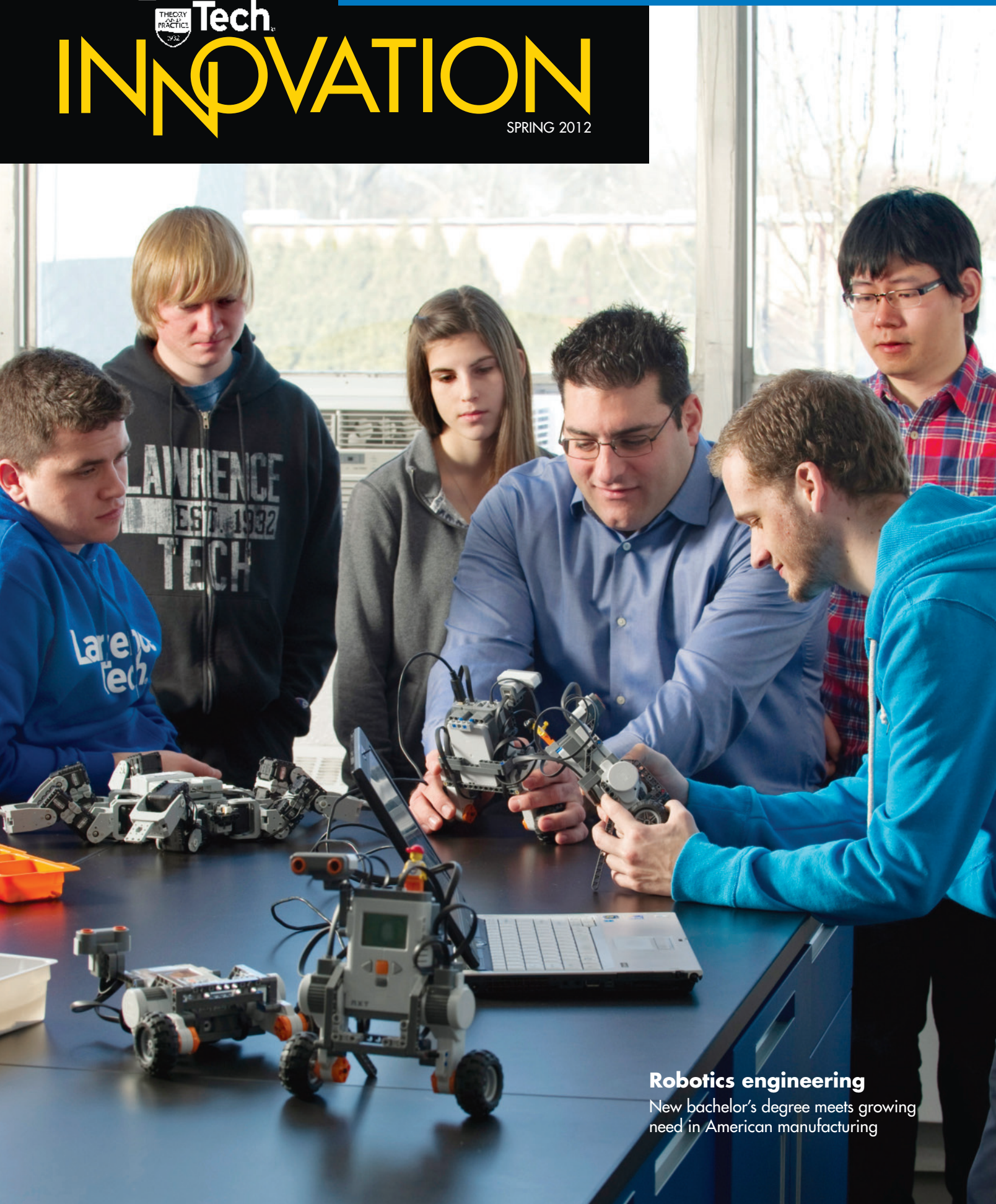
Lawrence Tech

INNOVATION

THE MAGAZINE OF THE COLLEGE OF ENGINEERING AT LAWRENCE TECHNOLOGICAL UNIVERSITY

SPRING 2012



Robotics engineering

New bachelor's degree meets growing need in American manufacturing

Lawrence Tech
THEORY AND PRACTICE
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On the cover: Lawrence Tech has launched a Bachelor of Science in Robotics Engineering, the first degree program of its kind in Michigan, and has opened a new robotics lab to support it. Assistant Professor Giscard Kfoury, the director of the new degree program, and students examine some of the robots in the lab that can be programmed. (Cover photo by Glenn Triest)

From the **Dean**

It's an exciting time to be an engineer! As Michigan, along with much of the country, recovers from the recession, Lawrence Tech's College of Engineering is addressing a surging demand for qualified engineers through improvements to its faculty, technology, academic programs, and over the next few years, its facilities.

The demand for engineering talent in all specialties is outstripping supply in the United States as many companies embrace the next generation of technological advances and strive to compete more effectively in the global economy. Job prospects for our graduates have improved greatly (see page 5) thanks in large part to the renaissance of the auto industry.

In the past year we hired four new faculty members (see page 28), each of whom brings a strong portfolio of credentials, skills, and industry experience. They are committed to research that will increase knowledge in their chosen field, while also meeting our high expectations for teachers and mentors in the classroom and laboratory. We have already hired two new faculty who will join us in the coming year.

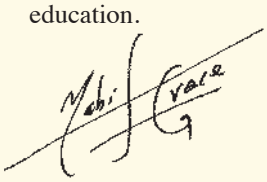
We continue to add to the research equipment available to both our students and our faculty. In 2011, our biomedical engineering program was bolstered by the acquisition of the Detroit area's first environmental scanning electronic microscope. In our Center for Innovative Materials Research, we have added the ElectroPuls E10000 laser measurement system that has civil engineering, biomedical, and military applications.

Lawrence Tech already has strong graduate-level programs in mechatronics and systems management. In 2011, we took the next step by instituting a bachelor's degree in robotics engineering (cover story) in order to meet the growing needs of industry. A new robotics lab has been established to support this degree program.

Also in 2011, we made good progress in raising the $55 million needed to build an engineering, architecture, and life sciences complex to be named in honor of A. Alfred Taubman, who has been joined by his family in donating $1 million for planning and issuing a $10 million challenge grant (see page 23). Our existing Engineering Building will be renovated as part of the new complex.

For almost two decades Lawrence Tech has been cited in the top tier of its class, Best Universities-Masters-Midwest, by the *U.S. News & World Report*'s annual survey, "America's Best Colleges." In that survey, Lawrence Tech is also ranked among the best undergraduate engineering programs in the country. The Princeton Review has also included Lawrence Tech in an elite group of Midwestern colleges.

We are most appreciative of your support as we continue to strive for pre-eminence in engineering education.



Nabil F. Grace, PhD, PE
Dean, College of Engineering

ROBOTICS engineering

NEW BACHELOR'S DEGREE ADDRESSES GROWING NEED IN AMERICAN MANUFACTURING

At a time when automotive companies and other manufacturers are reinventing themselves for the next round of global competition, Lawrence Technological University has launched a Bachelor of Science in Robotics Engineering (BSRE). It's a proactive initiative that recognizes the rapidly expanding demand for robotics engineers in the auto industry specifically and the manufacturing sector in general.

The interdisciplinary degree program introduced in the fall of 2011 blends mechanical engineering, electrical engineering, and computer science with robotics. In keeping with Lawrence Tech's motto of theory and practice, the curriculum gives students an avenue for hands-on implementation of the knowledge gained in the classroom.

Robotics Laboratory Instructor Jim Kerns brings a wealth of experience gained in the automotive industry to the task of helping students master both the mechanics and programming involved in robotics.

The new degree program is designed to address the shortage of qualified robotics engineers both in Michigan and throughout the country. Manufacturers seek specialists in the field who will require a minimum amount of on-the-job training. Lawrence Tech's BSRE provides undergraduates with crucial knowledge that cannot be obtained by studying mechanical, electrical, or computer engineering as individual disciplines.

Robotics has grown into a primary engineering field in its own right, according to Assistant Professor Giscard Kfoury, director of the new degree program. "This interdisciplinary degree provides graduates with the tools they will need to hit the ground running," he said.

Robotics engineering is an evolving discipline that goes beyond designing and building remote-controlled machines and tethered robot arms. In order to meet the greater demands of 21st-century production, robotics engineers are called on to design new robots, develop new applications for robots, and conduct research to expand the functionality of new applications. Of course, robotics engineers are also responsible for ongoing maintenance of robots so that tight production schedules can be met.

Greater demands have been placed on the emerging field. Robotics engineers have to be well-versed in the world of systems engineering and must possess the versatility to design and build a "human-like" system, consisting of control algorithms that represent the brain of the product, sensing and actuating schemes that simulate the nerves and muscles, and a mechanical system that makes up the skeleton of the design.

"Robotics engineering is an evolving discipline that goes beyond designing and building remote-controlled machines and tethered robot arms."

Lawrence Tech also offers a master's degree in mechatronic systems, and both master's and doctorate degrees in engineering systems. Undergraduate students in robotics benefit from the education infrastructure that has been built in those areas. The theoretical and practical knowledge gained in the BSRE program will equip the graduates to perform well in both of those fields.

Lawrence Tech faculty bring a wealth of experience in industry back to the classroom. They understand the complexity of this rapidly developing field and are dedicated to helping students build the foundation they will need to either enter the manufacturing sector after graduation or move on to graduate studies.

A new robotics lab dedicated to the support of the BSRE program has been established under the direction of Jim Kerns, a 36-year veteran of Ford Motor Co. (see page 28). The lab includes state-of-the-art measurement and data acquisition systems, along with various robotic kits and electromechanical components. In the near future it will be equipped to support research in robotics.

Lawrence Tech also remains unique in Michigan and rare nationally by supplying all undergraduates with a laptop or tablet computer loaded with all the specialized software programs they need for all their courses leading to a bachelor's degree. For undergraduates in robotics engineering that includes CATIA and other software programs used in the industry. □

The BIOLOID King Spider is cool enough to attract middle school and high school students to robotics programming and yet complex enough to challenge the programming abilities of college students.

RoboExpo brings together robotics fans of all ages

Lawrence Tech's first RoboExpo in September 2011 connected academia, industry, and government sectors involved in robotics, and it also attracted students of different ages interested in the rapidly growing field.

The event was organized by Professor CJ Chung as a way to bring together the different robotics initiatives at Lawrence Tech. Chung is the founder of Robofest, an annual international competition for programming autonomous robots that attracts more than a thousand contestants from grades 5-12.

The one-day RoboExpo included an introduction to next year's Robofest competition, and five high school teams competed in what is believed to be the world's first hexapod robot sumo event.

Chung started RoboExpo to build new connections among people who are interested in robotics. "We want to bring academia, industry, and government together to share knowledge and resources, promote R&D collaboration, and introduce new robotics products, services, and educational programs," Chung said.

The keynote address was delivered by Mark Salamango, MSCS'06, co-founder and president of RobotTown Inc., a planned robotics research consortium and education center in Detroit. The next RoboExpo is planned for late September or early October.

Small robotic vehicles used for military missions were very popular at Lawrence Tech's RoboExpo.

Other new degree programs

Bachelor of Science in Biomedical Engineering Technology

Ken Cook, chair of the Department of Engineering Technology, works with a student in the new bachelor's degree program in biomedical engineering technology.

Lawrence Tech's new Bachelor of Science in Biomedical Engineering Technology is the first of its kind in Michigan and among the first nationally. It combines classical engineering technology and the practical applications of biomedical technologies, with an added focus on project management and network system administration.

The rigorous curriculum provides a strong foundation in electronics, science, and math. Course work and labs encompass biomedical control systems and circuitry, biotech electronics, embedded processors, imaging technologies, and the application of lasers and electro-surgery.

Biomedical engineering technologists develop, calibrate, and repair critical medical instruments.

Doctor of Philosophy in Civil Engineering

As technology advances and solutions become more complex, Lawrence Tech has responded to the growing need for additional education by offering a PhD in Civil Engineering. Candidates can choose to specialize in construction engineering and management, environmental and water resources engineering, geotechnical and geoenvironmental engineering, or structural engineering and materials.

Lawrence Tech's exceptional hands-on opportunities for PhD candidates include pioneering applied research projects. They have the opportunity to work in Lawrence Tech's Center for Innovative Materials Research (CIMR), a major center for research, development, and testing of carbon fiber composites and other new materials with defense and infrastructure applications. CIMR has been designated by the Michigan Department of Transportation as a Center of Excellence for Sustainable Infrastructure and Structural Testing.

Doctor of Engineering in Mechanical Engineering

The new Doctor of Engineering in Mechanical Engineering provides candidates with formalized exposure to advanced theory and practice. Doctoral candidates can specialize in thermo-fluids; solid mechanics, dynamics, and vibrations; manufacturing; automotive; or mechatronics.

The steady stream of technological advances in engineering have made advanced degrees more and more important for professionals in the field. Some find that a master's degree is no longer enough to keep pace with new knowledge and technologies.

A doctoral degree at Lawrence Tech enables the professional to continue lifelong learning, while contributing to the profession through applied research.

GREAT EXPECTATIONS

Michigan's job market is rebounding and looks promising for new engineers

Lawrence Tech automotive engineering graduate student Karthik Devaraj talks to a recruiter at a networking reception held at Lawrence Tech in April 2011.

Despite widespread uncertainty about the economy and high unemployment, Lawrence Tech engineering graduates have good prospects in Michigan in large part because the automotive industry is growing again.

That was the personal experience of Karthik Devaraj, who earned a master's degree in automotive engineering from Lawrence Tech in May 2011. He knew that finding a job in the United States would be hard because of the extra time and expense required for companies that want to hire foreign nationals.

The native of India started his search more than a year ahead of graduation and saw the job market improve dramatically. He had seven interviews prior to graduation and started working in July at Hella Corporate Center USA when a position as a sales account manager opened up.

"Companies are trying to hire every engineer they can find," Devaraj said. "It's still going to be hard for international students, but for Americans it's going to be a piece of cake."

As director of Lawrence Tech's Office of Career Services, Peg Pierce saw a surge in hiring in technology-related fields start in 2010 and grow stronger in 2011. When Lawrence Tech held its annual technology jobs fair in conjunction with nearby Oakland University in September 2011, employer attendance was 74 percent higher than the previous year, and the two universities had to turn away employers for the first time.

"The Big Three and Tier I suppliers were there, and there was also a nice blend of industries and companies of different sizes. Almost all of them had actual positions to fill," Pierce said.

Computer engineering, electrical engineering, and computer science were the degrees most in demand, and there was an increase in opportunities in aerospace.

The trend that Pierce first saw developing in Michigan almost two years ago was confirmed by a report released by TechAmerica in October 2011 that showed Michigan added more tech jobs than any other state between 2009 and 2010. Job gains in key sectors like software and research and development have helped the state recover from hard economic times, according to the industry group based in Washington, D.C.

In September 2011, *Newsweek/The Daily Beast* ranked Michigan number one in job growth, and CNN and Bloomberg have described Detroit as the next Silicon Valley.

Michigan's large technology sector was largely overlooked during the recession when the state's unemployment rate rose above 14 percent. But a 2011 survey by the Anderson Economic Group of East Lansing showed that southeast Michigan was second only to Silicon Valley in terms of architecture and engineering employment, coming out ahead of recognized tech centers like Boston, Seattle, and Austin.

Southeast Michigan had the highest concentration of technology jobs in the Midwest, 13.7 percent of all jobs compared to the national average of 9.3 percent. Michigan's other technology center based in Grand Rapids was second in the Midwest, followed by Minneapolis.

For years, economists have warned that Michigan was too dependent on the shrinking auto industry and faced economic catastrophe if the state's economy didn't become more diversified. While the auto industry has become much smaller and the state's economy has become more diversified, the auto industry still remains at the center of the state's economy.

"The auto industry still drives this region," Pierce said. "The recovery of the auto industry allows suppliers and many other companies to remain in business here, and many of those companies are diversifying into other areas like aerospace."

Engineers are in great demand again because the auto industry must employ new technologies to gain competitive advantages in the global market and also meet quality goals such as better fuel efficiency. But these companies have shed thousands of engineering jobs during the past decade, and many of the engineers who remain are approaching retirement age.

The result is a strong demand for newly minted engineers with bachelor's and master's degrees as the automakers and their suppliers fill vacant positions and create new ones. "This is a great time to work in the automotive industry because the companies are reinventing the way they do everything," Pierce said.

In recent years, some Lawrence Tech engineering students switched to the emerging field of biomedical engineering to find employment in the growing health care sector, but they found jobs in the automotive industry instead.

"Safety issues and ergonomics have created many opportunities for biomedical engineers in the automotive industry," Pierce said. ☐

In the summer of 2011 students from the six universities in the Dynamic Compass Network toured the Henry Ford in Dearborn while attending the Creativity, Innovation, and Ingenuity Summer Enrichment Program hosted by Lawrence Tech in partnership with the museum. At the far right are Lawrence Tech hosts Andrew Gerhart and Donald Carpenter.

Building entrepreneurs

University collaboration prepares graduates to make a difference

"Students are going to need to be more entrepreneurial minded. Even if they are working within a corporate context, they will need to be more diligent at seeing opportunities not only for themselves but for their corporations."

Those words from Donald Carpenter, associate professor of civil engineering at Lawrence Tech, sum up the goal of the Dynamic Compass Network, a collaboration of six universities seeking creative ways to improve entrepreneurial education for undergraduate students.

"This network is set up to help students recognize opportunity, learn how to be critical thinkers and critical innovators, and then to use that for the benefit of their employers or for themselves if they go out into their own businesses," said Carpenter, who serves as Lawrence Tech's project director for the three-year program.

Lawrence Tech, Boston University, Gonzaga University, Kettering University, Saint Louis University, and Worcester Polytechnic Institute are all members of the Kern Entrepreneurial Education Network (KEEN). They formed the Dynamic Compass Network in October 2010 to share innovative approaches to entrepreneurial education in curricular innovation, faculty development, practitioners' community, student collaboration, and experiential learning.

The six universities will receive a total of $2.4 million in grants over three years from the Kern Family Foundation and the DCN grant builds on the five-year, $1.1 million grant Lawrence Tech was awarded in 2009 from the Waukesha, Wis.–based foundation to further integrate the entrepreneurial mindset effort. Lawrence Tech has taken a lead in this initiative with several pilot projects in the first year that provide benchmarks for the Dynamic Compass Network. Now that the six universities are connected, active participants, future funding for each university depends on the success of all six, Carpenter explained.

Each college must clearly demonstrate that the network provides "a unique benefit to all of their students over and above what they could do for their students individually," according to KEEN Program Director Timothy Kriewall.

Kriewall emphasized that getting the universities to work collaboratively was a major goal for the Kern Family Foundation. "It will be increasingly difficult for schools to receive larger grants if they are not able to demonstrate alliances with other schools in the network," he said.

The Dynamic Compass Network began its interconnected program in earnest in May 2011 when faculty from the institutions gathered for a week-long, problem-based learning workshop developed to enhance the undergraduate classroom experience. The Network really showed its potential in August 2011 when 24 students from the six universities participated in a week-long Creativity, Innovation, and Ingenuity Summer Enrichment Program hosted by Lawrence Tech in partnership with the Henry Ford. The camp included three days of instruction at Lawrence Tech and two days of touring and instruction at The Henry Ford in nearby Dearborn. Students learned about pioneers in American innovation and visited the Rouge F150 Assembly Plant.

Andrew Gerhart, associate professor of mechanical engineering and a widely respected expert in thermodynamics and fluid mechanics, led the summer workshop along with Carpenter. In 2010, Gerhart was named Michigan's Professor of the Year for excellence in undergraduate teaching and mentoring by the Carnegie Foundation for the Advancement of Teaching and the Council for Advance-

During a development workshop in May 2011, Lawrence Tech faculty work on their problem-based learning strategies that have been added to the curriculum as part of the Kern initiative on entrepreneurial engineering education. From left to right are Filza Walters, Lewis Frasch, Andrew Gerhart, Hiroshan Hettiarachchi, and Eric Meyer.

The Legends Entrepreneurial Student Awards

In 2011, the Kern Family Foundation provided $15,000 to teams of students working on senior projects as part of its overall support of entrepreneurial engineering education at Lawrence Tech. The recipients were selected by a panel representing the LEGENDS, a group of Lawrence Tech alumni who have been business entrepreneurs.

Projects Funded – Spring and Fall 2011

Project Title: Design of Novel Ligament Tissue Engineering Scaffold for Use in a Cyclic Bioreactor
Description: A ligament holder for growing tissue for treatment of knee injuries
Students: Megan Richardson-Frazzitta, Joseph Seta, Khoeung Chov

Project Title: Head-controlled Power Wheelchair
Description: Head-controlled device to increase mobility of paraplegic/quadriplegic patients
Students: Haider Abdulzahra, Jack DiGiovanni

Project Title: Takeoff and Landing (robotic plane)
Description: New design for vertical takeoff and landing of an unmanned aerial vehicle
Students: Zeran Gu, Z. Wang

Project Title: Iontophoresis Glove
Description: A unique glove that can be used for the treatment of a skin condition known as hyperhidrosis.
Students: Brian Podczervinski

Project Title: Hydro-Electric Test
Description: Hydro-electric test stand that can be used to explain the basic concepts of how a hydro-electric plant produces electricity
Students: Amy Tsang, Ian Williams, Garnett Davis, Erick Blank

Project Title: : VeriTEK – Car Rack
Description: The cartop carrier of the future
Students: Collin Graw, Jack Larabee, Zakariya Abu Zaid

Project Title: Controllable Pneumatic Suspension
Description: Controllable vibration damping device
Students: Oscar Tache, Erick Nickerson, Paul Wells

Project Title: Hidden Assets
Description: A product that protects valuables in cars
Students: Robert Ramirez, Paul Krupa

Project Title: RABCO Infrared Grill
Description: A unique grill for apartment dwellers with no propane or open flame
Students: Admad Bass, Frederick Red, Hussain Alessa

Project Title: The Grout-Gater
Description: Great for cleaning tile floors
Students: Kevin Bartos, Douglas Hocking, Nader Al Olotaibi

Project Title: Chair Booties
Description: Chair leg slip-ons that protect floors
Students: Jeffrey Scott, Gordon Merriweather

Project Title: Traffic Turbine
Description: A revolutionary "orange barrel flasher" charged by wind and solar
Students: Christian Sodeiikat, Kevin Jammer

Project Title: I-Shower
Description: The shower head for everyone with a digital clock, timer and flow meter
Students: Joan Brown, Lance Bowles, Andrew Bauer

Project Title: The Shingle Shucker
Description: A pneumatic-powered roof shingle removal device
Students: Nancy LaBelle, Matt Calahan, Rory Walters

Project Title: Gutter Gizmo
Description: A unique product that cleans house gutters efficiently
Students: Jason James, S. Sandoval, Ryan Morabito, A. Michailu

Project Title: Solar Power Fountain
Description: An artistic solar or line-powered fountain
Students: Bipin Dhakal, Jason Murphy, Jacob Smith

ment and Support of Education.

"When I heard about the program, I jumped at the opportunity to spend a week with Dr. Gerhart and a bunch of open-minded engineering students from around the country," said Ben Bargman, a senior majoring in mechanical engineering and one of four Lawrence Tech students participating in the summer session.

"The time spent in class was fun and engaging and really got everyone to think much more creatively by the end," Bargman said. "One of the most difficult parts was re-learning how to come up with crazy, ridiculous ideas and not saying anything negative about anyone's ideas until the judging step. We also participated in team-building activities at the beginning that taught everyone about the importance and difficulties of good communication. This really helped everyone lower some walls and do a better job of working together throughout the week."

Sylvia Moore, a junior majoring in construction management, found the summer program to be "very enlightening and edifying," particularly in its focus on creativity and building an awareness of one's capabilities.

"It increased my awareness of the God-given talents that I possess and developed a greater capacity in me to influence the world creatively," she said. "Creativity is like a child. If nurtured and cultivated it will develop to its full potential. In a creative environment, it will flourish and exceed a person's wildest dreams; if left idle and untapped, creativeness will be stifled."

Moore has continued her involvement in the program and recently was named a student entrepreneurial ambassador for the program and the Collegiate Entrepreneurs Organization (CEO) Club on Lawrence Tech's campus.

The innovation camp prompted additional activity at the other DCN schools with Saint Louis University students applying what they learned toward student challenge competitions at their institution. The 2012 version of the summer camp will be hosted by Boston University, whose students are also applying what they have learned on their campus.

As the program continues to build momentum, the six Dynamic Compass Network universities will build on shared experiences and develop innovative programming through synergistic interaction. Over the course of the year, teams of Lawrence Tech faculty will visit every school in the network. The participating universities also keep in regular communication through conference calls and online meetings as they build upon common interests, including robotics, first-year design experience, ethics, technological entrepreneurship, and commercialization. The Kern Family Foundation will promote this interaction through conferences, workshops, publications, and a website. ☐

Lawrence Tech senior Samantha Hutson works with Assistant Professor Eric Meyer on her directed study in the biomechanics of the knee.

GOOD SPORTS

Students support a professor's research to find ways to reduce knee injuries

Sports-related injuries – typically to the knee and ankle – represent an estimated 10 to 19 percent of all injuries treated in emergency rooms. For some athletes, such injuries can signal the end of a season or, in severe cases, even a career.

For half a century crash test dummies and computer simulations have been used to save lives and prevent injuries in automobile accidents. Using a newly developed three-dimensional computer model of the ankle, researchers at Lawrence Tech are applying the same methods to understand and prevent sports injuries.

"This type of simulation is very appealing for modeling experiments because it is relatively easy to make modifications to the anatomy and geometry to investigate many different questions about how certain motions/forces produce ligament sprains in sports situations," explained lead researcher Eric Meyer, assistant professor of biomedical engineering.

"By applying these results through working with equipment manufacturers and sports governing bodies, we hope to turn the tide for serious knee and ankle injuries in athletes, so that everyone can increase their enjoyment of sports."

The researchers are studying anterior cruciate ligament (ACL) tears in the knee and high ankle sprains – two of the most severe sports injuries at those joints. ACLs are one of the most popular topics for research, but the injury mechanism remains beset by many unknowns and therefore prevention strategies have had only limited success so far, Meyer noted.

"High ankle sprains have had only limited attention, but there are high-profile cases, such as Rob Gronkowski of the New England Patriots in the AFC Championship game in January, that follow our hypothesis for why this injury happened," he said. "A major factor that could be addressed through engineering is designing the shoes or artificial surface to a certain injury threshold."

Two senior biomedical engineering students are working on directed-study projects related to this research. Brian Figueiredo began the development of a computational model of the whole human lower extremity last summer, by isolating the bones of the leg and foot from CT images and reconstructing them into a 3D CAD model.

Student Samantha Hutson is adding realistic ligaments to the knee joint so that the researchers can use this model to simulate dynamic experiments that investigate various ligament sprain injury mechanisms in cadaver knees.

"Having a model that will function realistically like the knee joint is important because it gives us all more knowledge on the different movements of the ligaments during an injury. That knowledge allows us to find solutions to prevent injury or lessen the damage in the injury," said Hutson, who is finishing up dual majors in biomedical and electrical engineering.

Hutson said she would like to work in tissue engineering and help in the search for ways ameliorate knee injuries and reduce the need for knee replacements. Her directed study with Meyer should be a step toward that career goal.

Meyer will be presenting at a sports-injury conference in Dublin in September about different ways that his research team has used a similar ankle model to simulate many sports situations. The team has built six subject-specific ankle models using this approach and has submitted a paper to the software developer Materalise for its MIMICS Innovation Awards. ☐

A LEG UP

Researchers explore a multifaceted approach for regenerating critical ligament tissues

Each year an estimated 200,000 people in the United States suffer painful and potentially debilitating anterior cruciate ligament (ACL) tears, and the number is growing annually. Such injuries are particularly common among athletes and the elderly.

The ACL connects the femur and tibia in the knee and provides stabilization during motion, but surgery to replace the torn ligament can lead to complications later in life. A process known as tissue engineering may be a better option, according to Yawen Li, assistant professor of biomedical engineering.

Li heads a research team that seeks to regenerate ligament tissues using a combination of cells, biomaterial scaffolds, and mechanical and biochemical stimulations.

The biomaterial scaffold is an artificial structure capable of supporting three-dimensional tissue formation. It provides a structure that mimics the in vivo microenvironment of the target tissue. Cells are seeded into the scaffold, attach and proliferate, secrete growth factors, and form their own matrix. During this process, the scaffold – usually made of biodegradable polymers – initially will provide mechanical support to the cells, and will gradually break down, until the new tissue is formed and takes over the mechanical load.

"The knowledge we gain from this study will help us in the design and optimization of scaffolds for ligament regeneration. It also provides useful reference for other researchers who might choose the materials for the regeneration of other tissues or organs," Li said.

Tristan Maerz, BSBmE'09, an engineer in the Department of Orthopaedic Research at William Beaumont Hospital, first brought the idea for this research to Lawrence Tech. Beaumont is a major collaborator on the project. Joseph Corey, M.D., at the University of Michigan is another collaborator.

The research team is using a state-of-the-art environmental scanning electron microscope to study the mechanical properties and microstructure of different types of nanofiber scaffolds. It is also used to conduct various biochemical tests to evaluate the interaction of the cells with the polymeric nanofiber materials.

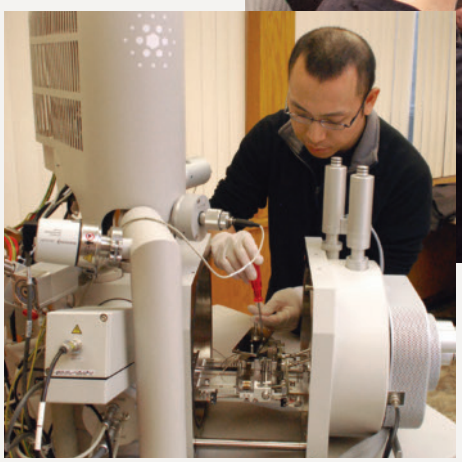
The project started in January 2010, when a team of three biomedical engineering students took it on as their senior design project. They successfully designed and fabricated a bioreactor before graduating in May 2011. Then the current team of Kheoung Chow, Joseph Seta, and Meagan Richardson-Frazzitta took over, also as their senior design project. When they complete their project this May, Li expects another team to continue the study.

Richardson-Frazzitta is primarily involved in the cell-biomaterial interaction study, while Seta and Chow are focusing on the mechanical testing.

"Understanding how the cells interact with these scaffolds, as well as how mechanical stimulation affects their behavior, will allow us to optimize our process to provide an ideal environment to encourage cell proliferation and the production of collagen. Results from this study will provide data necessary to move forward with ligament tissue engineering using biodegradable scaffolds," said Richardson-Frazzitta," a biomedical engineering major.

This student team was one of 16 that won funding support during 2011 from the Kern Family Foundation as recipients of the Legends Entrepreneurial Student Awards. ☐

Lawrence Tech Assistant Professor Yawen Li (second from right) plans a test with the members of a student team, Joseph Seta, Meagan Richardson-Frazzitta, and Kheoung Chow.



Lawrence Tech student Kheoung Chow prepares the environmental scanning electron microscope for a test.

GETTING TO GREEN

Demand for hybrid and electric vehicles drives new curriculum

Lawrence Tech student research assistants Jesse Paldan and Wei Yao and Professor Vladimir Vantsevich discuss laboratory experiments for a new curriculum they are developing on hybrid-electric and hybrid-hydraulic vehicle engineering.

Lawrence Tech is playing a leading role in developing a Bachelor of Science in Mechanical Engineering curriculum focusing on hybrids and electric vehicles that will serve as a model for other colleges and universities seeking to turn out a new generation of engineers with a knowledge-based mindset toward "green" vehicle development.

Professor Vladimir Vantsevich of Lawrence Tech's A. Leon Linton Department of Mechanical Engineering is leading the project in collaboration with Macomb Community College, which has received a grant from the National Science Foundation to develop a new automotive engineering center. Two student research assistants, Jesse Paldan and Wei Yao, are helping him with core development.

Vantsevich represents Lawrence Tech in the Michigan Academy for Green Mobility Alliance (MAGMA), an organization dedicated to ensuring that the automotive industry has the trained workers it needs to grow and prosper in the emerging "green economy."

"At MAGMA, we work together to determine how to make vehicles more 'green' than they are today, and one approach is hybrid electric vehicles,"

> "At MAGMA, we work together to determine how to make vehicles more 'green' than they are today, and one approach is hybrid electric vehicles."

Vantsevich said. "The problem is how to educate undergraduate students in this area."

In response to industry's requirements, education and training institutions such as Lawrence Tech support MAGMA by developing learning opportunities that are targeted, innovative, flexible, and have a strong focus on hands-on practical experience.

Vantsevich said the project will expand the existing undergraduate engineering curriculum to introduce students to the unique mechatronics design considerations involved in hybrid-electric, hybrid-hydraulic, and fully electric vehicles. This includes four modules for an existing course, Introduction to Mechatronics, and a new course, Introduction to Hybrid and Electric Vehicle Engineering.

In the laboratory, students will use equipment from Festo, a German company that specializes in automation

technology, and a robotic vehicle donated by National Instruments Corp., a firm that produces automated test equipment and virtual instrumentation software.

The new curriculum targets junior and senior undergraduate students majoring in mechanical and electrical engineering. In addition, the upgraded course, Introduction to Mechatronics, will be a prerequisite course for graduate students in automotive engineering, mechatronic systems engineering, and mechanical engineering, who did not take courses on controls and dynamics in their undergraduate study.

"This new hybrid and electric vehicle engineering course will be placed in the public domain," Vantsevich explained. "It will be accessible to others who want to develop a similar course at their institutions."

> "Introduction to Mechatronics will be a prerequisite course for graduate students in automotive engineering, mechatronic systems engineering, and mechanical engineering."

The project is implemented in the new 2,140-square-foot Mechatronic Systems Laboratory and the 2,900-square-foot Vehicle Dynamics Laboratory, which houses Lawrence Tech's unique four-wheel-drive vehicle chassis dynamometer with individual wheel control. The dynamometer is used to conduct industry research in areas such as vehicle traction control, turn ability and ride stability, acceleration and braking, all-wheel-drive driveline system performance, diagnostic testing, safety systems, fuel efficiency improvement, and emissions testing. The new course includes lab work on the dynamometer. ☐

Lawrence Tech inks 'green' agreement with German institution

Lawrence Tech has signed a three-year agreement with Germany's Thuringia Center for Innovation and Mobility to cooperate in the development of mechatronic vehicle systems and other innovative technologies for "green" mobility, such as hybrid and electric ground vehicles.

The two institutions agreed to explore programs to benefit researchers, students, and faculty in Germany and the United States, in keeping with their commitment to "mutual understanding for scientific and academic growth through transatlantic research activities and intercultural education."

The cooperation will begin with a work plan developed by Professor Vladimir Vantsevich, director of the Mechatronic Systems Laboratory at Lawrence Tech, and Klaus Augsburg, director of the Thuringia Innovation Center for Innovation and Mobility, which is associated with Ilmenau University of Technology in Germany.

"Both partners, Lawrence Tech and Thuringia Center, can gain much from working together on the industrial applications of mechatronics. Lawrence Tech's location at the center of the automotive industry in the United States should provide new opportunities for our German colleagues, and our German partner will provide access to European industry," Vantsevich said.

Mechatronics is a multidisciplinary field of engineering that incorporates aspects of mechanical engineering, electronics engineering, computer engineering, software engineering, control engineering, and systems design engineering. Lawrence Tech's master's program in mechatronics, launched in 2006, concentrates on conventional and unmanned vehicle and industrial robot engineering. ☐

Vladimir Vantsevich (L), director of the mechatronics program at Lawrence Tech, presents a document to be signed by Lawrence Tech President Lewis Walker and Matthias Machnig, minister for economics of the German state of Thuringia.

ROBOTICS RESEARCH

Students utilize mechatronics systems in search for cheaper unmanned vehicles

Lawrence Tech student Zeran Gu tests his unmanned aerial vehicle in the first-floor hall of the Engineering Building.

Some 20 companies around the world manufacture unmanned aerial vehicles or UAVs at an average cost of $27,000 each. At Lawrence Tech, an undergraduate mechanical engineering student is developing a UAV model that, if successful, could cost as little as $500.

With no pilot on board, UAVs can be remote controlled – flown by a pilot at a ground control station – or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems.

Zeran Gu, who will receive his bachelor's degree in mechanical engineering in May, launched his UAV project as a junior under the guidance of Professor Vladimir Vantsevich, director of the University's Master of Science in Mechatronic Systems Engineering degree program. It is one of nearly 25 student projects related to autonomous vehicles and robotics currently in progress at Vantsevich's Mechatronic Systems Laboratory.

Gu's project is financed by a $1,000 grant from Lawrence Tech's Alumni Fund, coordinated by Senior Lecturer Don Reimer, director of entrepreneurial programs in Lawrence Tech's College of Engineering. Last year Gu, who has built 10 UAV models, received the Autonomous Vehicles and Robotic Systems Outstanding Student Award from the University.

"Zeran built the very first quad-copter at Lawrence Tech. It is a learning project and a very advanced student project at the undergraduate level. He learned a lot in addition to his courses in the BSME program," said Vantsevich.

Vantsevich is the faculty adviser to the Autonomous Vehicles and Robotic Systems Student Research Committee, which is part of the Great Lakes Chapter of the Association of Unmanned Vehicle Systems International (AUVSI). The first AUVSI Student Research Committee in Michigan and perhaps the entire country was made possible with help from co-advisers Bruce Legge, president of the Great Lakes Chapter, and John Wilson, sales and engineering manager of National Instruments, a strong supporter of Lawrence Tech's mechatronics program.

Gu's "quad-copter" UAV is about one-half operated by remote control and about one-half controlled by an internal navigator. "It is equipped with a camera on board that provides real-time video transmissions. It senses distance from the ground. It also senses obstacles and can avoid them automatically. This is called obstacle avoidance," Gu said.

As the project continues, Gu's next step is to add a GPS and compass sensor. After that, he plans to develop a "friendly" human interface on a computer to make operation easier.

"The most important goal of this entrepreneurship project is to develop a

> "With no pilot on board, UAVs can be remote controlled – flown by a pilot at a ground control station – or can fly autonomously based on pre-programmed flight plans."

cost-effective vehicle, not to make money from it. Personally, I hope more students will be interested in next generation of aviation technology," Gu said. "UAV is a high technology. Tomorrow, it will not be a high technology."

Military use of UAVs has grown exponentially in recent years, but there are a variety of non-military uses as well. For example, Gu said, architectural engineering students could use these vehicles to take pictures of buildings or terrain from the air while meteorology students could use them to measure temperature, wind, pressure, and humidity. ☐

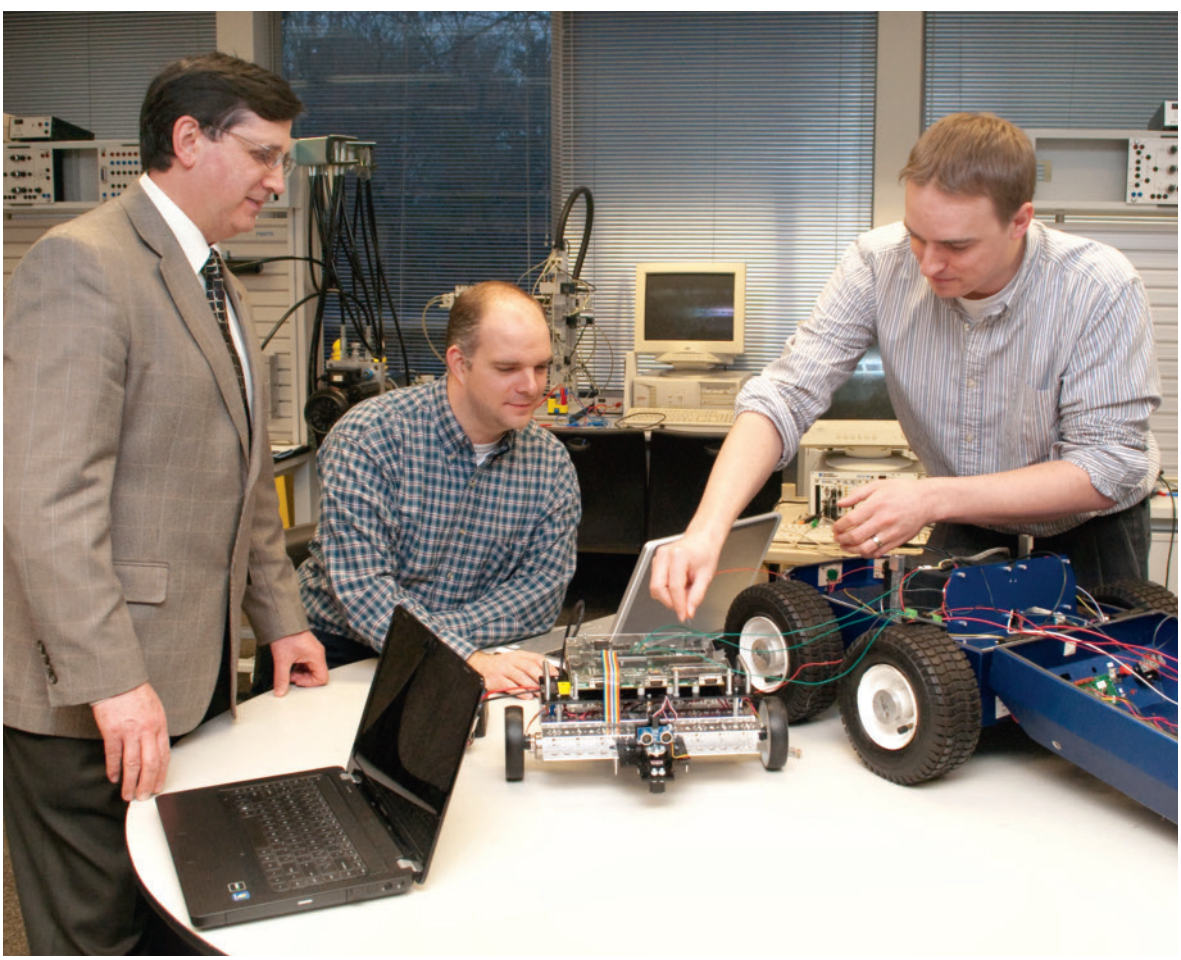
Students build 4x4 unmanned ground vehicle

Matthew Siero and Tim Wilson are working on a 4x4 unmanned ground vehicle (UGV). The robotic vehicle is equipped with sonar distance sensors, a three-axis accelerometer, a yaw sensor, and wheel encoders. The robot features a National Instrument sbRIO board that employs a newly developed code for the Labview model-based controls of the robot's motion.

Siero is pursuing a master's in mechatronic systems at Lawrence Tech while working fulltime as a mechanical engineer for DCS Corp. Wilson received his master's degree in mechatronic systems in December and returned to campus to help finish the project they started together last fall.

"As a student, I am integrating both the electronics and mechanics as well as writing the control software," said Siero. "This gives me an opportunity to learn the hardware and software side of designing and building a mechatronic system."

Siero, Wilson, and Chris Kopchick, MBA'10, already have published a research paper based on a project they did with Professor Valdimir Vantsevich in 2011. "In our current project, Tim and I are implementing in hardware a novel algorithm to control the vehicle dynamics and energy efficiency of the UGV. We do this based on the optimal power distributions between the four independently driven wheels," Siero said. ☐



Professor Vladimir Vantsevich discusses the wiring for an unmanned ground vehicle with Tim Wilson, MSMSE'11, and graduate student Matt Siero.

Student solutions

Industry-sponsored senior projects put students to work on real-world research

For 80 years Lawrence Tech engineering undergraduates have been provided the opportunity to put into practice the theory they have learned in the classroom through senior projects. Now that concept has been taken to the next level with the Industry-Sponsored Projects Lab where students are no longer practicing, but instead are contributing to the research and development needs of real companies.

Engineering seniors (L–R) Kyle Stopczynski, Deeyonna Gray, and Ahmad Al Hilal are analyzing data for Ford Motor Co. prior to graduation.

This academic year two student teams are working on automotive projects. One team is working with Ford Motor Co. to gather data needed for modeling a new engine's performance, while another team has been asked to improve the design of a foldaway seat in a Chrysler minivan.

"This is really a once-in-a-lifetime opportunity to work on a complex project," said Todd Wilmore, a member of the student team working with Magna International Inc., the Tier I supplier that manufactures the "Stow-n-Go" seat for Chrysler Group LLC.

The Industry-Sponsored Projects Lab is a logical outgrowth of Lawrence Tech's long-standing "theory and practice" philosophy. It also fits into the more recent emphasis on cultivating the entrepreneurial mindset, which has become a major goal for undergraduate engineering programs.

All Lawrence Tech engineering students are required to complete a capstone project in their senior year in order to graduate. By the time they are seniors, these students have the technical expertise to work on complex projects, and many have practical experience working as interns or employees of manufacturing companies.

Filling a need in industry

The Industry-Sponsored Projects Lab was created two years ago by faculty of the A. Leon Linton Department of Mechanical Engineering. The economic recession had reduced the research and development budgets in the manufacturing sector, and many companies in the metro Detroit area had more R&D projects than they could keep up with.

Lawrence Tech faculty saw a unique opportunity to make it easier for companies to tap into the expertise, energy, and enthusiasm of top-notch faculty and

> "The process begins when the business partner identifies a design project that requires conceptualization, engineering computations, a final design, prototyping, and testing."

Todd Wilmore (R) discusses the measurements from a force gauge with his teammates on a industry-sponsored senior project, Dan Pniewski (kneeling) and Mike Hilligoss.

students in the College of Engineering while gaining access to Lawrence Tech's high-tech testing and diagnostic facilities. It's a high-quality, cost-effective way to conduct research or develop products.

The benefits are both practical and educational, according to Vernon Fernandez, coordinator of the lab and associate professor of mechanical engineering.

"Companies benefit by participating with academia, where new ideas are born, and they benefit from getting their projects completed," Fernandez said. "Students benefit by being able to work on real-world projects and also by being exposed to professionals from industry and working toward their standards. Lawrence Tech benefits because its faculty is working with industry on current projects and applications."

The process begins when the business partner identifies a design project that requires conceptualization, engineering computations, a final design, prototyping, and testing. Then a cross-disciplinary team of three to five students tackles the project for one or two semesters. Working with a faculty mentor and with guidance from the an advisory board, the team gives weekly status reports, formal oral presentations, and a confidential final report documenting results.

The client company pays a nominal fee to cover expenses and provides a mentor and materials for its design project. The company retains ownership of any technology that is developed and sets its own confidentiality requirements.

Stepping into the real world

Of course, students acquire invaluable knowledge in the process. In many cases, the lessons that have been taught in the classroom are reinforced through interaction with industry executives.

"It turns out that what their professors have been saying makes a lot of sense in the real world. This is not an ivory tower. Yet there has to be a transition from the theoretical to the technical, and the industry-sponsored projects are an excellent way to accomplish that," Fernandez said.

Students quickly learn what is expected when communicating with engineers and managers in industry. They have to use the correct technical terms and not fall back on colloquial or imprecise language. Each company has its own set of rules that must be observed.

"The students quickly realize that in a professional environment there are a series of 'hard stops' that must be met. There are timelines and deadlines, budgets, and specifications," Fernandez said. "Industry demands can be pretty brutal at times."

Building a better mousetrap

The student team working with Magna on the "Stow-n-Go" seat for Chrysler are stepping into the shoes of seasoned product designers and engineers. An R&D team at Magna probably spent close to a year taking the seat's storage assembly from concept to production. Now that the Magna team has moved on to other projects, the students have been given the task of finding a way to make the storage process more user-friendly.

Magna provided the students with the full specifications for the seat. Their job is to do computer modeling of proposed changes using CATIA, buy test components, and then modify them to fit in with the new proposed design.

One of the first things the students learned is that product design is a process of trial and error. More than once, they spent a couple of weeks on a proposed modification only to discover that an unanticipated safety issue returned them to square one.

"We learned that this wasn't going to be as simple as we originally thought. It's

quite complex because all the components have to work in snychronization," said team member Mike Hilligoss, a returning student who has a fulltime job working on interior trim for fire trucks.

Working through failures is perhaps the most educational aspect of a senior project, according to Assistant Professor Giscard Kfoury, the faculty advisor for the team working with Magna.

"The students learn the most by trying out ideas and eliminating them. This is their first real design project," Kfoury said.

Filling the need for more data

Manufacturing in the 21st century relies more and more on sophisticated computer programs that can model parts and processes and predict their performance. That approach has created the need for more and more data.

That's the situation at Ford Motor Co. following the introduction of a new turbocharged V-6 engine model for the Taurus SHO. Ford engineers need to assess the performance of this new product and investigate ways to make it perform more efficiently in the future. But even a global enterprise as large as Ford doesn't always have the manpower available for all the research projects. Moreover, companies like Ford like to provide opportunities for students to research real-world problems to create better engineers who will be enthusiastic about advanced engineering research.

That's a role Lawrence Tech students can play in a research project that tracks universal exhaust gas oxygen (UEGO). One measurement that the Ford engineers want to track is the impact of exhaust temperature and flow rate on the sensor's power consumption. One problem researchers must overcome is that the turbo makes it harder to keep track of heat losses.

Ford engineers installed measuring equipment in the trunk of a Taurus SHO, and then it was up to the Lawrence Tech student team to collect the data.

"We monitor data coming from a sensor mounted right after the catalytic converter. The goal is to obtain data on the heat of the exhaust under different conditions and model the exhaust and sensor response," said student team member Kyle Stopczynski.

"The students learn how their work has a role in a global enterprise. If their piece fails, then the whole enterprise can fail," Fernandez said. "These projects help them understand how the world works and why. They are learning why we are doing what we do, and that makes them better engineers." ☐

LAWRENCE TECH STUDENTS CO-DEVELOP PRODUCTS FOR VENTURE CAPITAL FIRM

Lawrence Technological University and Sargon Partners of Walled Lake, Mich., have a nonbinding agreement for commercializing new products developed by students.

The agreement came about in 2011 after three student teams working on senior projects in the Department of Engineering Technology co-developed products that Sargon deemed worthy of taking to market.

When Sargon identifies a student project with commercialization potential, Lawrence Tech will provide commercialization rights for a limited time period. The University will also provide supporting information for the product's intellectual property, including prototypes, manufacturing plans, engineering designs, University assistance, documentation, and market research.

In return, Lawrence Tech can expect to receive a 5 percent royalty or equity stake in the resulting venture. The exact terms will be determined in a contract for each product that will also include the role and compensation for the students who developed the product.

"We want the students to become the management team with equity in the company that developed the product," said Jeff Golota, managing director of Sargon Partners. "The students who developed the product, understand the technology, and are passionate about the product are the ideal team to take that product to market."

The first product developed under the agreement was Super Squat, a safety device for athletes doing barbell squats for lower-body weight training. That project was also the first to receive a $1,500 Professor George Schneider, Jr. Senior Project Award, which was created to bridge the gap between academia and industry. ☐

Super Squat is a safety device for weightlifters developed by Lawrence Tech students (L-R) Bahaa (Bill) Harp, Jonathan Reynolds, and Keith Bohlinger.

Company Collaboration 'Real world' problem solving enhances learning while aiding corporate partners

Teoresi Inc. President and CEO Giuseppe Santangelo talks to Lawrence Tech students who expressed an interest in doing research for his company.

Independent contractor agreements between Lawrence Tech and global corporations play an important role in the University's innovative research work and engineering in the Master of Science in Mechatronic Systems Engineering program.

"Independent contractor agreements have a very specific goal with specific outcomes, which immediately go to a company's engineering or contribute to the company's research in novel directions," explained Professor Vladimir Vantsevich, founder and director of the mechatronics program and professor of mechanical engineering. "By doing such contract work with companies, we take a responsibility and risk to deliver a real product."

In March, Lawrence Tech launched a project to develop original engineering cognitive functions in the framework of Teoresi Inc.'s Cognitive Diagnostic Equipment (CODE). Based in Troy, Teoresi Inc. is the U.S. branch of Teoresi Group, an Italian firm that specializes in powertrain and infotainment technologies.

The research contract and joint teaching with Teoresi is paying multiple dividends for the University, which is seeking to extend its cooperative agreements with European companies, Vantsevich said.

Giuseppe Santangelo, president and CEO of Teoresi Inc., donated his time to develop and deliver three lectures at Lawrence Tech in February on spacecraft dynamics and navigation control system engineering topics, which is a new area for Lawrence Tech. The 14 students who took the course responded enthusiastically to the presented material and will be eligible to participate in the Teoresi research project.

Teoresi is also donating a software product and hardware to the College of Engineering. "By establishing a collaboration with Teoresi, we are launching a new strategic direction in our research and teaching – spacecraft and space vehicle engineering," Vantsevich said.

Students working with Vantsevich are currently involved in four independent contractor agreements, including an engineering project to design and test a prototype of a new robotic gripper and a collaboration on heavy-duty vehicles with a major OEM in Europe. Typically, such contracts involve non-disclosure agreements barring publication of specific details, Vantsevich noted.

Over the past three years, 15 research papers have been published by mechatronics students in scientific journals and proceedings of prestigious international conferences based on research established and advised by Vantesvich at Lawrence Tech's Mechatronic Systems Laboratory. ☐

Dean of Engineering Nabil Grace (R) explains some of the uses for carbon fiber to Michigan Gov. Rick Snyder (L) and Michigan Department of Transportation Director Kirk Steudle, a Lawrence Tech graduate.

Better bridges

Five states support research on alternative materials for highway bridges

Lawrence Technological University has received a three-year, $349,000 contract to evaluate alternative materials and a new approach to building highway bridges for the state transportation departments of Oregon, Minnesota, Wisconsin, and Iowa, in addition to the Michigan Department of Transportation, which is the lead agency for the research project.

The study is testing noncorrosive cables and ultra-high-strength concrete in a bridge design that is both easier to maintain and faster to construct because it doesn't have a cast-in-place deck slab. The project is supported by the pooled fund of the Federal Highway Administration, and utilizes allocations from the five states.

Dean of Engineering Nabil Grace and a research team that includes students are conducting the study in Lawrence Tech's Center for Innovative Materials Research (CIMR) to test the advantages of a pre-stressed decked bulb-T beam bridge design compared to side-by-side box beam bridges that have been widely used during the past 50 years in Michigan and other states.

The decked bulb-T beam has a wider upper flange than the traditional I-beam. The upper flanges of adjacent beams do not touch, and six inches of ultra-high-performance grout completes the connection to form the deck surface. The lower flanges of the I-beam are shorter, creating a cavity between the beams that makes it easier to inspect and repair the deck from underneath. The connection between adjacent beams is reinforced with two layers of non-corrosive carbon fiber composite cable (CCFC).

The study will also compare alternative noncorrosive reinforcement materials such as stainless steel and carbon fiber reinforced polymer materials.

"The ultimate goal is to develop and construct a bridge superstructure system with a service life of 100 years requiring less maintenance and fewer repairs that tie up traffic," Grace said.

Many bridges built with side-by-side box beams are now reaching the end of their service life, primarily because of corrosion of the steel reinforcement caused by water contaminated with salt and chlorides used to improve winter driving conditions. The conventional grout material used between the beams also deteriorates in the numerous freeze-thaw cycles of winters in northern states.

"Since the safety and mobility of the traveling public is a very important consideration when building or rehabilitating bridges, there is a need to develop a beam type that can be built using accelerated bridge construction techniques," Grace said.

The objectives of the study at Lawrence Tech's CIMR include:

- Develop a mathematical model of the proposed side-by-side decked bulb-T beam concrete bridge.
- Construct, test, and examine the constructability of a half-scale decked bulb-T beam bridge model with five transverse post-tensioned diaphragms and three control beams (two with CFCC and one with steel).
- Determine the optimum transverse post-tensioning level and the adequacy of the number of transverse diaphragms in the bridge model.
- Assess the suitability of the system for accelerated construction, part-width construction, and bridge deployment.
- Develop design recommendations for the deployment of the decked bulb-T beam bridge.

Since 1988, Grace has conducted more than two dozen studies for state and federal agencies that have pointed to the long-term reliability of carbon fiber reinforcement of concrete highway bridges. ☐

Lawrence Tech Project Engineer Charles Elder describes the process for testing a pre-stressed decked bulb-T beam bridge (in the foreground) to an audience that included government officials and media representatives.

Governor praises Lawrence Tech for innovative research on carbon fiber

Michigan Gov. Rick Snyder chose Lawrence Tech's Center of Innovative Materials Research (CIMR) as an appropriate setting for a major address on the state's infrastructure in October 2011.

Media representatives, government officials, and industry leaders filled CIMR to hear Snyder outline the problems caused by the $1.4 billion shortfall in infrastructure investment identified by a bipartisan legislative report. Possible solutions he suggested included a streamlined gasoline tax and higher vehicle registration fees.

Prior to the speech, Dean of Engineering Nabil Grace gave Snyder a tour of CIMR to show him some of Lawrence Tech's groundbreaking research on innovative materials to replace steel rebar used to reinforce concrete in bridge structures.

Carbon fiber is more expensive than steel, although the cost difference would be reduced if Tokyo Rope, the Japanese company that supplies carbon fiber rebar to Lawrence Tech, builds a plant in the United States.

Grace accompanied Snyder on a trade mission to Japan earlier in the year, and Snyder and Tokyo Rope signed an agreement to explore the possibility of locating a plant in Michigan.

Gov. Rick Snyder chose Lawrence Tech as an appropriate setting for his message about Michigan's infrastructure. (Photo by John Stormzand/South Oakland Eccentric)

In his speech at Lawrence Tech, Snyder said Grace's research on carbon fiber could have a dramatic impact on Michigan's economy. "Dr. Grace and his team have done truly wonderful research … that hopefully will bring companies to Michigan and truly bring innovation to transportation," the governor said. ☐

Michigan begins using carbon fiber for highway bridge reconstruction

Last year the Michigan Department of Transportation used a major renovation project on a Detroit freeway to experiment with carbon fiber in the reconstruction of a bridge, and the new approach will be repeated this summer on a three-span bridge in the city of Jackson.

The engineering specifications for using carbon fiber reinforced polymer (CFRP) materials in place of steel were developed at Lawrence Tech's Center for Innovative Materials Research (CIMR) Tech under the direction of Dean of Engineering Nabil Grace.

"We are partnering with Lawrence Technological University on this initiative in which carbon fiber is used instead of steel to prevent corrosion while maintaining the same strength and durability," said MDOT Metro Region Engineer Tony Kratofil.

The Pembroke Avenue bridge in Detroit was rebuilt with CFRP materials replacing steel for three major components:

- The transverse post-tensioning cables that tie together the box beams of the bridge's main supporting structure.
- Reinforcement of the bridge's concrete deck slab.
- Reinforcement of the concrete barriers on each side of the road bed.

Grace's research was first put to the test in 2001 on a bridge to an industrial park a few miles from Lawrence Tech. One lane was constructed with steel and the other with CFRP materials.

Every six months Lawrence Tech shares performance data with state and federal officials, and so far the CFRP components are performing as expected.

A bridge with CFRP materials developed at Lawrence Tech has also been built in Maine. ☐

SOUND EDUCATION

Audio engineering technology students learn how to perform in a production studio

Students in Lawrence Tech's new Bachelor of Science in Audio Engineering Technology program travel 20 miles from the Southfield campus to take many of their classes – and it's well worth the commute.

The academic theory courses are taken on the campus in Southfield, while the students strengthen the practical side with classes taken at an affiliate studio, Plymouth Rock Productions, a full-service audio/video production company in Plymouth, Mich. The production team's client list includes the Detroit Symphony Orchestra, J. Walter Thompson, Ford Motor Co., Aretha Franklin, and the popular music group 50 Cent Headrush, to name just a few.

Lawrence Tech's bachelor's degree program provides students with many opportunities in the audio field because they gain both a strong science background and practical production experience, according to Kenneth Cook, chair of the Department of Engineering Technology.

"While the students gain studio experience and work with industry professionals at Plymouth Rock Productions, they learn the physics and electronics of what goes on inside all these instruments here on campus," Cook said. "This program is in the right place at the right time for this industry."

> "Students have multiple extracurricular opportunities to develop their audio engineering skill sets by visiting real job sites and obtaining internships."

Plymouth Rock Productions owner Chris Breest is on the industry advisory panel that helped develop the program, and he applauds Lawrence Tech's emphasis on theory and practice.

"At the studio students immediately immerse themselves in the inter-workings of a functional recording business, as well as having an opportunity to make contacts with real industry professionals," Breest said. "This makes the traditional classroom setting come to life in a way that is not only educationally dynamic but also highly inspirational for students."

Lawrence Tech has made a concerted effort to bring instructors into the program like Ben Blau, Rob Nelson, and Dieter Giese, who all hold positions in the field of audio engineering and exhibit a true passion for what they are teaching.

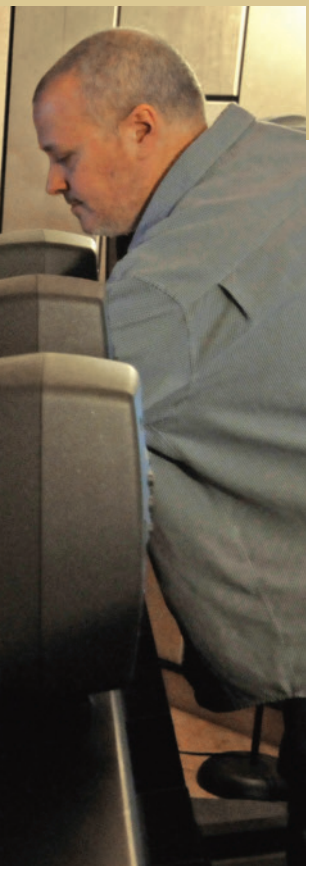
A recording engineer since 1982 and an instructor since 1990, Blau has authored books about the audio recording industry. Nelson owns a business that teaches music. Giese has more than 30 years of experience with acoustics and noise, vibration, and harshness (NVH) as a product development engineer with Ford Motor Co. He is now the owner/operator of his own company, GieseKustic, which provides sound measurement/monitoring consulting services.

Students have multiple extracurricular opportunities to develop their audio engineering skill sets by visiting real job sites and obtaining internships. Lawrence Tech students have worked at music publishing companies, recording studios, film sets, and NVH facilities. These are unique opportunities and experiences rarely available at other universities, according to Cook.

Brandon Wheeler, one of the 20 or so students enrolled in the program, said the experience has provided him with numerous opportunities.

"I started out by interning with Chris Breest and learning the fundamentals behind how most audio engineers work," he said. "During this time I was also in the classroom learning the ways of electronics and also acoustical concepts that will later help me out in my career."

As Wheeler progressed through the program, he obtained a position at North Star Media of Bloomfield Hills, where he



Instructor Ben Blau (R) of Plymouth Rock Productions points out some of the features of the Neve Custom Series 75 recording console to Lawrence Tech students Caitlin Carpenter (L) and Alex Porchia.

Lawrence Tech student Aaron Glasius works on Avid Pro Tools HD9, a software program used in the production studio that is also loaded onto the personal computer of every student in the audio engineering technology program.

Knowing how to play music helps students gain a better understanding of the principles of audio engineering. Lawrence Tech students Tayler Peruski (L) and Rachel Sweet play the keyboard and the guitar, and instructor Rob Nelson is on the drums.

learned more about the music publishing industry. He moved on to an internship as a transducer engineer at Harman Kardon, the pioneering company that helped create the high-fidelity audio industry.

"With the concepts and experiences from my previous terms at Lawrence Tech, I was able to confidently show my passion and knowledge in the world of audio," Wheeler said.

Another student, Rachel Sweet, said she is "super excited" with the audio engineering technology program and especially with the opportunity to study with Rob Nelson, who teaches music theory.

"Rob is teaching me the fundamentals of music that I need to know, such as learning how to read and compose music. Also, I am getting experience with other instruments. I played a bass guitar, drums, and piano all in one day!" she said.

"These classes will benefit me because knowing music production technology, I will be able to communicate and interact with other professionals in the field," Sweet said.

While there is a strong theoretical component to Lawrence Tech's program, it is the practical experiences that provide students with a unique edge, Cook said. ☐

Audio engineering offers wide variety of opportunities

Lawrence Tech's Bachelor of Science in Audio Engineering Technology blends the concepts of classical audio engineering with modern-day applications, including multimedia components, digital technology, computers, and network systems, to give students a strong set of skills with which to enter the field. In addition to studying the music principles of sound, students in this degree program are exposed to the electronics of audio transmission through their study of hardware, fiber and wireless technologies, as well as acoustics – the physics behind the sound.

From music to movies, from industrial to environmental applications, audio engineers play an integral role in bringing arts and entertainment, and even the sciences, to life. They combine creativity with their technical background to record, process, and ultimately create sound.

Audio engineering offers a growing spectrum of employment choices because it is a constantly changing field driven by advancing technology. Employment prospects are expected to grow even faster in the next few years. Broadcasting networks, multimedia firms, recording studios, theater productions, amusement parks, computer games, and film and video are some of the industries that hire audio engineers. ☐

In **Brief**

Lawrence Tech president honored for contributions to engineering and science

Lawrence Technological University President Lewis Walker has been awarded the 2012 Gold Award by the Affiliate Council of the Engineering Society of Detroit (ESD) for his many contributions to the field of science and engineering. He was nominated by the Detroit chapters of the American Institute of Architects (AIA) and the Institute of Electrical and Electronics Engineers (IEEE), both ESD affiliates.

Walker has served as president and CEO of Lawrence Tech since 2006. He joined the university in 1994 as provost and took on the additional role of executive vice president in 2003. He will be stepping down as president on June 30.

Walker holds a PhD in electrical engineering from the University of Missouri-Columbia. As a registered professional engineer, he was a principal investigator of numerous research contracts and helped develop systems to communicate with deeply submerged submarines anywhere in the world.

In 1982, Walker became dean of engineering and professor of electrical engineering at the University of Hartford and later also served as special assistant to the president. He has organized and presented many short courses and seminars on power system protection and power system dispatch operations. He has published more than 50 technical papers and has lectured in Europe, Asia, and South America.

Emphasis on leadership and entrepreneurship

Upon becoming president, Walker quickly identified leadership education as one of his top priorities, putting Lawrence Tech in the vanguard of what has become a national trend. The University has taken a comprehensive approach to undergraduate leadership education that helps Lawrence Tech students maximize their potential.

Students receive instruction and fulfill leadership obligations in all four undergraduate years. They participate in curricular and co-curricular activities to earn leadership transcripts through attendance in topical seminars, service activities that aid community charities, and student mentoring.

The leadership program has reinforced another initiative in the College of Engineering to cultivate the entrepreneurial mindset in undergraduate engineering programs. A $1.1 million grant from the Kern Family Foundation has helped Lawrence Tech pursue the ambitious goal of preparing engineering students to be leaders with an entrepreneurial spirit and a global view.

The grant has enabled the University to add entrepreneurial components to more than a dozen courses in the engineering curriculum, and a total of 30 courses will eventually be enhanced.

Lawrence Tech President Lewis Walker (L) is congratulated on his Gold Award by American Institute of Architects Detroit President Frank Arvan and Joseph Veryser, Lawrence Tech's university architect and past president of AIA Detroit.

More opportunities in engineering and science

After assuming the presidency in 2006, Walker continued to pursue academic priorities that he had helped put in place as provost and executive vice president – transportation design, sustainable architecture, emerging energy technologies, innovative materials, life sciences, and computer applications.

The growth of degree and fast-track certificate programs from the associate through doctoral level has been a hallmark of Walker's leadership. The number has jumped from 60 when he became president to over 100 today. Many involve emerging technologies in engineering and science. Some are the first in Michigan and among the first in the nation. *The Detroit News* called Lawrence Tech's new robotics engineering degree "education innovation at its best."

Walker demonstrated his own leadership style in the fall of 2008 when Lawrence Tech became the first university in the state to take a comprehensive approach for helping workers displaced by the economic crisis. He and his leadership team quickly put together the "Recovery Starts Here" initiative that benefitted many engineers whose jobs had been eliminated.

The centerpiece was the introduction of more than 35 "fast track" certificate programs designed to help displaced workers make a quick transition to new careers in emerging fields such as sustainability, alternative energy, and life sciences.

Cultivating the next generation of engineers

Under Walker's leadership, Lawrence Tech has played an active role in encouraging middle school and high school students to pursue their interest in science, technology, engineering, and math, the so-called STEM subjects. Lawrence Tech is the home of Robofest, an international competition in which students in grades 4–12 program autonomous robots. Lawrence Tech's summer camps encourage hundreds of high school students to develop their interest in STEM subjects that could lead to a college major and a promising career.

In 2005, Walker played a leading role in the creation of University High School (UHS), a unique partnership between Lawrence Tech and the Ferndale Public Schools. The public high school's rigorous curriculum was designed by Lawrence Tech faculty to prepare students for college, especially in the STEM subjects. Many UHS students receive instruction from college faculty on the Lawrence Tech campus.

Leading the way on the soccer field

Mechanical engineer majors Danny Reyes and Chadd Scruggs are co-captains of the Lawrence Tech soccer team that will join the Wolverine-Hoosier Athletic Conference in the fall. Last year Lawrence Tech joined the National Association of Intercollegiate Athletics and is now adding more varsity athletic teams. In the photo above, Reyes (L) slips by a defender during a 2011 game.

Bonanno kicks off entrepreneurial lecture series

Salvatore J. Bonanno, BSME'69, a former Chrysler executive now involved in multiple business enterprises, was the first speaker in 2011–12 Entrepreneurial Lecture Series sponsored by the Lawrence Tech chapter of the Collegiate Entrepreneurs' Organization and the Legends Entrepreneurial Alumni Organization, WWJ Newsradio 950, and the *Great Lakes Innovation and Technology Report.*

The lecture series, which is part of the College of Engineering's Lear Entrepreneurial Program, is designed to foster the University's commitment to leadership through theory and practice, as well as create an entrepreneurial mindset. The speakers give Lawrence Tech students a greater awareness and understanding of entrepreneurship – and how it can benefit all of us.

Bonanno held many executive-level positions during a 30-year career at Chrysler Corporation. A turnaround specialist, he has been chairman of the board of two manufacturing companies. In 2000, he formed Bonanno Enterprises, LLC, an acquisition and consulting organization specializing in manufacturing companies.

Lawrence Tech alumnus Salvatore Bonanno speaks to a student following his presentation in the Entrepreneurial Lecture Series in September 2011.

Mayo Clinic engineering chair inaugurates Lawrence Tech lecture series

Kevin Bennet, chair of the engineering division at the Mayo Clinic in Rochester, Minn., discussed collaborative engineering when he gave the first President's Leadership Seminar at Lawrence Tech in October 2011.

The President's Leadership Seminar provides a forum for leaders who can show that innovation results from collaboration among diverse disciplines and a desire to solve an important problem. It also relates to the areas of expertise and the academic programs offered at Lawrence Tech.

Since 1999, Bennet has led a Mayo Clinic division of 60 individuals who seek to apply the skills of engineers and programmers for the creation of novel biomedical engineering systems, equipment, implantables, and devices. Major efforts include cardiac monitoring, paging systems, clinical devices, surgical instruments, and a variety of other projects in support of cancer, genomics, therapeutics, surgery, information technology, and infrastructure.

College Professor Filza Walters (L), director of Lawrence Tech's architectural engineering program, talks with Kevin Bennet of the Mayo Clinic following his presentation at Lawrence Tech in October 2011.

Taubman commits $11 million to new academic complex

Prominent philanthropist and former student A. Alfred Taubman has committed $11 million to a $55 million construction project that will expand Lawrence Tech's engineering facilities, while also providing greater connectivity between engineering, architecture, and biomedical academic programs.

A new building of more than 100,000 square feet will be the centerpiece of the A. Alfred Taubman Engineering, Architecture and Life Sciences Complex. The existing Engineering Building will be upgraded and integrated into the new building. Construction is expected to begin in 2014.

Lawrence Tech President Lewis Walker accepts a check from A. Alfred Taubman representing an $11 million commitment for the construction of the A. Alfred Taubman Engineering, Architecture, and Life Sciences Complex.

Taubman's gift is structured to strengthen the fund-raising efforts needed to complete the private financing. He is giving Lawrence Tech $1 million for planning and development efforts

and has offered a $10 million challenge grant that must be matched by $20 million in new contributions for the construction of the building.

"Lawrence Tech made a big difference in my life, as it has for generations of young people working to build successful careers and fulfilling lives. I am immensely proud of my Lawrence Tech affiliation," said Taubman, who is best known as a pioneer developer of shopping malls.

Higher Learning Commission gives thumbs up to Lawrence Tech

More online degree programs and three new doctorate-level degree programs are the immediate changes at Lawrence Technological University following its reaccreditation by the Higher Learning Commission (HLC) for another 10 years.

No conditions were placed on the University when the review process concluded in 2011. The University was given a clean bill of health following a decade in which the campus was transformed and dozens of new degree and certificate programs were introduced.

This year Lawrence Tech launched a new doctorate program in mechanical engineering and a PhD in civil engineering. A PhD program in management should be launched later this year.

The HLC report also gives Lawrence Tech the authority to create new online degree programs without obtaining prior approval from HLC.

"Lawrence Tech is a very different place than it was 10 years ago," said Associate Provost Alan McCord, who led the Lawrence Tech team that prepared for the reaccreditation process. "There has been great progress in the breadth of programs, the composition of the faculty, and the academic climate. Due to the efforts of many people, we have maintained the standards of the Higher Learning Commission while going through a period of significant growth."

CIMR adds new equipment to aid research

Lawrence Tech's Center for Innovative Materials Research (CIMR) has added another state-of-the-art testing instrument, the Instron ElectroPuls E10000, which uses a laser to measure the performance of materials under different stress factors and environmental conditions.

The ElectroPuls E10000 is an all-electric system that doesn't need hydraulic mechanisms or a cooling system. The laser measuring device is an attachment that makes the instrument both more accurate and easier to use. As currently configured, the testing instrument has a retail value close to $400,000, according to Dean of Engineering Nabil Grace.

The ElectroPuls measures the performance of materials when subjected to pulling, twisting, and repeated loads. An environmental chamber can test the performance in dry heat up to 180°F or in sub-zero temperatures.

Grace said the instrument has military applications. It will be used at Lawrence Tech to determine the ability of prototype materials to withstand bomb blasts and other high-intensity stresses. The instrument also has applications for biomedical engineering research currently under way at Lawrence Tech.

Dean of Engineering Nabil Grace examines the ElectroPuls testing instrument with students Alan Killewald and Erisa Panajoti.

Lawrence Tech honors automotive industry legend

The dean's conference room in the College of Engineering has been named in memory of Lewis Veraldi, BSME'68, the pioneering creator of the car team development approach that in 1986 introduced the original Ford Taurus that became America's top-selling car.

Veraldi earned his Lawrence Tech degree after taking evening classes for 18 years while working at Ford Motor Co. He was vice president of product and manufacturing engineering at Ford when ill health forced his retirement in 1989 at age 59. He died in 1990.

He was also a graduate of the Henry Ford Trade School, and its alumni association funded the creation of a plaque honoring his accomplishments.

Lawrence Tech was founded in 1932 in a building owned by Ford near its famous production plant in Highland Park. Many early Lawrence Tech students were graduates of the Henry Ford Trade School.

"We share a mutual champion in Henry Ford, who was key to establishing both organizations," said Lawrence Tech Provost Maria Vaz. "Our steadfast commitment to the theory-and-practice approach to education advocated by Mr. Ford continues to distinguish the Lawrence Tech educational experiences of today."

Lawrence Tech President Emeritus Richard Marburger shares personal recollections about the late Lewis Veraldi at an April 2011 ceremony.

Faculty **Achievements**

Jawad Named SAE International Fellow


Badih Jawad

Professor Badih Jawad, chair of the A. Leon Linton Department of Mechanical Engineering at Lawrence Tech, has been named a 2010–11 SAE International Fellow.

Jawad joined the LTU faculty in 1996 after teaching at several local universities and working as a research and product development engineer for Chrysler Corp. He created the Master of Science in Mechanical Engineering, of which he is currently the director, and is leading the launch of the doctoral degree in mechanical engineering.

Jawad has served as a faculty adviser to the Formula SAE and Supermileage car teams. In 2002, under his guidance, the LTU Formula SAE team won the very first *Road and Track* trophy for the fastest car in the competition. He is the adviser of the Lawrence Tech student chapter of the American Society of Mechanical Engineers and co-adviser of Lawrence Tech's SAE International student chapter.

SAE Fellow is the highest grade of membership bestowed by SAE International. It recognizes outstanding engineering, scientific, and leadership accomplishments by an individual that have resulted in meaningful advances in automotive, aerospace, and commercial vehicle technologies.

Alwerfalli leads student team to Italian machine tool conference

Lawrence Tech Professor Daw Alwerfalli and Professor Luis Sanchez of the University of Colorado led a team of eight students from Lawrence Tech, Purdue University, Texas A&M University, North Carolina Agricultural & Technical University, and Kettering University that attended the 2011 Italian Machine Tool Technology Award Program held in Milan, Italy.

Roger Harrison, a Chrysler employee and a Lawrence Tech graduate student in engineering management, was among the recipients of the "Innovation in Technology" award for his patent, "Power Generating Trailer Invention Concept." The patent was a result of his directed study, "Innovative Energy Management System," with Alwerfalli in 2009.

The trip included visits to Milano Polytechnic University and Italian manufacturing companies such as Ferrari.

Professor Daw Alwerfalli (L) and graduate student Roger Harrison of Lawrence Tech join Luis Sanchez of University of Colorado during a conference in Milan, Italy, in July 2011.

Taraman provides leadership in STEM education


Khalil Taraman

Lawrence Tech Professor Khalil Taraman completed his three-year tenure as president of the Society of Manufacturing Engineers (SME) Education Foundation Board of Directors at the end of 2011.

"We have been honored to have had Dr. Taraman as our president and thank him for his leadership, insightful direction, and reinforcing demeanor," said Bart Aslin, CEO of the SME Education Foundation. "He's our champion among manufacturing educators."

An SME member since 1970, Taraman joined the SME Education Foundation Board in 1992. He was elected to a two-year term as president in 2009 and his term was extended by a year.

According to Aslin, Taraman steadied the course of the SME Education Foundation during the economic recession. He advanced its mission to transform manufacturing education, change public perception of manufacturing, and direct funding to STEM (science, technology, engineering and mathematics) education to address the shortage of manufacturing and technical talent in the United States.

His leadership impacted the funding of tech-based education programs designed to motivate young people.

"His total commitment to manufacturing engineering education, which spans more than 40 years, includes mentoring scores of young men and women and encouraging them to pursue viable careers in manufacturing, engineering, science, and technology. His international perspective on how education is delivered in a global economy is highly regarded," Aslin said.

Taraman is a former dean of Lawrence Tech's College of Engineering and is currently director of graduate programs for manufacturing systems engineering. Prior to coming to Lawrence Tech in 1986, he taught at the University of Detroit Mercy for 16 years and was a senior technical consultant to many companies, including Ford Motor Co. and General Electric.

Taraman has two degrees from Ain Shams University in Egypt, a master's in mechanical engineering from the University of Wisconsin, and a PhD from Texas Tech University.

Cuper wins Marcum customer service award

Adjunct Professor Jerry Cuper, BSIM'74, of Lawrence Tech's Department of Engineering Technology was awarded the Mary Ann Marcum Customer Service Award for the 2011 fall semester. The award is named in honor of Mary Ann Marcum, MBA'92, who was director of the University's continuing education program when she was killed in a tragic auto accident.

Cuper worked for more than 30 years at Ford Motor Co. in engineering design, management, product planning, testing, and development. He also has been affiliated with Lawrence Tech for more than 30 years, working in the Office of Admissions and teaching. Five years ago he joined the Department of Engineering Technology on a full-time basis as both a lecturer and advisor.

"Jerry's passion, enthusiasm, and personalized attention help students learn and meet their goals. He is always willing and available to assist in meeting student needs," Lawrence Tech President Lewis Walker said.

Cuper demonstrated his commitment to students by announcing that he would give his $1,000 stipend to several students having trouble paying for their education.

Adjunct Professor Jerry Cuper (L) is the latest winner of the Mary Ann Marcum Customer Service Award. To his right are Tammy Botzen and Kathy Gilman, two administrative assistants in the College of Engineering who are previous winners of the award.

Software product uses equations from Lawrence Tech research

Research by Associate Professor Hiroshan Hettiarachchi on a new way to estimate shear strength properties of soils has been included in the NovoSPT software by NovoTech Inc., a Canadian geotechnical engineering software development company. The software has been used in more than 25 countries.

Hiroshan Hettiarachchi

The basis of the model was first researched by Tim Brown, BSCvE'05, MSCvE'07, when he was a graduate student. Hettiarachchi is director of the civil engineering graduate program and supervised the research project. After Brown's results were published at a 2008 conference, Hettiarachchi extended the research and published a final paper in the *ASCE Journal of Geotechnical and Geoenvirnmental Engineering.*

The research covers the relationship between the energy dissipation and the shear strength properties of soils during a standard penetration test (SPT). According to Hettiarachchi, previous equations used to solve this question were the result of curve fitting.

"The equations proposed by me are based on a rational explanation (energy conservation) and they have produced consistent results," Hettiarachchi said.

Lawrence Tech gives high school students a college preview

During the fall semester Oxford High School students earned two college credits when Lawrence Tech Associate Professor Robert Fletcher taught them Introduction to Engineering, a course designed for first-year college students.

The problem-based course gives student teams 14 design-build projects that help them develop an understanding of the basic engineering processes and principles. They include a bamboo bridge, a solar oven, a chair made out of newspaper, and a machine to crush soda cans. Following the demonstration of each project, Fletcher led the students in a critique of what went right, what went wrong, and why. The goal is to help these students who are still early in their engineering education to start to think, approach problems, and work as engineers.

In the spring semester, Lawrence Tech is offering a mechanical engineering graphics course. The high school students will learn to design parts with computer-aided design (CAD) with the eventual goal of fabricating the parts on computer-numerical-control (CNC) machines.

The courses at Oxford High School are part of Lawrence Tech's commitment to encourage more students to continue taking science, technology, engineering, and mathematics (STEM) courses when they get to college and then pursue careers in related fields.

Lawrence Tech Associate Professor Rob Fletcher discusses the results of a load-bearing test in an introductory engineering course he taught to high school students.

Seed **Grants**

Engineering professors win seed grants for research

During the past year five engineering faculty have taken advantage of Lawrence Tech's Faculty Research Seed Grant program. The grants encourage, develop, and support faculty research and creative endeavors with the goal of subsequent development of proposals for external funding.

The typical seed grant is $3,000, and applications from pre-tenure faculty are given preference.

Selin Arslan, assistant professor of mechanical engineering, received her grant to conduct computational analysis of evaporation in tailored microchannel evaporators. Microchannels show promising potential for implementation in next-generation high-heat flux cooling schemes. While significant advances in microchannels can be found in the literature, little work is being done to develop microchannels with non-uniform cross sections that can evaporate fluid without the presence of the bubbles at the exit flow. The design and modeling approach, microfabrication process, and the full testing of the tailored microevaporators were a part of Arslan's PhD studies. The proposed research combines mathematical modeling with engineering design and evaluation of tailored microchannel evaporators. A deeper understanding of the two-phase flow in micron scale and temperature distribution in microchannels with non-uniform boundary conditions will be obtained, which will provide further guidance to the design and development of tailored microchannel evaporators.

Umasankar Kandaswamy, assistant professor of electrical and computer engineering, plans to replace traditional confocal microscopy with Lawrence Tech's environmental scanning electron microscope (ESEM) to collect preliminary data from live specimens. In addition, part of the seed grant will be used to develop advanced real-time computational tools that will replace the existing slow and cumbersome methods for analyzing the imaged data. This project will help to bridge two fields of science, engineering and health science, while making mutual advancements in both fields. He is working closely with Assistant Professor Yawen Li and Arts and Sciences Dean Hsiao-Ping Moore to complete this multi-faceted project. Recent progress in the field of live-cell confocal microscopy, especially with the development of super-resolution techniques and bio-markers, has significantly helped scientists break the long-standing barriers in understanding some fundamental working principles of the human brain and many neurological disorders such as Alzheimer's disease. However, imaging with confocal microscopy is riddled with problems, particularly when the bio-markers move in and out of the focal plane.

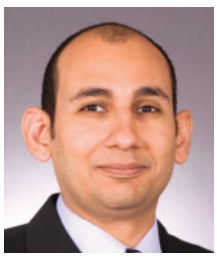
Giscard Kfoury, assistant professor of mechanical engineering, will study the use of electroactive polymers as artificial muscles through experimental analysis, modeling, and control. One of the main areas of study in biomimetic robotic systems is the different actuation and sensing techniques needed to mimic biologically inspired motions. Electroactive polymers (EAPs) are of particular interest as a viable option for artificial muscle actuation of robotic systems. The purpose of Kfoury's study is to conduct experimental studies on prototype samples of EAPs to investigate the possibility of using such polymers as actuators for exoskeletons to assist paraplegics in gaining the ability to walk. The experimental work will provide information on stress-strain curves, power requirements, maximum deflections, and actuation forces for different configurations of EAP samples. The data will also be used to formulate control-oriented electro-dynamic models of the different actuator configurations. Experiments will then be conducted to explore different control strategies.

Keith Kowalkowski, assistant professor in civil engineering, used his research grant to study structural steel connections subjected to fire. A detailed literature review was used to determine the fire-testing needs of structural steel connections. Experimental investigations were performed in the fire/load-testing chamber in the Center for Innovative Materials Research to study the maximum fire temperatures that bolted-and-welded connections could sustain under various loads. Analytical investigations were performed using the finite element program ABAQUS. Methods for analytically simulating the experimental investigations were developed and validated using the results of the experimental testing. A research plan will be developed for investigating several failure mechanisms of connections when subjected to fire loading.

Eric Meyer, assistant professor in the biomedical engineering program, is studying anterior cruciate ligament (ACL) microdamage induced by single and cyclic subfailure loading. Injuries to the knee are among the most common sports injuries, but there is an ongoing debate about what loading mechanisms have the highest risk. The only previous study on the effect of cyclic subfailure stretches on the failure properties of the ACL applied purely tensile strain, while Meyer's experiment was designed to simulate microdamage or undiagnosed partial tears that might occur in sports involving frequent jump landings. His study employed a novel tibiofemoral compression loading mechanism to the knee joint to investigate microdamage accumulation on the ACL and its effect on failure characteristics for subsequent loading on the knee joint. The study used 12 porcine hind limbs from the Animal Science Department of Michigan State University.

New **Faculty**

Mena Bebawy Assistant Research Scientist, Center for Innovative Materials Research


Mena Bebawy

Mena Bebawy has participated in various research projects addressing problems in structural engineering, such as cracking and durability of bridge systems, strengthening of defective structural elements with fiber reinforced polymer (FRP) materials, and improving the performance of structural elements under both fire and loading events. His current research interest is to develop a fire-proof system for FRP materials.

Bebawy uses his extensive background in finite-element modeling and analysis in simulating the real performance of a wide variety of full-scale structures. He combines the results from the experimental and numerical investigations to establish a solid platform for design and evaluation guidelines that enable engineers to optimize their designs and build sound structural systems with extended lifespans.

Bebawy earned his PhD in structural engineering from the University of Windsor, where his research focused on developing innovative techniques to protect the FRP-strengthened structural elements in fire events. He received his master's degree in structural engineering from Lawrence Tech and his bachelor's degree in civil engineering from Assiut University in Egypt.

Umasankar Kandaswamy Assistant Professor, Electrical and Computer Engineering


Umasankar Kandaswamy

After pursuing postdoctoral programs in computational neuroscience for three years at Washington University in St. Louis, Umasankar Kandaswamy joined Lawrence Tech in the fall of 2011.

He received his PhD in electrical and computer engineering in 2008 from Clarkson University, Potsdam, NY. There he worked extensively on benchmarking state-of-the-art color texture recognition algorithms, as well as developing an automated, machine-learning-based image recognition algorithm.

During the postdoctoral program he found several key areas in the field of computational biology where advanced/automated signal processing and computational tools could have a significant impact at both the biological data acquisition stage and the processing stage. Currently he is pursuing research on developing computational tools and devices that are efficient, interoperable, and also commercially viable.

He earned his bachelor's degree in electrical and electronics engineering from the University of Madras in India and a master's degree in signal processing from West Virginia University.

Jim Kerns Robotics Engineering Laboratory Instructor, Mechanical Engineering


Jim Kerns

After nearly 36 years at Ford Motor Company, Jim Kerns has joined Lawrence Tech to lead the new robotics engineering laboratory. During his career at Ford, he worked primarily on powertrain controls – spanning the transition from mechanical systems to modern computer controls. He also has experience in diverse areas, such as combustion analysis and active aero control.

Kerns has been awarded more than 60 U.S. patents covering various control system and diagnostic inventions.

Kerns received his bachelor's degree in mechanical engineering from the University of Michigan, and his master's degree in electronics and computer-controlled systems from Wayne State University. He previously served on the adjunct faculty at Lawrence Tech, Wayne State University, and Henry Ford Community College.

His background in controls and mechatronic systems will help him guide students in the new bachelor's degree in robotics engineering.

Jim O'Connor College Professor, Engineering Technology


Jim O'Connor

Jim O'Connor worked for General Motors Corp. for 18 years before deciding to pursue his passion for teaching. After working in pre-engineering at Henry Ford Community College for a year, he joined the Lawrence Tech faculty in 2011 as a full-time college professor of engineering technology.

His GM assignments included extensive testing of software used within vehicle modules, analysis of electrical systems, and release responsibility for HVAC systems on all truck and luxury car programs.

He tested small DC motors for two years at Chrysler Corp. and spent three years at Uniroyal Tire Company, developing custom instrumentation and control circuits used for measuring force and moment data on tires.

He earned a bachelor's degree in electrical engineering from Lawrence Tech in 1986, and a master's degree in systems engineering from Oakland University in 1997.

He is a PhD candidate at Oakland University in systems engineering, specializing in intelligent feedback control systems. His research interests include adaptive control, neural networks, and parallel processing.

Student **Achievements**

Engineering students teach English in China

Civil engineering student Sarah Dare and biomedical engineering student Olesya Motovylak joined a Lawrence Tech group that taught American culture and English to seventh-graders in the Chinese city of Tongxiang about two hours outside Shanghai.

Every year the Office of Leadership Programs offers Lawrence Tech students the opportunity to teach in China during the summer break through a partnership with the Council on China Exchange.

"The experience makes you more open to diversity and gives you a greater appreciation of all the different places around the world," Motovylak said. "It gets you out of your bubble."

At first Motovylak and Dare had a lot of trouble in communicating with their students. But they made changes to the PowerPoint lessons they had prepared and found other ways to overcome the language barrier.

"It improves your communication skills," Motovylak said. "At first I wasn't comfortable with it, but it was fun."

Lawrence Tech biomedical engineering student Olesya Motovylak poses with some of her Chinese students.

New ESD scholarship award goes to architectural engineering major

Architectural engineering major Rachel LaCasse is the first recipient of the $500 Gold Awardee Scholarship, which the Affiliate Council of the Engineering Society of Detroit (ESD) has established to honor the ESD Gold Award winner in the previous year. In 2011, that was Gordon V.R. Holness, chairman emeritus of Albert Kahn Associates.

Rachel LaCasse

LaCasse is president of the Architectural Engineering Institute (AEI) student chapter at Lawrence Tech. She has a bachelor's degree from Western Michigan University in political science and comparative religion. She decided to pursue a career in sustainable housing in Third World countries after living in South Africa for five months.

Graduate student wins second honorable mention in photo contest

Lawrence Tech engineering graduate student Delia Radbata has won an honorable mention for a second year in a row in the student photo contest sponsored by the American Institute of Steel Construction (AISC).

She chose the annual Labor Day walk across the Mackinac Bridge in 2011 as an opportunity to represent the contest's theme, "Celebrate the Visual Experience of Steel." With a main span of 3,800 feet, the Mackinac Bridge is the third-longest suspension bridge in the United States and the 12th-longest in the world. It was opened in 1957 to connect Michigan's lower and upper peninsulas where Lake Huron meets Lake Michigan.

Radbata is pursuing a master's degree in civil engineering and has been taking classes in structural engineering. She is a structural steel detailer who prepares fabrication shop drawings for Hensen & Associates in Sterling Heights. "Working as a structural steel detailer for more than six years, I became passionate about steel structures, and I wanted to be more involved in this field," Radbata said.

This photo of the Mackinac Bridge by Lawrence Tech graduate student Delia Radbata captures the beauty of the open web trusses that help maintain the stability of the deck despite the strong wind patterns in the area.

Shevenock wins NASA scholarship and internship

Stephanie Shevenock, a mechanical engineering major at Lawrence Tech, is one of 25 students nationwide who have won scholarships and summer internships for the 2011–12 academic year from the National Aeronautics and Space Administration (NASA).

Stephanie Shevenock

Shevenock will receive $15,000 per year to cover tuition costs for two years and a $10,000 stipend for an internship this summer with NASA.

She will have the opportunity to work with NASA researchers on such projects as managing air traffic more efficiently; reducing noise, fuel consumption, and emissions; and improving safety.

Shevenock has been a member of Lawrence Tech's SAE Aero Design teams that finished in the top 10 in national competition for the past three years. She is captain of the 2012 team and president of the Lawrence Tech chapter of the American Institute of Aeronautics and Astronautics. Last year she went to Washington, D.C., as a student lobbyist for Citizens for Space Exploration.

"NASA is Stephanie's dream job and one of the key reasons she is studying engineering," said Associate Professor Andrew Gerhart, Lawrence Tech's SAE Aero Design faculty adviser.

Lawrence Tech finishes in top 10 of SAE Aero Design East Competition

For the third year in a row, Lawrence Tech finished in the top 10 in the 2011 SAE Aero Design East Competition held in Marietta, Ga. It was one of a few teams to complete all six flight rounds and finished eighth overall.

"Lawrence Tech was one of the few teams that went home with an intact plane – no crashes!" said Associate Professor Andrew Gerhart, the faculty advisor.

The SAE Aero Design competition challenges engineering students from around the world to design, build, test, and fly a radio-controlled, heavy-lift, scale cargo airplane. Given a set of constraints, the goal is to airlift the most weight possible. In the final flight round, Lawrence Tech's plane had a payload of 26.5 lbs., one of the heaviest in the competition. But despite a perfect flight and landing, the results didn't count because the plane exceeded the 200-foot takeoff limit by three feet.

Some members of Lawrence Tech's 2011 SAE Aero Design team pose with their plane. They are (L-R) Justin Hempel, Tom Tiedt, Rob Baldwin, Phil Schupp, Bill Robertson, and team leader Ryan Fox.

The team had to add some last-minute reinforcement to the landing gear, which had started to bend as more payload was added in the earlier rounds.

"While the plane was certainly capable of achieving better than eighth place, the members of the team can be proud of the favorable impression they left with those involved in SAE Aero Design around the world," Gerhart said.

Schuel named finalist for ACI Student Fellowships

Civil engineering graduate student Brittany Schuel, BSCvE'11, has been selected as a finalist for the prestigious fellowships offered by the American Concrete Institute.

Brittany Schuel

As a research assistant in Lawrence Tech's Center for Innovative Materials Research, Schuel has worked on a range of projects related to concrete structures, such as concrete bridges and the behavior of high-strength concrete subjected to fire.

Through an internship with Fishbeck, Thompson, Carr & Huber in Farmington Hills, Mich., she helped test and inspect road construction projects. She gained valuable knowledge about concrete construction techniques while inspecting the reconstruction of a highway overpass, and she also learned about concrete paving and standards for interstate construction projects.

"Through these experiences, I realized how important it is to supplement an education with experience in the field," Schuel said.

Schuel would like to pursue a career in bridge design after becoming a licensed professional engineer and structural engineer. She took the first step by passing the Fundamentals of Engineering Exam in 2011.

Lawrence Tech wins community master plan competition

An interdisciplinary, multicultural team of Lawrence Tech students took first place in a competition to create a master plan for Chaldean Town, located along Seven Mile Road between Woodward and John R in Detroit. The competition was sponsored by the Michigan chapter of the Arab American Association of Engineers and Architects in the fall of 2011.

The team of Timothy Truitt, Fadia Shuayto, Elizabeth Kaminsky, Mark Dotar, Nameer Tillo, and Michael Paciero shared the first-place prize of $5,000 in scholarship money. Most of the

students are majoring in architectural engineering.

The first phase of the winning entry, Sabah Street, consisted of simple, inexpensive improvements, such as painting, landscaping and façade repairs to create continuity and a sense of place in Chaldean Town. The second phase involved the development of a major retail space built with Middle Eastern features and businesses.

The team proposed the development of two apartment complexes, a community park, and the utilization of vacant buildings and lots for the third phase, which would coincide with the completion of a proposed light rail project.

Lawrence Tech College Professors Nadia Shuayto (L) and Filza Walters (R) flank students Timothy Truitt, Elizabeth Kaminsky, and Mark Dotar, members of the team that won the master plan competition for Chaldean Town in Detroit.

Lawrence Tech supports Future City competition

Faculty and students of Lawrence Tech's architectural engineering program took the lead role in establishing a special award, Architectural Engineering of an Integrated, High Performing City, in support of the Future City regional competition sponsored by the Engineering Society of Detroit.

The award was won by Team 3 from the Detroit Edison Public School Academy. Teams were judged on their efforts in energy savings, sustainable living practices, team work, and integration of buildings systems, technology, and the environment.

Faculty and students from the College of Engineering and the College of Architecture and Design also participated in planning the event and serving as judges.

Posing with one of the winning teams at the Future City regional competition are architectural engineering freshman Chris Fazzalare (L) and on the right, admissions counselor Kimberly Light, College Professor Filza Walters, director of Lawrence Tech's architectural engineering program, and civil engineering graduate student Mishi Joshi.

Lawrence Tech recognized for connecting engineering education and practice

The Department of Civil Engineering has won $7,500 as one of five finalists in a competition sponsored by the National Council of Examiners for Engineering and Surveying (NCEES) for connecting engineering education with practice.

During the 2010–11 academic year, two senior project student teams put their engineering education into practice by collaborating with the nonprofit corporation Self Help Addiction Rehabilitation (SHAR) of Detroit, which is promoting the redevelopment of blighted property in Detroit through its RecoveryPark master plan.

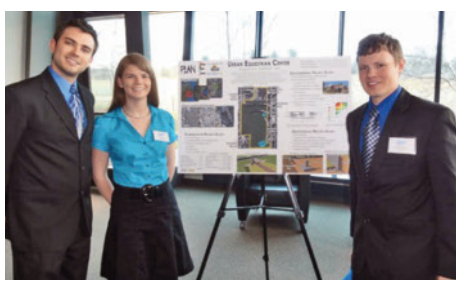
The Project E student capstone team developed plans for rehabilitating an abandoned market as an equestrian center for the Detroit Police Department. The project involves the renovation and expansion of a local landmark, the Chene-Ferry Market, rehabilitation of 12 square blocks in Detroit's Eastern Market neighborhood, and the environmental remediation of 46 acres.

The Earth, Preservation, and Recovery team proposed using a closed Detroit Public School building as a vocational school for urban farming and sustainable living skills. The project would redevelop the former Frederick Douglass High School on Detroit's east side. A new addition would house laboratories and a greenhouse.

During the planning process, the student teams worked with mentors in the civil engineering profession and made their final presentations to an industry advisory board. They also were in contact with industry practitioners and community organizers.

"These two teams gained knowledge about an underserved population in the Detroit area, and they saw how their skills as engineers can be used for the benefit of society," said Associate Professor Donald Carpenter, who was a faculty adviser along with Assistant Professor John Tocco.

The student team of (L-R) Neil Ganshorn, Lindsay Hakala, and Kevin Brown proposed an equestrian center for the Detroit Police Department.



Lawrence Tech students (L-R) Jessica Howard, Bryan Dage, Eric Walker, and Michael Kapetansky proposed an urban agri-tech vocational school.

Student **Awards**

Outstanding Member of a Student Organization

Alternative Energy Group:	Amy Tsang
American Society of Civil Engineers:	Neil Ganshorn
American Society of Mechanical Engineers:	Aaron Hanson
Chi Epsilon Honor Society:	Jessica Stiles
CEO:	Zhaolong Wang
Eta Kappa Nu Honor Society:	Ryan Meganck
Institute of Electrical/Electronic Engineers:	Matthew Lanting
National Society of Black Engineers:	Jasmine Jones
Paul Michel Award:	Eric Kostesich
Pi Tau Sigma Honorary:	Cassondra Whitlow
Society of Automotive Engineers:	Derek Remillong
Tau Beta Pi Honor Society:	Bryan Clinton
Society of Manufacturing Engineers:	Eric Patrick
Architectural Engineering:	Michael Paciero
Biomedical Engineering Society:	Meagan Richardson-Frazzitta
Autonomous Vehicles and Robotic Systems:	Zeran Gu
American Institute of Aeronautics and Astronautics:	Stephanie Shevenock
Blue Devil Motorsports:	Patrick McInally

Outstanding Service Award

Biomedical Engineering:	Erick Blank and Allison Andre
Civil Engineering:	Matthew Hawley
Computer Engineering:	Moses Thompson
Electrical Engineering:	Eric Lezon
Mechanical Engineering:	Matthew Meyer
Technology:	Nancy LaBelle
Architectural Engineering:	Timothy Truitt

Academic Excellence Award

Architectural Engineering:	Francesca Montana
Biomedical Engineering, senior:	Danielle Beski
Civil Engineering, senior:	Brittany Schuel
Civil Engineering and Architecture, dual degree:	Shasta Gibbs
Computer Engineering, senior:	Matthew Lanting
Electrical Engineering, senior:	Ryan Meganck
Engineering, junior:	Michael Newton
Engineering Technology, senior:	Bahaa (Bill) Harp
Mechanical Engineering, senior:	Ryan Meganck

Outstanding Student Award

Biomedical Engineering:	Steven Maloney
Civil Engineering:	Michael Kapetansky
Computer Engineering:	Bradley Latowski
Electrical Engineering:	Daniel McGee
Engineering Technology:	Steven Alexander
Mechanical Engineering:	Amy Tsang

Meagan Richardson-Frazzitta is honored as the 2011 outstanding member of the Biomedical Engineering Society by Lawrence Tech President Lewis Walker, Dean of Engineering Nabil Grace, and A. Leon Linton Department of Mechanical Engineering Chair Badih Jawad.

Chi Epsilon inducts new class

The 2011 inductees to the Chi Epsilon national civil engineering honor society chapter at Lawrence Tech include (L-R back row) Kirk Steudle, BSCE'87, director of the Michigan Department of Transportation, and Ahmad Hamawi, Grant Beahlen, Erik Jongeward, Alan Killewald, Jake Bilinski, Matthew Hawley, Michael Kapetansky, Nicholas Brass, and Bryan Clinton, and (front row) Ashley Dragan, Jessica Stiles, Brittany Schuel, Heather Gendron, Carmelle Tremblay, Katrin Bosch, Shasta Gibbs, and Madison Vanderburg. Faculty adviser Edmund Yuen is second from the right in the front row.

Opportunities in Engineering at Lawrence Tech

Lawrence Technological University offers a wide range of engineering programs at its campus in Southfield, Mich. For more information, contact the Office of Admissions at 800.225.5588 or admissions@ltu.edu, or visit ltu.edu/futurestudents.

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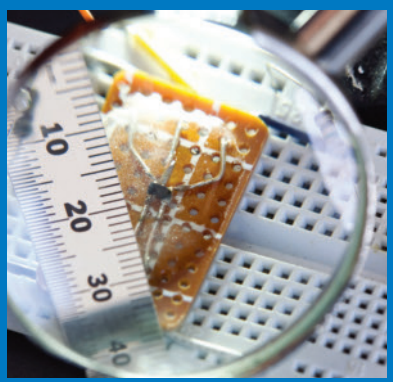
Lawrence Tech helps develop a 'smart' glucose meter

For nearly 26 million Americans living with diabetes, using a glucose meter to check their blood sugar levels – often several times a day – is as routine as brushing their teeth or taking a shower.

Monitoring and tracking these levels and compiling the patient's history are critical to the proper control of diabetes, but the glucose tests are intrusive and cumbersome. Up until now there has been no direct connection with physicians or other health-care professionals.



Lawrence Tech researchers are experimenting with a sensor that is only three millimeters long to capture an individual's glucose readings and then transmit the information to medical practitioners via a smart phone.

InteractiveMD, a "telehealth" company based in Boca Raton, Fla., wants to take this medical technology to the next level by developing a "smart" glucose monitor that can be plugged into virtually any mobile communication device to acquire, display, and transmit blood glucose levels.

A Lawrence Tech student team led by Umasankar Kandaswamy, assistant professor of electrical and computer engineering, is working with InteractiveMD to develop a working prototype. Launched in early February, the project's first phase is slated for completion by early April.

"The future of diagnostic medicine hugely depends on reliable and simple devices that are both interoperable and interactive," Kandaswamy said. "What we are trying to achieve is a device that provides maximum comfort and ease of use."

The glucose meter is a solar-powered device, which means the user never has to worry about replacing its battery. Furthermore, because it uses an audio port to communicate with the smart phone, the user doesn't need any special cord or base station to connect to a smart phone or tablet.

"One of the main missions of our various companies is to bring health-care access to the point where most people can get connected using a mobile device, such as an iPod, iPad, or any type of smart phone," said Jesse Kessler, CEO of InteractiveMD (www.interactivemd.com).

"The goal is to have a mobile diabetes application that can not only take tests throughout the day intermittently but can also store that data on a website to give the users and their physicians access to it," he said. "This is taking it to a new level."

The Lawrence Tech prototype is unique in that the monitor is small and easy to use, yet extraordinarily rich in features due to the marriage with a smart mobile device.

Using the smart phone app, consumers will be able to choose options to track their activity, see how their day-to-day activity impacts their blood glucose level, and share the data with a medical professional. Consumers can also keep a log of their daily meals, workouts, and other activities.

"These details become very useful for getting the proper care from physicians," Kandaswamy said. "Traditional diagnostic devices will give the user just one piece of information, but when we tie the diagnostic technology to the user's smart phone, we get the whole enchilada." ☐