Mosier, vice president of workforce development and training at Edmonds.

"Materials science is important to all of manufacturing," Mosier says, noting that in addition to Boeing and its suppliers, a diesel truck manufacturer, a prosthetics maker, and a recreation equipment company in the Puget Sound region are interested in the college's materials science students. After completing the two-year associate of applied science degree, students are ready to go to work as technicians, or they may transfer to one of several regional university baccalaureate programs. Edmonds and Everett Community College in Everett, Washington, also offer certificates for completing clusters of the composite technology curriculum.

"We think our curriculum will be part of the benchmark," Mosier says of the effort by the National Center on Manufacturing Materials Technology Education to collect and disseminate the best materials science courses.

As construction of the new carbon-composite, fuel-efficient Dreamliner begins, the partnership of government, industry, and educational organizations, of which Edmonds is a strong part, continues to develop learning strategies that improve productivity.

CSEC Builds Corps of Cyber Technicians

The Cyber Security Education Consortium (CSEC), a regional ATE center in Oklahoma, is using multiple tactics to create a cyber security and information assurance industry in the Great Plains.

By concentrating on the metropolitan areas across six states, CSEC wants to educate sufficient numbers of cyber security and information assurance technicians—several thousand over the next few years—to allow U.S. companies and government agencies to keep their critical security functions in the United States. To compete globally, companies need some assurance that their trade secrets and customer data are secure.

CSEC's leaders hope that the availability of skilled technicians will attract corporate and governmental cyber security work, just as the concentration of engineering graduates from universities in Silicon Valley in Northern California; Austin, Texas; and Cambridge, Massachusetts; stimulated the growth of high-tech industries in those areas.

"We want to prime the pump and produce large numbers of highly trained students," says Sujeet Shenoi, principal investigator of CSEC. "When we are producing large enough numbers, it will be attractive for companies to move here."

CSEC was formerly known as the Oklahoma Center for Information Assurance and Forensics Education. Oklahoma's Career and Technical Education System, four of its largest two-year

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colleges and the University of Tulsa were the original partners that won the ATE grant. Other education collaborators in Texas, Arkansas, Kansas, Colorado, and Missouri joined the initiative in its second year as the Oklahomans pursued their regional vision for economic development.

Shenoi sees the Great Plains states as particularly good places to recruit and educate technicians who can master the latest cyber techniques and qualify for government security clearances. Midwesterners' habit of staying close to home is actually a plus in cyber security, because international travel can disqualify candidates for certain government security jobs.

In 2005, the Committee on National Security System (CNSS), the federal agency that sets high standards for certification of security education programs, approved programs at three institutions within the Oklahoma partnership. This approval indicates the CSEC-initiated programs are up to the government's rigorous standards. At the time the three obtained the CNSS certifications, only four other two-year institutions in the United States had obtained this distinction.

"The CNSS certifications are an integral part of the National Security Agency's National Information and Assurance Program," says Sheryl Hale, state coordinator of Adult Career and Development for the Oklahoma Department of Career and Technology Education. "These certifications will definitely help our students get important jobs in industry and with federal agencies," she states in a press release. Hale is co-principal investigator of the ATE grant that created CSEC.

Jonathan Seltz, a student at the Tulsa Technology Center in Oklahoma, uses an iris scanner for secure access authentication as part of his training through the Cyber Security Education Consortium (CSEC).

To prepare students, CSEC has offered professional development for faculty. One hundred instructors took courses offered by the center during 2004–2005, its first year. In the summer of 2005, 40 instructors from eight states attended hands-on workshops on biometrics, intrusion detection, and digital forensics in Oklahoma. During 2005, the center took its professional development programs to Kansas, Texas, Arkansas, and Colorado. In 2006, center personnel hoped to teach faculty in Missouri, and they were scheduled as featured presenters at national and international digital forensics meetings.

Approximately 20 Oklahoma community college and technical college faculty members also have enrolled in cyber security courses or master's degree programs at the University of Tulsa, where Shenoi is Oliphant Professor of Computer Science. The university, which has been designated as a national development center by the National Security Administration, guides the learning and mentors the two-year college faculty members involved in the ATE center grant.

The consortium also educates law enforcement officers throughout the region in the basics of identifying, preserving, and deciphering digital information. "Every crime now has an electronic component," Shenoi says. He cited the fax machine that led to the arrest of the BTK killer in Kansas City and the global positioning system unit recovered from the car of the Washington, D.C., snipers as examples of two notorious criminal cases with critical digital evidence.

Most police departments lack the funds to inform their staffs in the intricacies of digital forensics. The center addresses this need by instructing police officers, particularly those in rural areas, about what constitutes electronic evidence, how to preserve it at crime scenes, and how to transport it to the appropriate professionals who can decipher it. ■

For more information, see www.cseconline.org and www.okcareertech.org.

KCTCS is U.S. Partner for New Siemens Certificate Program

KCTCS officials hope the certification program they plan to begin offering to students in fall 2006 will set benchmarks for technicians in the automotive industry and many other industries, as well.

The Kentucky Community and Technical College System (KCTCS) is the U.S. partner for Siemens' new Mechatronic Systems Certification Program. Mechatronic systems integrate mechanical, electronic, and computerized components and operate everything from household appliances to jetliners.

"Our dream as educators is to create a portable credential that can cross state lines," says KCTCS Chancellor Keith Bird. He calls the multidiscipline mechatronic systems certification "a competency credit card" that employers will value because of its validation by Siemens. The company, which is based in Germany, has a presence in 190 countries. Bird and others in Kentucky hope the certification program will attract students and employers. They eventually hope to offer professional development to educators from other states so they will be able to teach the certification courses at their colleges.

Kentucky is essentially the beta site for the new, international manufacturing certification program. It is a role that Bird traces directly to work KCTCS personnel and their industry partners did with an ATE planning grant for a nine-state, automotive technical education collaborative. The automotive collaborative's proposal for an ATE project grant was still pending in early 2006. The ATE planning grant provided funds in 2004 and 2005 to assess and develop training for the automotive industry, particularly the small-to-medium-sized companies that supply the region's automakers. KCTCS did receive a $2.5 million grant from the U.S. Department of Labor in early 2006 for Kentucky aspects of the automotive initiative.

James A. White, director of KCTCS's Center for Excellence in Automotive Manufacturing, said that when he and the other educators from 14 colleges met with automakers for the planning grant and asked what they need in technicians, the companies' leaders did not ask for a particular program. Instead, they asked the colleges to come up with a way for them, as employers, to know the qualifications of the technicians they hire.

"They want a predictable outcome from training programs throughout the world," White says, explaining that the priority for the companies is to hire people who are well qualified. "They want them to be able to perform to a specific standard."

While these discussions were going on with automakers and their suppliers, others at KCTCS were in contact with Kellyn Kruger-Wiewiorra, leader of the Siemens Technik Akademie Berlin, to explore ways for the two-year college system to broaden its scope. A tool-and-die apprenticeship program, modeled on the German Dual Vocational Education System and certified by the Munich Chamber of Industry and Commerce, and a master wood craftsman program were developed from KCTCS's international outreach.

Before going to work for Siemens in Germany, Kruger-Wiewiorra worked at Macomb Community College in Warren, Michigan. The academy she leads in Berlin is part of Siemens Professional Education and has traditionally educated the corporation's German personnel. In recent years, however, it has offered programs to educate personnel from the company's non-German business units and joint ventures. The mechatronic systems certification program grew out of these efforts.

White explained that while the ATE automotive collaborative developed its proposal for additional NSF funding, KCTCS proceeded to build its partnership with Siemens. As one of the world's largest high-tech manufacturing corporations, Siemens is interested in what automotive companies and their suppliers are doing in the United States. As an emerging field, mechatronics interests the automakers, because it focuses on integrated systems technology.

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The program does not exactly replicate the segmented German curriculum but blends aspects of German and American postsecondary education offerings. The result is a three-level certification program—associate, assistant, and professional—that fits into associate degree programs or can be offered as modules for incumbent workers to enhance development of their competencies.

The model is similar to the information technology certification programs offered by Cisco, Microsoft, Sun, and others. Twelve KCTCS faculty members attended two weeks of classes in Germany with a group of educators from Thailand during the summer of 2005. Siemens personnel traveled to Kentucky in early 2006 to teach KCTCS faculty at an Amatrol, Inc., facility. Bird describes the involvement of the private training provider as another aspect of the "unique" partnership.

Additional professional development is scheduled in Germany during the summer of 2006. KCTCS faculty must pass Siemens' exams to qualify as instructors of the courses that lead to certification. Students also will have to pass Siemens' exams to attain certification. ■

For more information see www.kctcs.edu/workforcenetwork.

Faculty Externships Make Impact on Campuses

Of the many valuable experiences that Odell Glenn gained during his faculty externship, one of the most important was becoming acquainted with manufacturers' current business practices. It was just 2001 when he left his full-time engineering job to get a master's degree in electrical engineering. Since then, however, the technological advances that accelerated everything from the speed of the Internet to the pace of outsourcing changed fundamental aspects of U.S. companies.

"Students today need to know about these changes," says Glenn, an assistant professor of engineering/engineering technology at Manchester Community College in Manchester, Connecticut. Thanks to the externship offered by the Regional Center for Next Generation Manufacturing (RCNGM), he says, "I'm able to give more practical examples."

RCNGM is an ATE-funded Regional Center of Excellence that is part of Connecticut's College of Technology. Forty-four community college and high school instructors participated in one-week externships through an ATE project grant that preceded the center's grant.

Both ATE grants compensated the community college and high school educators for the time they spent working at the companies and developing new curricula based on their externship experiences. Feedback from the faculty and company participants prompted the center to extend its summer externships to four weeks in 2005. The extra time gives the educators the opportunity to work on more complex projects and to build better connections with industry personnel, says Karen Wosczyna-Birch, principal investigator of RCNGM.

During his four weeks at the Space, Land, and Sea Division of Hamilton Sundstrand, a subsidiary of United Technologies Corp., Glenn helped test the high-pressure nitrogen and oxygen cells built into the life-support systems of NASA astronauts' backpacks. He also rewrote a 500-page instructional document on how to process high-pressure gas compressors. The compressors pressurize oxygen and nitrogen for the system that tests the life support components of astronauts' space suits. Glenn's fresh approach to the

procedure resulted in a "great working document" for the company's laborers, technicians, and engineers to use, according to Jeffrey Houle, a manufacturing systems engineer and Glenn's main industry colleague. Houle describes Glenn as "a perfect match" for Hamilton Sundrand's externship. He also said that Glenn was such a pleasure to work with that the externship "led into a bigger partnership at the college level with his students." Houle is helping Glenn develop a new curriculum using real engineering technology problems.

Glenn planned the lessons for two sections of an "Introduction to Engineering" course in fall 2005 around a problem with the glycol chiller systems in astronauts' backpacks. Early in the semester, he taught the basics of thermodynamics and fluid mechanics so the students could get started troubleshooting. Houle visited the class to explain the project and later guided students on a tour of Hamilton Sundstrand's Windsor Locks facility. To mirror the company's work teams, Glenn assigned students to four-person groups that brainstormed and conducted research to develop their solutions. They made PowerPoint presentations of their ideas at the end of the semester.

Houle was impressed by the variety of the students' designs. "I planned on sitting through eight or nine presentations that were very similar, but every team had very different approaches to the problem,"

Introductory engineering students from Manchester (Connecticut) Community College toured Hamilton Sundstrand's Windsor Locks facility with Assistant Professor Odell Glenn (far left). The tour grew out of Glenn's faculty externship and gave the students an opportunity to see astronauts' life support systems and the equipment used to test them.

he explains, adding that at the end, "I gave students a few hints about speaking and preparing electronic presentations and the importance of good communication."

Glenn and Houle are adapting another engineering problem for students to use during spring 2006. Houle explains that it is important for students to deal with real-life problems and projects. "This exposes them to some of the other issues that aren't taught through the textbooks, such as design costs and schedules. Students need to learn there are sometimes cost restrictions. This experience also helps students with building teamwork and communication skills. Learning to communicate your ideas, thoughts, and questions is key when you are trying to interact with suppliers, engineers, and management."

At the college, Glenn and the three other faculty members who had externships often share their experiences and industry contacts with colleagues. Students are responding to the new energy within the department. The college added a fifth section of the introductory engineering course for the spring 2006 semester, and enrollment is growing in the next tier of courses in the engineering technology sequence.

The externships immediately expanded the roster of speakers for the college's engineering club and classes. Glenn is recruiting some of the engineers he met for the college's corps of adjunct faculty. "It's so critical for people working in the field to keep us updated," Glenn says. He plans to keep himself updated with another externship. ■

For more information, see www.nextgenmfg.org.

Stark State College's Fuel Cell Prototyping Center is 'Unique Resource'

"It is a unique resource that provides some facilities that don't exist broadly across the country," says Ken Alfred, executive director of the Ohio Fuel Cell Coalition.

With its Fuel Cell Prototyping Center, Stark State College of Technology in North Canton, Ohio, wants to launch a new phase in fuel cell commercialization. University researchers and business people hope that the work accomplished in the clean room, production, and testing areas within the 25,000-sq. ft. center will help resolve the scientific and economic challenges that have impeded the wider use of fuel cell technologies.

"We want to be ahead of the curve, because we can't afford to be behind," says Dorey Diab, executive director of emerging technologies at Stark State. The public community college has received $5.4 million in grants from various state and federal agencies to build the center on its campus and to create fuel cell technology education programs.

Stark State is using its ATE grant to develop fuel cell competencies that can be plugged into high school curricula, a fuel cell tech prep program, and an associate degree program in emerging power technologies that will be shared with other Ohio colleges. The college also offers professional development programs for high school teachers and community college faculty. The college has been designated as the training and testing site for Ohio high school teachers to learn about fuel cell technologies.

The prototyping center and the entrepreneurial activities it is intended to facilitate are among the goals of the Wright Fuel Cell Group, a state-funded innovation center based at Case Western Reserve University in Cleveland. In addition to Stark State, the group's educational partners include the Ohio State University, Cleveland State University, and the University of Toledo. Eight companies, NASA's Glenn Research Center, and Battelle Labs are among its industry partners.

The educators, industry leaders, and government officials hope to make Ohio a center for fuel cell manufacturing by capturing 5% of the global fuel cell market and creating 5,000 new jobs in Ohio during the next decade. In a state that has lost more than 200,000 manufacturing jobs in recent years, 5,000 jobs would be a significant step toward high-tech economic development. If all goes well, the companies that locate in or near the prototyping center will create 500 to 1,000 of those anticipated new jobs.

The center is scheduled to open in spring 2006 with all of its commercial space occupied by SOFCo-EFS Holdings LLC, a developer of planar solid oxide fuel cell components and gaseous and liquid fuel processors. The company is part of McDermott International, Inc.

"It is a unique resource that provides some facilities that don't exist broadly across the country," says Ken Alfred, executive director of the Ohio Fuel Cell Coalition, a nonprofit industry trade group. The Wright Fuel Cell group is part of the coalition.

Alfred describes fuel cell production as "an industry in its infancy." Most fuel cell makers are in the precommercialization stage of their business plans and depend on government assistance for research support. "There are a limited amount of commercial units out there," he says.

Fuel cells are electrochemical devices that generate electrical energy from the interaction of chemical reactants, such as hydrogen and oxygen. The high efficiency and low pollution of fuel cells makes them appealing. But manufacturing costs and by-products have inhibited the use of fuel cells. Automakers are experimenting with hydrogen fuel cells for electric cars, because when hydrogen combines with oxygen it generates water vapor. But extracting hydrogen from natural gas, coal, and oil creates pollution; cooling and compressing the hydrogen takes tremendous energy.

Diab does not anticipate that the prototyping center will resolve

the hydrogen infrastructure issues. He does, however, expect it to reduce production costs by providing a place for manufacturers to improve designs and gain production efficiencies.

"By designing, fabricating, assembling, and demonstrating a fuel cell, the center helps in proving the concept and in establishing the steps necessary to manufacture and automate the process," he says. ■

For more information, see www.starkstate.edu/fuelcell.

Process Technician Internships Alter Corporate Hiring Strategies

Internship programs facilitated by the Center for the Advancement of Process Technology (CAPT) are changing hiring strategies of BP and Shell Oil Company. Both companies' long-term hiring projections now include the expectation that their process technician internship programs will grow and that successful interns will increasingly be filling full-time operator jobs.

"We'd actually like for this mechanism to become our primary source for partnering with the two-year technical and community colleges to bring a strong technical emphasis, the classroom training, and the desire to work in the energy industry into our operations and crafts jobs," says Monte King, manager of Shell's Workforce Development Initiative. "We've built plans to utilize interns at more and more of our facilities, including E&P [exploration and production] business, both offshore and onshore, and at our refineries and chemical plants across the U.S.,"

"Once supervisors get interns in, they see the value of these highly skilled people coming into the workforce," says Johnny Payne, worldwide operations technical training manager for BP Exploration and Production.

King explains. Shell had 25 internships for two-year process technology program students in 2005 and plans to have 75 interns in 2006

"Once supervisors get interns in, they see the value of these highly skilled people coming into the workforce," says Johnny Payne, worldwide operations technical training manager for BP Exploration and Production. He started BP's technician internship program in Alaska in 2000 and has driven the growth of BP Exploration and Production's internships in the U.S. Gulf Coast since 2002. There were 37 exploration and production interns and 29 other interns among BP's upstream and downstream facilities during 2005. Many of the interns were offered full-time jobs contingent upon completion of their associate degrees.

King and Payne both identify the standardized core curriculum developed by CAPT for the associate of applied science degree in process technology (PTEC™) as essential to the strength of their internship programs. "I have to have assurance that if I recruit from Washington or New Jersey or Texas or Louisiana or otherwise, I know what kind of education is being delivered at those institutions, and that is what the standardized program delivers," Payne says. A long-time supporter of the uniform curriculum for process technicians, Payne serves as chairman of CAPT's National Steering Committee.

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The internships at BP and Shell are not identical but are structured similarly as one-on-one mentorships. Both companies review the intern applications as they would those from candidates for full-time jobs. Once chosen, interns are assigned to work alongside experienced employees for a semester, and their performance is closely monitored. The interns are not permitted to work alone for safety purposes and to ensure that learning is occurring.

CAPT markets BP and Shell internships on its Web site, promotes them through materials sent to its 43 affiliated community and technical colleges, and coordinates the selection process with the companies. CAPT, which is located at the College of the Mainland in Texas City, Texas, also sent the announcement of Shell internships to the Industrial Instrumentation and Controls Technology Alliance to recruit people interested in instrumentation.

King was particularly impressed by the efficient way CAPT notified its affiliates electronically of the internships. Three weeks after Shell decided to offer 17 internships in the summer of 2005, it had 172 applications from all over the United States and Canada. "This was a very effective way to get the word out. People use this mechanism to prepare and submit their application [online] in a very timely basis," he says, comparing it to the time it would have taken to distribute paper flyers or contact individual colleges.

King cites the guidance provided by Joanna Kile, CAPT's director, and the experiences shared by Payne as important factors in the growth of Shell's operator internships. Before 2005, Shell offered only a few internships each year at its Geismar, Louisiana, chemical plant. King said he and other managers were pleased with the quality of the PTEC™ students at the initial review of their applications and then during their internships. "Most importantly our business units have been pleased with the quality of the candidates after the internship experience," King says, noting that eight of the 2005 interns started as full-time employees in January 2006. ■

For more information, see www.captech.org.

(npt)^2 Provides Competitive Edge

The Alabama River Pulp Company has made significant productivity gains by hiring entry-level technicians with associate of science degrees in paper and chemical technology. The company is also refreshing the competencies of its incumbent workers with training at the National Network for Pulp and Paper Technology Training Center (npt)^2. The associate degree program was developed using three ATE project grants that preceded the center's funding in 2004 as an ATE National Center of Excellence.

"Enhancing the pool of workforce knowledge," is how Greg Martin, a senior vice president at Alabama River Pulp, refers to this dual strategy that company leaders hope will keep the company competitive internationally. Alabama River Pulp is the largest market pulp producer in North America. Overseas, customers buy 65% of its pulp bales, which are the dried, bleached wood fibers used for everything from paper towels to glossy magazines. Its most significant competitors are from South America and southern Asia where labor costs are significantly less, he explains.

"Our productivity has got to come from our people," he says, citing education as the key to raising employees' productivity. "If you're going to compete, you've just got to raise the skill and talent level of the folks that you are bringing in here.

"Our productivity has got to come from our people," says Greg Martin, senior vice president for the Alabama River Pulp Company, citing education as the key to raising employees productivity. "If you're going to compete, you've just got to raise the skill and talent level of the folks that you are bringing in here. You've got to do it."

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Since 2000, the company has participated in $(npt)^2$'s scholarships–internships–jobs program. Randy Parker, principal investigator and director of the $(npt)^2$, describes the model as effective for developing highly skilled technicians in the rural area. In 2005–2006, 44 of the students in the pulp and paper technician program received scholarships. Sponsor companies cover the cost of tuition, books, and fees, which amounts to approximately $3,400 annually for each student selected through the competitive process that the center facilitates. The companies also pay the students to work as interns for eight to ten weeks during the summer between their first and second years in the program. Although the scholarship students are not guaranteed a job after graduation, the companies typically give the students they sponsor a close look.

Alabama River Pulp sponsors five new scholarships each year and gives preference to graduates of the two-year program at nearby Alabama Southern Community College in Thomasville, Alabama. The company has required an associate degree of all entry-level technicians since 2003.

Martin, who was plant manager from 2000 to 2005, says he likes to hire from the local community college's pulp and chemical technician program, because the graduates quickly make a positive impact on the workplace. "These young kids come in, and they have a much, much better understanding of the overall operation than somebody who has been here for 25, 26 years. There's no doubt about it. They come in and they have good fundamental understanding," he says.

Currently 16 graduates of the $(npt)^2$ program are permanent employees. Another 11 are considered temporary employees who receive "straight time" wages of $36,000 annually but not the full complement of benefits. Most of the temporary employees will obtain permanent status, Martin says, explaining that permanent hiring has been delayed while the company redesigns how work is done within the mill.

Given that most entry-level employees spend more than two decades working for the company, Martin estimates that each technician hired represents a $2 million decision over the term of his or her employment. The company has told current technicians that they will not lose their jobs as the company strives for greater efficiencies. However, without additional training, workers who are experienced—but less skilled—may not advance. "Our goal is to make everybody successful," Martin says. So the company sends groups of incumbent employees to the center for refresher training one day each week.

"As the technology continues to progress we need people to learn more, to know more, to be more flexible. They have to do more. Even with all this hiring going on, we're still looking at reducing the number of jobs in the mill that it takes to produce a ton of pulp. We're going at it on both ends. At the end of the day, what you're going to end up with are fewer folks who have more knowledge and skills and can do more," he says.

Twenty percent of the 520 employees at the facility in February 2005 were over the age of 55. In 10 years, if the company continues to gain efficiencies and older workers retire, Martin estimates that 40 to 50% of the operations and maintenance technicians will be graduates of the $(npt)^2$ program. "We believe that will be an extremely competitive advantage," he says. ■

For more information, see www.npt2.net.

CVCC Nuclear Science Modules Try to Close Gap in Students' Understanding of Science

Before creating curriculum modules on nuclear energy, educators at Central Virginia Community College (CVCC) in Lynchburg, assessed the knowledge of their target audience: high school chemistry and physics students. Their findings were disconcerting not only to the nuclear industry, which is hoping to grow, but to anyone who would like the United States to cultivate a new, larger cohort of technicians, engineers, and scientists.

"We're finding a big gap between the theory and the education," says Bob Bailey, the NSF project manager at CVCC. According to Bailey, of the 200 high school students evaluated in the initial assessment, only 15 met the minimum standard to be considered for technician jobs in nuclear power plants.

Lynchburg middle school students who attend Central Virginia Community College's Summer Career Academy for Nuclear Energy get to suit up for mock activities that explain the work of technicians in a nuclear power plant.

"It was the application of theory" that stymied students, Bailey explains. "They could solve an equation using thermodynamics. But they can't tell you how a steam generator works. [Yet] they understand the concept of, 'If you heat water up, it boils.' They understand the theory behind all this, but they don't understand how you apply changes in state, volume, and pressure to, "Oh, I can take water turn it to steam, run it through a turbine,'" he says.

CVCC's modules attempt to bridge the gaps between theory and application while increasing students' interest in nuclear careers in medicine and energy. These fields include technician jobs in robotics, repair technologies, and nondestructive testing.

The college's efforts to "prime the pipeline" are starting to have an impact. Bailey reports that 25% of the 67 students who worked in teams on designing electrical systems for a fictional community on Mars expressed increased interest in nuclear energy after the hands-on module. In addition to the assessments and modules, CVCC's ATE grant supports expansion of information about nuclear technologies in the college's dual enrollment program for high school students, a summer science camp for middle school students, community career information activities, and summer workshops for elementary and secondary school teachers.

The college developed an innovative work-study program for contract employees of Framatome Advanced Nuclear Power, Inc. (ANP), which is the college's main industry partner for its ATE project grant. Framatome ANP is part of Areva, a French nuclear energy company with facilities in 30 countries. The program uses the winter and summer lulls in the work schedules of contract workers who maintain nuclear power plants. These technicians generally work long hours during less-than-peak operation times in the fall and spring when nuclear power plants are taken offline for maintenance.

Instead of being unemployed during the summer and winter, the contract employees who qualify for CVCC's program take traditional and compressed courses that lead to associate of applied science degrees in nuclear support technologies. The company compensates the students based on the number of hours they work in a year. In the first year, a contract employee who works a typical contract period of 2,000 hours earns $24,000. In their third year of the work-study program, they make $32,000.

The college teaches 80% of the nuclear support technologies courses

at the new $10-million training facility that Framatome ANP built on its property in Lynchburg, Virginia. "They've got a mock up of every component of a nuclear power plant in there. So basically, they built it, but it's just another building for the college to use as we build those programs up," Bailey says, adding, "They are a tremendous partner." ■

For more information see www.cv.cc.va.us/Framatome.htm.

Lee College Center Focuses on Fieldbus Technology

From the beginning of the industrial age to the 1930s, instruments in process industries and manufacturing were directly connected devices, such as valves that had to be turned by hand. Automated systems began with pneumatic signal transmission devices in the 1940s; but they were not cutting-edge for long. They were quickly replaced by electronic instrumentation in the form of tubes, then transistors, and then distributed control circuits. Computers began controlling processes in the 1970s, and by the 1980s, digital control systems were considered state-of-the-art.

Instrumentation systems are now in a new phase of their evolution with the expanding worldwide use of fieldbus systems. Fieldbus is an open, nonproprietary technology that is interoperable with other registered devices, which means that equipment made by different manufacturers can work together. Greater compatibility and workability among the components means fewer technicians are needed to keep facilities running around the clock. The streamlining and resultant cost savings is what makes fieldbus the emerging technology that is affecting all technicians' activities, according to Chuck Carter, director and principal investigator of the Fieldbus Center at Lee College in Baytown, Texas.

The center has used ATE project grants to teach fieldbus and other process control network systems to community college and technical college instructors. It also developed a multicraft, standardized curriculum for instrumentation technicians to learn fieldbus and other industrial networking technologies. The center's facilities include a multimillion dollar pilot plant and several state-of-the-art MicroPlants™ where students can build and configure devices and develop control strategies.

Because many international companies are using fieldbus when they construct new facilities, Carter considers training in it essential for U.S. technicians who work in the petrochemical industry, oil and gas refining, oil and gas exploration and production, biotechnology, power generation, pharmaceuticals, food and beverage production, pulp and paper, and wastewater treatment. "Learn it or become a dinosaur in five to ten years," he says.

The streamlining and resultant cost savings is what makes fieldbus the emerging technology that is affecting all technicians' activities.

The center is capitalizing on the many industries' interest in fieldbus by offering multiday workshops for engineers, managers, designers, incumbent technicians, and sales personnel. Income from these programs will sustain the center when its NSF grant expires, according to Bob Kosar, co-principal investigator of the center. ■

For more information, see www.knowthebus.org.

Partnerships Integrate Renewable Energy Technologies

Partnerships in Educational Resources for Renewable Energy Technologies use a novel blend of face-to-face and virtual pedagogies to resolve several technician education challenges. This makes it possible for colleges to offer courses on renewable energy technologies without all the start-up costs.

The partnerships project based at Madison Area Technical College (MATC) in Madison, Wisconsin, brings world-class renewable energy experts to students via modules on the Internet. In addition, it offers Web-based "learning objects" to boost students' understanding of key concepts such as the workings of fuel cells and wind-powered turbines.

As a cap to the two types of electronic instruction, the partnerships project plans to offer one- and two-week workshops at various sites around the nation. "If you only do the hands-on part of it then you're not getting that full theory and technology that we should be developing," says Joy A. McMillan, the director of MATC's Center for New and Converging Technologies and its office of Grants and Sponsored Projects. Similarly, the virtual environment cannot replicate the experience of applying theories to hands-on tasks under the guidance of a renewable energy expert. She noted, for instance, that learning how to install photovoltaic panels is best accomplished with in-person guidance from a qualified electrician.

"We're not creating a program … we're creating models for the integration of renewable energy technologies," says Judy DaWalt, principal investigator, Madison Area Technical College.

MATC is granting certificates in renewable energy for the series of modules and workshops until an industry-sanctioned accrediting agency certifies the courses. The experts are from Oakland (Michigan) Community College, the Florida Solar Energy Center, Solar Energy International, the University of Wisconsin–Madison, and the Midwest Renewable Energy Association. The modules on topics from energy management to solar home design are offered from the experts' institutions through the Consortium for Education in Renewable Energy Technologies (CERET) based at Madison Area Technical College. Both CERET and the partnerships project received ATE grants.

Many of the "learning objects" were developed by MATC faculty members with the CERET grant. Students navigate through the animated graphics using queries that cover technical information in ways that complement the modules. The modules function as independent learning opportunities for individuals or as part of students' associate degree programs.

Midwest Renewable Energy Associates will provide the workshops at MATC, and Solar Energy International may offer some workshops at its facilities in Colorado. Principal Investigator Judy Da Walt notes the partners also hope that the colleges that use the modules to supplement their on-campus offerings will open their workshops as face-to-face learning opportunities for others who use the on-line modules.

"We're not creating a program… we're creating models for the integration of renewable energy technologies by having more technicians trained in these fields, and ultimately to increase the availability and use of renewable energy. ■

For more information, see www.ceret.us.

SCME in Microsystems Manufacturing Hotbed

Paul Tafoya was taking classes at Albuquerque Technical Vocational Institute (TVI) in Albuquerque, New Mexico, to become an electrical technician when he told his soldering teacher that he liked working on the smallest resisters best.

"It's almost like playing with magic," says Albuquerque TVI student Paul Tafoya of microsystems technology.

A student fabricates a pressure sensor using a variety of microsystem processes at the University of New Mexico's cleanroom. The University of New Mexico is a partner institution working with the Southwest Center for Microsystems Education (SCME) in Albuquerque, New Mexico.

"'You don't know what small is, you've got to look into microsystems,'" Tafoya says the teacher replied. His follow-up conversation with a faculty member at the college's Southwest Center for Microsystems Education (SCME)—an ATE Regional Center of Excellence—made him even more curious. "So, I took the introductory course, and I was hooked. It's almost like playing with magic. All these devices are so little mass, the problems of friction are almost gone," Tafoya explains.

The magic-like devices Tafoya is referring to are micro electro mechanical systems or MEMS. They are also called microsystems, microstructures, microstructural technologies, and mechatronics, depending on their use and the industry using them. By whatever the name, the micron-sized devices contain electrical, mechanical, or optical components made of silicon or other materials. Their moving parts are smaller than a human hair.

Kees Eijkel, president of the Micro and Nanotechnology Commercialization Education Foundation (MANCEF), describes commercial uses of micro and nanotechnologies as "new ground to all involved." The industry grew a bit in 2005, but Eijkel notes on the foundation's Web site that most of the growth was in early research and development and applied research. Accelerometers for car air bags are among the biggest commercial applications of MEMS technologies.

MANCEF's Web site describes Albuquerque, New Mexico, as "an emerging world-class hotbed of microsystems and nanotechnology research and development, science and engineering that also boosts a solid, established, and early stage commercial base. Supporting Albuquerque's and the region's micro-nano commercialization and economic development efforts is a vanguard of national labs, institutes, universities, state governments, international organizations, and business venture support."

TVI and SCME are deeply involved in this economic development mix. TVI received a grant from NASA to create one of the nation's first curricula for MEMS

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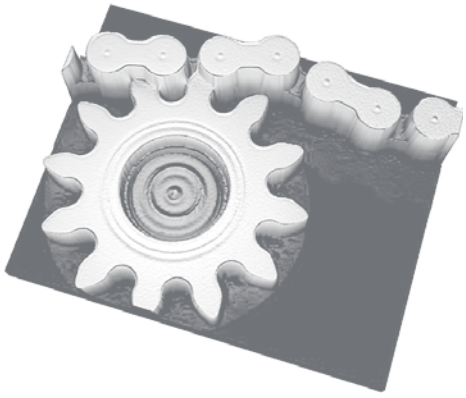
technicians. Currently, the community college is using its ATE regional center grant to develop national skill standards for microsystem technicians and to create model workforce development clusters.

SCME's primary partner is Sandia National Laboratories, the world's premier research and design source of surface micro machining technology and the integration of that technology with integrated MEMS. SCME's other partners include the University of New Mexico and two ATE centers—the Maricopa Advanced Technology Education Center (MATEC) and the National Advanced Technological Education Center of Excellence in Biotechnology (Bio-Link).

In addition to providing student internships, Sandia lent Al West (its director of environment, safety, and health) to work as the center's director, and provided SCME Principal Investigator Matthias Pleil with a part-time job to advance his understanding of technicians' work.

Pleil has a doctorate in applied physics, but his brief stint as a technician at Sandia informed his development of new courses and the national competencies. He found that working in the laboratory was "more involved" than simply reading research or talking



The world's smallest chain as designed by Albuquerque TVI student Paul Tafoya, in a MEMS design class, Spring 2005. This design was submitted to Sandia National Laboratories' design competition and was selected by Sandia for prototype manufacturing.

Presidential Panel Spotlights Microsystems Center

Matthias Pleil, the principal investigator of the Southwest Center for Microsystems Education in Albuquerque, New Mexico, told President George Bush about his center and the Advanced Technological Education (ATE) program during a panel discussion in February 2006.

"I'm working [on] creating educational materials for college students, and also for college and high school teachers so that we can teach the future technologists about microsystems," Pleil explained to the president.

The rare opportunity for a conversation with the president started with the ATE Principal Investigators Conference in October 2005.

NSF Deputy Director Kathie Olsen addressed the ATE principal investigators and their industry and education partners during the annual conference, and then toured the ATE Centers' showcases. It was there that she met Pleil and watched his students demonstrate the microsystems products they had manufactured. Olsen was impressed. She immediately told a colleague she wanted NSF Director Arden L. Bement Jr. to see the center in November when he visited Albuquerque.

Bement did visit the center at the Albuquerque Technical Vocational Institute, and talked at length with students and staff. He mentioned the center's work in a speech the day after his visit. He also shared his favorable impressions with President Bush's science advisor, John H. Marburger III.

When it was decided in late January 2006 that President Bush would promote his request for additional funding of basic science research at three sites outside Washington, D.C., White House staffers called SCME for more information. Pleil was then invited to represent higher education in the 90-minute discussion with the president.

National media carried Bush's remark to Pleil that "One of the really great assets we have in America is the community college or technical school system. And the reason why is, is that these schools tend to be market-driven. And by that I mean the curriculum adjusts to the needs of the local folks."

"One of the really great assets we have in America is the community college or technical school system. And the reason why is, is that these schools tend to be market-driven. And by that I mean the curriculum adjusts to the needs of the local folks."

—President George W. Bush

with researchers to prepare the new curriculum. "When you get to know the individuals, and work with the tools that the technicians work with, you have a better understanding of the skills and competencies the technologists must have to excel in this environment," says Pleil. Brian Akins, a TVI student, took Pleil's place in the characterization laboratory during his internship. One of his tasks was using a little needle with a micropositioner to move miniature mirrors, which act as fiber optic switches, one micron at a time in MiniMes. SCME uses the MiniMes to show high school and college students what microsystems do. Akins plans to transfer to a baccalaureate engineering program when he finishes at TVI.

Tafoya plans to work as a technician and hopes eventually to be involved in designing MEMS. He is off to a good start. A device that Tafoya designed with a group of TVI students has been manufactured at Sandia, and a pressure sensor he designed was built at the University of New Mexico's cleanroom. While working weekends on his family's alfalfa farm, Tafoya has also come up with some ideas for a micron-sized bailer and composter. ■

For more information, see www.scme-nm.org.

ATE CENTERS

Biotechnology & Agricultural Technology

The National Advanced Technological Education Center of Excellence in Biotechnology (Bio-Link)
www.bio-link.org

The National Center for Agriscience and Technology Education (AgrowKnowledge)
www.agrowknowledge.org

The Northeast Biomanufacturing Center and Collaborative (NBC^2)
www.biomanufacturing.org

Chemical & Process Technology

Center for the Advancement of Process Technology (CAPT)
www.captech.org

National Network for Pulp and Paper Technology Training $(npt)^2$
www.npt2.net

Engineering Technology

The California Regional Consortium for Engineering Advances in Technological Education (CREATE)
www.create-california.org

New Jersey Center for Advanced Technological Education (NJCATE)
www.njcate.org

The Nondestructive Testing Resource Center (NDT)
www.ndt-ed.org

South Carolina Advanced Technological Education Center of Excellence (SC ATE)
www.scate.org

National Aerospace Technical Education Center (SpaceTEC)
www.spacetec.org

Environmental Technology

Advanced Technology Environmental Education Center (ATEEC)
www.ateec.org

Marine Advanced Technology Education Center (MATE)
www.marinetech.org

Northwest Center for Sustainable Resources (NCSR)
www.ncsr.org

Information Technology

Boston Area Advanced Technological Education Connections (BATEC)
www.batec.org

Center for Information Technology Education (CITE)
www.cite-tn.org

Center for Systems Security and Information Assurance (CSSIA)
www.cssia.org

Convergence Technology Center (CTC)
www.high-technology-center.org

Cyber Security Education Consortium (CSEC)
www.cseconline.org

Cybersecurity: Washington Area Technician and Consortium Headquarters (CyberWATCH)
Web site pending

Information Technology Education Center (iTEC)
www.itecfl.org

Kentucky Information Technology Center (KITCenter)
www.kitcenter.org

Midwest Center for Information Technology (MCIT)
www.midwestcenterforit.org

National Center of Excellence for High Performance Computing Technology (NCEHPCT)
www.highperformancecomputing.org

National Center for Telecommunications Technologies (NCTT)
www.nctt.org

National Workforce Center for Emerging Technologies (NWCET)
www.nwcet.org

Manufacturing Technology & Nanotechnology

Consortium for Alabama Regional Center for Automotive Manufacutring (CARCAM)
www.carcam.org

Florida Advanced Technology Education Center (FL-ATE)
www.fl-ate.org

Maricopa Advanced Technology Education Center (MATEC)
www.matec.org

National Center for Manufacturing Education (NCME)
www.ncmeresource.org

Regional Center for Nanofabrication Manufacturing Education
www.cneu.psu.edu

Regional Center for Next Generation Manufacturing (RCNGM)
www.nextgenmfg.org

Southwest Center for Microsystems Education (SCME)
www.scme-nm.org

The Technology and Innovation in Manufacturing Education Center (TIME)
www.time-center.org

For more information on the ATE program, please see:

National Science Foundation
www.nsf.gov

ATE Centers Impact
www.aacc.nche.edu/atecenterimpact

American Association of Community Colleges
www.aacc.nche.edu/ateprogram

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The American Association of Community Colleges (AACC) is the primary advocacy organization for the nation's community colleges. The association represents 1,100 two-year, associate degree-granting institutions and more than 11 million students. AACC promotes community colleges through six strategic action areas: national and international recognition and advocacy, learning and accountability, leadership development, economic and workforce development, connectedness across AACC membership, and international and intercultural education. Information about AACC and community colleges can be found at www.aacc.nche.edu.