New laboratories in industrial engineering, sound, architectural engineering, electronics, and more, give students unique opportunities.
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On the cover: Students work on a computerized robotic production line in the new Industrial Engineering Laboratory, located in the LTU Engineering Building.
Welcome to the 2019 edition of Innovation, the annual magazine of Lawrence Technological University’s College of Engineering.

Lawrence Tech remains a premier institution for engineering education in a world that is rapidly evolving technologically, and a world in which the prospects for the engineering profession have never been brighter. Engineers analyze and help solve humanity’s most vexing problems, leading to a society that is more sustainable and healthier, whose citizens are free to pursue happiness and success.

At Lawrence Tech, our longtime motto of “Theory and Practice” continues to be put into action in the new laboratories you will read about in these pages, which provide students with the opportunity to do meaningful applied research. A key differentiator of a Lawrence Tech engineering education is the opportunity for our students to engage in groundbreaking research, starting as early as their first semester here.

We equipped new laboratories over the past year, including more than a half million dollars for an industrial engineering lab that includes a robotic assembly line and manufacturing work stations. We are grateful to donors like Siemens Corp., Electro-Matic Inc., Faurecia, Cintas Corp., Sylvania Osram and others for their assistance in this buildout. There’s even an assembly line for LEGO race cars, which can teach our students a lot about designing a shop floor.

We’re also adding a new Building Physics Laboratory for our unique five-year integrated bachelor’s and master’s degree program in architectural engineering, which is observing its 10th anniversary, and which has earned several distinctions, including consistent top finishes in international design competitions and a 100 percent job placement rate. We’ve opened a second studio for our program in audio engineering technology. A large anonymous donation funded a new printed circuit board laboratory. We also added new technology in civil engineering to measure strain on materials. And we’re grateful to Brüel & Kjær for a gift of sound and vibration analysis hardware and software.

Lawrence Tech also continues to earn praise in rankings of colleges, including being named a “Best of the Midwest” university by the Princeton Review and earning distinction as a top university for veterans. We continue our outreach to the next generation of engineers through LTU’s Marburger STEM Center and individual faculty efforts, including weekly visits of students to West Bloomfield High School to our fabrication laboratory, who learn about robotics, materials science, and laboratory safety through hands-on activities.

We also added impressive new faculty members, and our student teams continued to shine in various collegiate competitions, from autonomous vehicles to racing cars to toboggans with runners made of high-tech formulations of concrete.

Overall, it’s been another wonderful year for the College of Engineering at Lawrence Tech and the support of our mission—to provide a well-rounded educational experience that prepares students for continued education or the engineering profession, applying scientific knowledge for the benefit of the world.

Sincerely,

Nabil F. Grace, PhD, PE, FESD
Dean, College of Engineering
University Distinguished Professor
New laboratories offer new opportunities for groundbreaking research

Lawrence Tech’s A. Alfred Taubman Engineering, Architecture, and Life Sciences Complex opened in the fall of 2016, offering 36,700 square feet of new laboratories and collaboration spaces for the University’s growing academic research effort. Spaces in existing buildings freed up by the relocation of expanded labs to the Taubman Complex are also being upgraded—some into the new laboratories seen in the following pages. Other lab spaces, both on campus and off, are being expanded as well.

The lab was kicked off in 2018 by a $75,000 donation from Siemens Corp., the United States subsidiary of the German industrial automation giant Siemens AG.
A new laboratory took shape on the Lawrence Tech campus over the spring semester.

The Industrial Engineering Laboratory houses more than $500,000 in industry-donated hardware and software, allowing LTU IE students to study everything from the human factor of production line fatigue to the optimal placement of robots, sensors, and parts bins on the factory floor.

The lab was kicked off in 2018 by a $75,000 donation from Siemens Corp., the United States subsidiary of the German industrial automation giant Siemens AG. (Rajeev Batra, BSEE’90, is president of Siemens’ Digital Factory division.) Since then, several other industrial automation companies, including Farmington Hills-based Electro-Matic Products Inc., the Detroit-area locations of the French auto supplier Faurecia, Cintas Corp., and Sylvania Osram, have stepped up with donations of equipment and assistance in program development.

According to Ahad Ali, associate professor of mechanical engineering, and Donald Riemer, retired college professor of industrial engineering, the lab’s several modules will create a real manufacturing experience for students:
• An assembly area, where students will manually assemble LEGO race cars, with the blocks required for assembly stored in 200 bins in the lab. “We’re trying to simulate an assembly line, as if they were workers in a plant on the line, assembling a car,” Reimer said. Added Ali: “We’ll study process flow, quality control, lean manufacturing concepts. How do we get more for less? We will be looking at the human factors in engineering.”
• An industry-grade conveyor line and programmable robot. The programmable robot is capable of simple assembly operations, pick-and-place inventory functions, and loading and unloading. Students will design the best assembly line operation sequence to accomplish various assigned tasks.
• Programmable Logic Control (PLC) units, which will be used to simulate setting up industrial automation systems.

Continued
• The instrument panel of a RAM 1500 truck, which students will program to create various displays and functions.
• An industrial work station, provided by Faurecia, will see students performing various mechanical functions using several tools on various objects, allowing students to determine the most efficient assembly methods.
• Quality inspection of parts using a coordinate measurement machine.

Ali and Reimer said the University is actively seeking continuing support from industry partners for other equipment in the lab, with the goal of creating realistic modeling and simulation of the plant floor.

They also said it’s hoped that regional manufacturers will use the new lab as a training and simulation center for their operations.

The lab is “not exclusively for industrial engineering students,” Reimer said. “It’s available for all students, in engineering and beyond.”
The old brick building at the corner of Holbrook and Pearl Streets in a residential area near downtown Plymouth, Mich., looks a lot like a church. As well it should, because it was indeed a house of worship for perhaps the better part of a century, but these days it’s the home of the Plymouth Rock recording studio.

Two days each week, Plymouth Rock serves as the satellite campus for students in Lawrence Tech’s Bachelor of Science in Audio Engineering Technology (BSAET). Ten individual audio engineering classes are taught there. Class sizes vary, but they’re small—around 10 students each, according to Ken Cook, chair of LTU’s Department of Engineering Technology and one of the program founders.

At Plymouth Rock, BSAET students, working alongside seasoned professionals, experiment with a variety of recording hardware and software applications, including Pro Tools. They explore sound mixing techniques, processing and production skills, microphone usage, digital recording, and more. The 125-credit-hour program prepares students to graduate with an in-depth knowledge of analog audio systems, digital audio systems, audio production, and audio application.

The idea, Fallahi said, is to “attract manufacturers to let us test their products.” The investment in the lab, he added, will be about $50,000. □ MR

Ali Fallahi

Pushing the (building) envelope

Architectural engineering program developing ‘building physics’ lab

One of the advantages of opening up the 36,700-square-foot Taubman Complex in 2016 is that it freed up space for other uses in LTU’s existing Engineering Building.

Part of that space is being put to new use this year, as the University’s unique, five-year combined bachelor’s and master’s degree program in architectural engineering develops a new Building Physics Laboratory.

“Building science, also known as building physics, is a collection of engineering knowledge that focuses on the analysis of physical phenomena affecting building performance,” said Ali Fallahi, assistant professor of civil and architectural engineering, who joined LTU in 2017 from Worcester Polytechnic Institute.

“It includes mechanical engineering, materials engineering and science, and to some extent electrical and structural engineering,” Fallahi said. “It encompasses building envelope materials and systems, thermal comfort, indoor air quality, HVAC energy efficiency, acoustics and lighting, and material durability and moisture analysis.

“What we are building will analyze heat, air, and moisture transfer in a building.”

Key to the new lab will be a tabletop climate chamber to simulate temperatures and relative humidity in a controlled environment. It will make use of liquid nitrogen to bring about sudden, dramatic drops in temperature.

There will also be highly accurate scales to track small amounts of moisture changes in materials.

In addition, the lab will feature a mock-up of a building envelope to measure the performance of various materials, and a weather station to measure outdoor atmospheric conditions, including temperature, precipitation, relative humidity and solar radiation.

The idea, Fallahi said, is to “attract manufacturers to let us test their products.” The investment in the lab, he added, will be about $50,000. □ MR
Chris Breest is Plymouth Rock’s CEO and founder as well as director of the BSAET Studio Program at Lawrence Tech. He was instrumental in launching the program, in 2008, working with Cook and Jerry Cuper, a professor and adviser in the Department of Engineering Technology.

“We designed it with support from our Industrial Advisory Board,” Breest recalled. “There were just two or three students initially. Now there are some 50 students enrolled, and the kids just love working in the studio.”

Breest has trained numerous Lawrence Tech students at his studio and in the field, helping prepare them to become audio professionals in the real world and to land jobs by the time they graduate, not just at music recording studios, but for major companies like Ford, Panasonic, and Harman International.

“In fact, one of the things Chris has accomplished since the program began is to establish relationships with companies like these where students can intern and work,” according to a recent feature article on the Lawrence Tech program in Tape Op magazine, an American magazine that focuses on creative recording techniques.

Basic audio engineering technology classes are taught on the Southfield campus, but Plymouth Rock is where the audio action is. The main level houses the original, more “traditional” studio, Breest said. A new studio on the lower level, completed in late 2018 after about a year and half in construction, is just the opposite. This stunning addition, he said, is where Lawrence Tech students will more fully experience the future of audio technology. Take note: the speakers alone cost $20,000.

In the Tape Op interview, Breest noted that the greatest advantage for Lawrence Tech students is that the program is focused on engineering technology as a whole, not just the music recording part. “Because the reality is that not many people are going to make a living producing hit records,” he says.

And what does the future hold for these students? Ken Cook says a recent career event, hosted by Michigan Quest at the Novi Expo Center, provides some insight. “Some 10,000 students from across Metro Detroit had the chance to visit hundreds of booths at this event.” Cook said. “One of the most popular booths was the one hosted by our audio engineering program. We were swarmed!”

Breest grew up in Plymouth, not far from the studio he now owns. Since then, he has worked with a number of clients, including Walt Disney, Ford Motor Co., Harman International, MIT, and PBS, among others. □MR
Thanks to a $75,000 alumni donation, Lawrence Tech now has a fully equipped printed circuit board lab. Nabih Jaber, chair of the Department of Electrical and Computer Engineering, says the new lab will allow virtually unlimited fabrication of circuitry in-house.

“This is a unique combination of equipment,” Jaber said. “It’s designed so that we never have to use outside companies or labs to build whatever we might need for senior projects.”

The new equipment includes an advanced printed circuit board prototype milling machine and laser from Germany’s LPKF Laser & Electronics, an advanced computer to control it, a large wall-mounted monitor for presentations and sharing designs with classes, a specialized printer used to print circuitry on a special film, a convection oven to heat pastes used in circuit board construction, an ultraviolet lamp box to apply materials to the circuit boards, a powerful microscope to aid in soldering tiny connections and examining small circuitry, and advanced soldering guns.

The lab also now includes a Mannocorp pick-and-place machine—essentially, a tiny industrial robot that is used to pick up and precisely place very small surface-mount elements on the printed circuit boards.

PCB lab offers students a chance to print their own circuitry

Students check out the tiny circuit board on a powerful new microscope.

This machine is a miniaturized industrial robot, grabbing and placing tiny parts on circuit boards.

Nabih Jaber, chair of electrical and computer engineering (right), goes over a circuit design with undergraduate Sudhir Khanal.
Undergrads jump right into groundbreaking research

The opportunity to engage in groundbreaking research starts in a student’s early days at Lawrence Tech. From sophomore students designing entrepreneurial products to help the disabled (see story, page 12) to real-world projects for employers, you’ll find engineering skills put to work to improve the lives of people every day.

FCA US-LTU research project helps students develop research, project management skills

Hands-on can often be the best way to learn. That’s what students who participated in a recent joint study between Lawrence Technological University (LTU) and Fiat Chrysler Automobiles (FCA US LLC) found out.

LTU was contacted by FCA US to perform a study on the gas molecules and solid particulates generated by weld guns used in automotive plants. The project was called the Welding Fume Analysis. FCA US was supported through Munther Hermez, an FCA US facilities engineer and LTU adjunct professor, in delivering and installing the welding system package, in collaboration with Roger Harrison, LTU project engineer; both assisted students with a feasible design concept, samples preparation, training on system programming and operation. Project primary investigators included Nabil Grace, dean of the LTU College of Engineering, and Keith Kowalkowski, associate professor and director of civil engineering graduate programs. All work was conducted at the Fire Testing Facility within the Structural Testing Center at LTU.

“Students learned unique experimental testing skills that could be used for a breadth of engineering disciplines. They also learned to meet client demands and schedules by interacting directly with the client and learning about corporate relations,” Kowalkowski said.

Marianne DeBrito, a student assistant in LTU’s civil engineering labs since April 2017, began working on the project in August 2018.

“This experience definitely taught me the importance of being flexible in my project plans. I was often faced with unexpected roadblocks and working around these problems was essential to

Continued
preventing any big-time setbacks,” she said. “When we didn’t have the proper sampling facilities, I designed and 3D printed the tools that we needed. When our equipment broke, I prepared for future tests during the repairs. Continuing to move forward despite all obstacles is a skill I’m proud to have gained throughout the project.”

DeBrito worked with another student assistant, Megan Roden, during the project.

“It was my responsibility to train her and delegate tasks to her—a leadership experience that I’ve never encountered before. Learning to take the help, train and trust a new teammate is an insight I’ve grown to value,” DeBrito said.

DeBrito is also taking with her skills on the latest 3D technology.

“One of my tasks was to design and 3D print our own tools to use for sample collection in the project. I learned to 3D model and print during the first summer I worked in the civil labs. Being able to utilize this skill was extremely helpful, and I’m sure it’s something I’ll want to use in the future,” she said.

Kowalkowski said knowing how to handle unexpected challenges is essential in an engineering career.

“The research team at LTU did not know much about the functionality of the weld gun and there were challenges in figuring out ways to hoist the weld gun and hold the specimen in place. The student assistants had a major role on the latter, figuring out ways to hold the specimen in place and stable using setups made from 3D printing technology,” he said.

On the FCA US side, the project will benefit plant personnel by discovering how to offset any possible hazards associated with welding certain materials and applications such as sealant and adhesives.

DeBrito sees the work she accomplished as a solid preparation for her future career.

“The experience I’ve gained from working on a team with the project investigators is something that I know I’ll face again in the work force. Communication and flexibility were essential in this project, and definitely will be in the future. Now, my future employers can see that I have experience in both because of my participation in this research. For anyone who has the opportunity to work on a research project like this, I’d absolutely encourage them to take it.”

FCA US representative Munther Hermez works with Marianne DeBrito on data analysis.
A student in LTU’s Doctor of Engineering in Mechanical Engineering (DEME) program wants to help with a better side view mirror.

Zulong Dong is working on designs that use concepts known as shape tuning and flow manipulation. The research involves the latest technology in computers and 3D printing, and LTU’s large wind tunnel, which is capable of simulating speeds of up to 200 mph.

The research project is co-advised by A. Leon Linton Department of Mechanical Engineering Chair Badih Jawad and Associate Professor Liping Lin.

Dong aims to use design and testing to improve the whole vehicle’s aerodynamic performance, reduce drag forces, and reduce the surface sound pressure level. After being tested in software, Dong prints out the mirror housings on LTU’s 3D printing equipment.

The testing also takes place in a smaller wind tunnel in LTU’s labs, where laser light is used to help visualize wind flow around objects. From left to right are doctoral student Zulong Dong, Associate Dean Elin Jensen, Associate Professor Liping Liu, and A. Leon Linton Mechanical Engineering Department Chair Badih Jawad.

**LTU doctoral student searches for better mirrors for more MPG**

This is the output of data from a test of wind flow around an object.
Biomed engineering students

work to meet demands of aging population

The demand for biomedical engineers is expected to increase dramatically, particularly as the nation’s 77 million Baby Boomers enter their 60s and beyond. At Lawrence Tech, students in the master’s degree program in biomedical engineering are working on design and research projects to meet that demand.

“Two projects in particular, conducted by students John Peponis and Ahron Wayne, have tremendous potential in either advancing the frontiers of biomedical research or creating low-cost scientific tools for a variety of biomedical applications,” according to Yawen Li, associate professor and chair of the Department of Biomedical Engineering.

Peponis’s work focuses on one method of making artificial blood vessels that mimic capillaries. This method includes an existing technique for constructing artificial organs called decellularization—or “decelling” for short.

“The idea is simple,” he said. “First, take a donor organ, for example, a pig’s heart. Second, chemically remove all the cells, thus leaving behind only the structural protein architecture. Third, replace the cells with the patient’s cells, which will grow in the correct shape and configuration because they have a scaffold to latch onto. And finally, culture it in the lab and deliver a new heart to your patient.”

Peponis’s research was primarily inspired by the work of Joshua Gershlak, a researcher at Worcester Polytechnic Institute, who was the first to decell spinach leaves, which have a branching network of vessels. He seeded human endothelial cells (which make up capillaries) and showed that they could be used as scaffolds to make artificial blood vessels.

Most importantly, Peponis explained, the artificial blood vessels that were formed were exactly the same size and shape as natural human capillaries. Compared to other techniques, this was less expensive, used easily procurable natural materials, and could be translated to clinical applications in hospitals and the medical industry fairly quickly.

“This was so remarkable to me that I immediately worked to replicate and extend this technique,” Peponis said. “I designed and refined my own decelling chamber, which is an apparatus where spinach leaves can hang as they are chemically treated to remove their cells. I updated many of Gershlak’s decelling methods, some of which I found to be unnecessary and wasteful.”

As spinach leaves are naturally fragile, Peponis discovered a new chemical treatment that strengthens them. “I showed that the new strengthening modification to the spinach leaves is still non-toxic to the cells and that strengthened spinach can still form blood vessels.”

Peponis’s ongoing work involves the combination of bioprinting and decelled spinach scaffolds to regenerate large-size vascularized tissues.

Ahron Wayne’s project, meanwhile, began as a search for inexpensive microscopy of any kind, especially for use in the classroom. “My eureka moment was when I was taking apart a DVD player and realized that all of the components necessary for advanced microscopy were present,” he said.

He discovered that this idea was not new. In fact, he said, a number of amazing feats have been performed with this piece of consumer hardware that is often tossed in the trash. “Since then, I have been focused on this optical disk drive microscopy, and I’m working on polishing up a system that is unique—and very cute!”

His device is a small (6x6x6 inch) 4-axis motorized microscope, almost entirely 3-D printed and made out of recycled parts. It can 3-D scan millimeter-scale objects, such as insects, at much higher resolutions than anything sold commercially. Wayne hopes to produce the device for sale to the public in order to encourage widespread adoption. “We know it is good for something other than 3-D scanning insects; hopefully, someone out there will tell us what that is!”

Ahron Wayne explains his project to turn recycled Blu-ray player parts into an inexpensive yet powerful microscope to Ken Cook, chair of LTU’s Department of Engineering Technology.

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A research project by an LTU junior under the guidance of Department of Civil and Architectural Engineering chair Edmund Yuen is leading Lawrence Tech into the latest method of measuring strain on materials.

No longer dependent on old-fashioned strain gauges, LTU student Marianne DeBrito formally studied recent technology called DIC, Digital Image Correlation. The project was one of just 10 university-wide to receive a Presidential Undergraduate Research Grant from the office of LTU President Virinder Moudgil. Using DIC, strain gauges are replaced with a random spattering of pigment on a surface.

“Strain gauges are limited,” Yuen said. “You can only use so many strain gauges, and there’s difficulty in putting a bunch of strain gauges on materials, with a bunch of wires coming off them, and then the issue of monitoring and collecting the information.”

With DIC, “you just use pigment—in a random pattern, very close together, with different sizes of spots,” he said. “Then, as load is put on a beam, you record the movement of the spray-on spots using cameras. We use high-precision cameras that are much more acute than the human eye. You pick up the movement of the pigment under load, and you calculate the displacement. Instead of one strain gauge, you have thousands, because each dot of pigment is like a strain gauge.”

The technique uses a single camera for a 2D analysis and two cameras for three-dimensional analysis, and can be used in still photography or a continuous video. Software called ARAMIS and Abaqus is used to analyze the data and show how the material reacts to strain.

LTU obtained the technology through Philadelphia-based Trilion Quality Systems, the North American distributor of Germany’s GOM, the DIC metrology equipment manufacturer.

“The big thing is to help undergrads experience DIC first-hand, because DIC is being used increasingly across many industries, from biomedical to automotive to civil engineering to aerospace, and a lot of consumer goods,” said Justin Bucienski, Trilion’s technical account manager for the Great Lakes region. “A lot of companies are taking DIC to the next level.”

Yuen said DIC technology “has been around for a while, but getting industry acceptance was the big hurdle.” It’s now being used by organizations and companies ranging from NASA to Boeing, he said, and “by all the automotive companies in Michigan.”

LTU has provided Trilion with office space in LTU’s Enterprise Center entrepreneurial accelerator on campus. Bucienski said the company brings customers to campus for training events, which “allows brilliant people from industry to rub shoulders with the young engineers at LTU. It’s really cool.”

Having DIC hardware and software on hand at LTU, Yuen said, “will help our students become more marketable in the workplace.”

Elin Jensen, LTU’s associate dean of graduate studies and research, is the first to use the equipment in a class, called Mechanics of Materials. Yuen said the technology can be used by biomedical engineering students to test the strength of prosthetics and artificial joints.
The Michigan Department of Transportation (MDOT) has asked Lawrence Technological University Associate Professor of Civil and Environmental Engineering Nishantha Bandara, a recognized expert in highway materials and design, to study the environmental impact of recycled concrete aggregate (RCA) as a base material for roads.

Over the last 20 years, RCA has become a popular replacement for natural base materials like limestone and gravel. To determine just how popular, Bandara and his team are surveying highway agencies throughout the United States and Canada. Of the 43 responses so far only two states prohibit the use of recycled aggregate.

Why is RCA so popular? Estimates indicate that using RCA to replace traditional crushed stone can save as much as 30 percent on one of the biggest costs in a road construction project.

The process of making RCA also alleviates the problem of what to do with construction demolition waste. The concrete of the old road is put through a crusher, debris and reinforcing metals are filtered out and the aggregate is crushed again before use. This process produces a base material with excellent mechanical properties and significant life-cycle benefits. It can also be done on site for convenience and to reduce transportation costs.

However, MDOT is concerned about the high pH levels of the water coming out of the roadway underdrains where the recycled aggregate is used.

That’s where Bandara and his researchers come in. They are reviewing work done in other states and continuing water sample collection started by MDOT. Their goal is to determine the cause of the high pH levels and propose practical methods to reduce them to conform to EPA standards for stormwater discharges. Why is the high pH level a concern? It can slowly corrode the road’s underdrains and can affect vegetation at the mouth of the drain.

The next step was to watch the weather. “That process could be described as one-part storm chaser and two-parts engineering research,” Bragg describes with a smile.

“Like many Michiganders, I travel along portions of several interstate highways during my daily commute, so when the opportunity arose to conduct research with LTU for MDOT, I had to get involved.”

To date the team has collected 230 individual samples after 12 rain events. It takes a rainfall of at least a quarter-inch before water leaches through the RCA and exits the drain.

According to Bandara, conclusions are premature because the team is only a third of the way into its work, but current information indicates that bioswales could be a cost-effective, low-maintenance, and practical response. Another response is to use filters called floe logs to clarify the storm water runoff.
Lawrence Tech’s longtime project to develop highway bridges that last a century has been extended.

The Michigan Department of Transportation has extended LTU’s contract to monitor five bridges built with carbon fiber reinforcement instead of steel bars through 2025 under a contract valued at about $600,000. The bridges are fitted with equipment to monitor bridge deflection—how much it bends under load—along with strain on the bridge’s concrete components and strain on the carbon fiber strands running through its beams.

The first bridge of the bunch, which carries Bridge Street in Southfield over a branch of the Rouge River, was installed in 2001, so LTU has been monitoring the structure for 18 years now. Other carbon fiber reinforced bridges are along I-75, M-102, and M-39 in the Detroit area, and on M-86 in southwest Michigan.

A sixth bridge, carrying Brush Street over I-75, is to be constructed in 2019, with more coming in 2020. Matthew Chynoweth, director of the Bureau of Bridges and Structures at MDOT, said the locations of those bridges haven’t been determined.

Carbon fiber remains more expensive than traditional steel reinforcing bars, but College of Engineering Dean Nabil Grace says the cost differential is shrinking. Tokyo Rope Co., which makes carbon fiber strands in a factory in Southfield using materials from Japan’s Toray Industries Inc., supplies the strands used in the advanced bridges.

Grace and researchers at LTU, including Associate Professor Mena Bebawy, have spent more than three decades researching the potential to replace steel reinforcing bars with carbon fiber-reinforced polymers. Grace says the technology holds several advantages over steel, including lighter weight, higher strength, and resistance to corrosion from salt used to keep roads clear of ice and snow.

A future in which computer-driven electric cars whisk us around in total safety was the automotive future envisioned by a panel discussion at the sixth annual President’s Symposium at LTU.

Speaking on the topic “Accessibility, Mobility, and Connectivity: The Edge of Future Transportation Systems,” panelists mostly saw vehicle electrification and autonomy as the inevitable future.

The holdout was Douglas Patton, former North American chief technical officer at Denso North America, who predicted the internal combustion engine (ICE) will survive well into the mid-21st century. He said even in nations where internal combustion engines are being outlawed, plug-in hybrids that use ICEs to charge their batteries are being considered as electric vehicles. Diesels will also continue to rule the roost for heavy trucks.

But as for automated driving, Patton said, “we are moving to automation, we are moving to connected vehicles, no doubt.”

Carla Bailo, CEO of the Center for Automotive Research, a nonprofit automotive think tank based in Ann Arbor, said the goal was zero—zero accidents, zero

Continued
Stormwater runoff management may sound boring. But how does half a billion dollars sound? You might say that makes stormwater anything but a dry subject.

Attendees at the sixth annual Regional Stormwater Summit, convened and hosted by Lawrence Tech last fall, learned that a computer-controlled system for managing stormwater from heavy rains could save the Detroit area $500 million in infrastructure costs.

The keynote presentation by Branko Kerkez, assistant professor at the University of Michigan, on his Open Storm project, kicked off the summit. Approximately 250 municipal officials, engineers and activists attended. The event was co-sponsored by the office of Oakland County Water Resources Commissioner Jim Nash and the nonprofit advocacy group Pure Oakland Water.

Kerkez argued that only computerized monitoring and software can maximize the effectiveness of stormwater management infrastructure. Putting “best practice” installations like bioswales into a stormwater management system at random can actually make the outflow of the system worse.

Instead, his team used sensors connected to wireless devices to monitor rainfall, the depth of water in runoff storage areas, and soil moisture, and connected them to software that makes automatic, intelligent decisions about opening and closing valves and gates of stormwater retention areas.

The technology, tested on Malletts Creek, which drains parts of Ann Arbor into the Huron River, produced an increase of 50 percent in the rainwater handling capacity of a retention basin, and a roughly 30 percent reduction in the cost of treating overflows during heavy rains—all from just $10,000 worth of electronics and equipment.

A study with the Great Lakes Water Authority to use similar controls on its massive system, which provides water and sewerage services to 127 communities in seven of Michigan’s most populous counties, found that using Open Storm’s sensors and software on its system could reduce 100 million gallons of combined sewage overflow in a serious storm. Kerkez said GLWA officials told him that building a 100 million gallon storage basin would cost $500 million.

The rest of the conference featured presentations on using green infrastructure to handle heavier rainfall events and autonomous and connected vehicles, saying autonomy could cut traffic congestion that costs the American economy $160 billion a year and releases an excess metric ton of carbon into the atmosphere a year.

Jeremy Tuggle, engineering manager for systems engineering and testing at Continental Corp. in Auburn Hills, also said autonomy was important to a zero-accident future that cuts carbon pollution. He said increasing connectivity and faster data processing will allow “e-mobility.”

He predicted a future of highly automated personal vehicles for long trips and shared, self-driving taxis for getting around cities.

Kirk Steudle, BSCE ’87, served as moderator. □ MR
Brüel & Kjær donation aids sound and vibration studies

Lawrence Technological University’s Audio Engineering Technology program students will benefit from a recent donation of sound analysis hardware and software from the Danish company Brüel & Kjær. The company is a world leader in the sound and vibration industry. The software also will be used in engineering noise, vibration, and harshness (NVH) engineering research at the University.

Nikolina Samardzic, assistant professor in the Department of Engineering Technology, said Brüel & Kjær will provide a 40 channel data acquisition system and 24 software licenses. Gary Newton, the director of automotive Americas at Brüel & Kjær, explained that “the donated software—which includes spectral processing, modal analysis, sound quality metrics—can be used to analyze sound and vibration data.” The hardware collects data using microphones and accelerometers, and can also be used as a signal generator for other forms of research.

Used by undergraduate and graduate students for work on senior projects and course and laboratory work, the donation will help students obtain hands-on experience in the field. Other programs at LTU that address acoustics and vibration, as well as sound quality, may also use the software and hardware.

The applications of the donation are diverse. Audio engineering technology reaches across media and industries, from music to movies to industry to environmental applications.

“Audio engineering is used in many industries, including automotive, entertainment, and commercial audio products,” Samardzic said. Career options range from advertising and public relations to audiology to industrial and environmental sciences.

“The Brüel & Kjær donation will significantly expand our potential for research in the area of sound and vibration,” she said. “It will also enhance the educational opportunities we can offer. This hands-on learning experience—with opportunities to accurately measure and analyze sound and vibration signals, then improve sound quality—will translate into highly sought-after skills in many sectors of industry.”

Samardzic, who obtained her PhD in mechanical engineering from the University of Windsor, used Brüel & Kjær products for her doctoral and post-doctoral research, as well as during her work as an NVH engineer in the automotive industry. She was previously employed at Rieter/Autoneum Automotive North America and Ford Motor Co., where she completed projects in the field of sound and vibration measurement, analysis, and simulation.

From auto warnings to training wheels, electrical and computer engineering senior projects run the gamut

Students in Lawrence Tech’s senior capstone project program in the Department of Electrical and Computer Engineering are applying the theories they learn in the classroom to solve real-world problems while getting a head start on achieving their career goals when they graduate.

Each capstone project has three stages or sequences. In the first sequence, students complete the initial planning, research, and design for their projects. In the second, they explore creative solutions and methods to achieve their goals. In the final sequence, prototypes are built and tested.

Ultimately, students will have completed their projects with circuit and software specifications fully implemented for their designs—some of which can even lead to patent applications, according to Nabih Jaber, associate professor and chair of the department and George Pappas, senior lecturer, who directs the program.

For example, student Michael Messina designed a rear or tailgate mounted gear indicator and clutch gauge for manual transmission vehicles. This consists of six segment displays (gears 1-5 and reverse), which are arranged in a shift pattern, and a gauge showing the clutch pedal position.

Continued
Many drivers tend to associate lit brake lights with a stopped vehicle and unlit brake lights with a moving vehicle. In a vehicle with manual transmission, this is not always the case, as the driver can remain stopped by simply disengaging the clutch. Messina’s indicators can show other drivers when the manual driver is waiting to take off or executing a shift.

“I chose this project because of the declining popularity of the manual transmission,” said Messina, who is eyeing a career in automotive design. “Beyond the safety aspect of conveying vehicle information to other drivers, another intent of this project is to spread information. My hope would be that someone who sees the display would be inclined to ask me, or to do research to find out what it means.”

Meanwhile, students Ashley Julin and Hana Beydoun completed a project designed to help children learn how to ride a bicycle. Their Automatic Balance Control Device (ABCD) relies on a congruent network of sensors and controllers integrated into a module that regulates the position of a pair of training wheels mounted to the rear of a child’s bicycle.

The rider will train as normal and the ABCD will assist in supporting the rider’s balance. The module sends signals, based on the information received from the sensor(s), to trigger a device that will either extend or retract the bicycle training wheels. The ABCD helps keep the bicycle from toppling, thus avoiding injuries while making it more convenient for kids to learn to cycle.

On a musical note, students Ibrahim Aljubaily and Matthew Matti built from scratch a fret-less electric guitar, which is an extremely challenging design. Their guitar produces four notes by using hardware and a Texas Instruments micro-controller. It has four strings with four force sensitive resistors or FSRs that react as an audio volume control sensor for each individual string.

The guitar has two modes—the “noob mode,” in which the player needs only to use the strings to produce the notes, and “expert mode,” which requires the player to use both strings and FSRs to release not only the note but also the volume of that note.
Robots, automation, AI, oh my! LTU mechatronics program leads students to tomorrow’s career

The average automobile today contains more than 100 computers. It’s just one of the many modern machines that rely on mechatronic systems. Factor in engineering needs for industrial robots, autonomous vehicles, and space probes—to name a few—and you’ve got a spectacularly growing field.

Lawrence Technological University’s mechatronic systems program, now in its 10th year, helps prepare tomorrow’s engineers for this growing segment of the industry.

Mechatronic systems engineers incorporate mechanical, electrical, and computer engineering, as well as math and computer science, to design the products, systems, and manufacturing processes mentioned above.

James Mynderse, associate professor of mechanical engineering at LTU, said the program essentially takes engineering to the next level. “This program goes into significant depth in the field which touches on automation, robotics, and provides both theory and practical application,” he says.

“We give graduates a skill set that evolves, offering them the flexibility to change jobs as technology changes.”

He said the program includes labs and courses on mechanical systems and control systems that integrate knowledge from other courses. Three electives allow students to tailor the program to their own interests. As the program has progressed, LTU has added new equipment and lab resources as well as new elective courses, Mynderse said. He has organized an NSF-funded series of workshops to help develop mechatronics and robotics engineering as a discipline.

Students are finding the program immeasurably beneficial

Shalaka Nayak, MSMSE’18, said she has a “fascination to get things to work without any human intervention, in short automate things… the mechatronics systems program provides me with a platform to showcase my interest and also develop my knowledge and skills in not only electrical and electronic controls but also mechanical controls.”

Now working in an automotive automation industry as a controls engineer, Nayak said the course schedule also makes it convenient for working students.

“The program is clearly laid out for every student to take the courses at their ease and learn at their own pace. As most master’s students are working professionals, most of the lectures are scheduled in the evenings which allows one to combine work and studies without any difficulties,” she said.

Daniel Hodges, a 20-year veteran of the engineering field, will complete the program this year. He enrolled in mechatronics to stay up-to-date on this evolving industry. Up-ended by the recession in 2009, he went through three downsizing events, but now looks forward to a recharged start.

“My career goal is to strategically lead my organization to innovative solutions which enrich our customers in ways that they don’t even know that they need yet. For that, I needed a graduate degree, especially in this global labor market,” he said. “I chose mechatronics because I needed more tools to fully explore creative solutions and to create adaptive systems. I am excited about what I now know I can do.”

Graduates from the program can go on to work in every segment of engineering, but Hodges said this can apply to every area of life.

“I understand how smaller technical needs are sometimes the very tip of the proverbial iceberg. For example, a tight shoe is supportive during basketball but detrimental to circulation. A systems-focused degree has taught me how to implement more powerful solutions. So, now I can evaluate adding an adaptive tension webbing to the shoe that tightens when I move or lessens when I stand still—a critical need for professional NBA players,” he explained. “But, what if I expand the technology to diabetics whose feet swell or to fighter pilots who endure high g-force turns or even slimmer space suits for astronauts... the possibilities abound.”

For more information on LTU’s Mechatronics Systems Engineering program, visit https://www.ltu.edu/engineering/mechanical/master-science-mechatronic-systems-engineering.asp.

Mynderse goes over a mechatronics project with a student.
New ECE chair aims for growth, connected cars, smarter grids

Nabih Jaber has made a career out of researching vehicle-to-vehicle and vehicle-to-infrastructure communications. So in an era when automakers are introducing advanced cruise control that lets drivers take their hands off the wheel in freeway driving situations, it seems like a perfect time for him to take over as chair of Lawrence Tech’s Department of Electrical and Computer Engineering.

Jaber joined LTU in 2012, coming from the University of Windsor where he earned his bachelor’s, master’s, and doctoral degrees.

There, he researched communication systems in vehicles, concentrating on a technology called DSRC, Dedicated Short-Range Communications. Today, it’s thought that 5G wireless phone communication may take over many vehicle autonomy and connection functions from DSRC, which the FCC granted space in the 5.9 GHz band for use by vehicle safety and mobility applications. Jaber maintains that there are “a lot of unknowns about 5G. DSRC has some advantages that 5G cannot replace. But the main thing they’re saying is that with 5G, the towers are already there, the infrastructure is already there.”

Jaber’s research these days involves digital signal processing and voice filtering systems, all informed by increasing interest in the role of artificial intelligence in connected vehicles.

Jaber takes over an ECE department with approximately 180 undergraduate and 20 graduate students, with growth in electrical engineering and embedded software engineering programs.

His goal is to boost undergraduate enrollment to about 200 and graduate enrollment to 50. And he aims to continue improvements in the laboratory infrastructure, including a new printed circuit board lab that opened last year and a new power systems lab as well.

“Students will build their own printed circuit boards for their projects,” Jaber said of the new lab—work that was previously farmed out.

And Jaber plans more outreach to area employers in the utility, manufacturing, and artificial intelligence industries to hire more students for internships and co-ops, and to boost sponsored research at LTU. A recent example is a new graduate course in connected vehicles being taught by an expert at Hyundai America Technical Center Inc. (HATCI).

LTU’s research also reaches into the power grid through a new course in smart grid communications that addresses issues like those that caused the massive 2003 power outage in the Midwest and Northeast. The answers are fast, wireless communication from the field, focused through the lens of artificial intelligence and probability mathematics.

“AI works with things you can’t predict,” Jaber said. “You use statistics and probability equations to predict where problems will occur—you don’t need to send someone out to look for the problems.”

Jaber said he’s proud to have gotten an email from a former student saying that he got a job because of that smart grid course. □MR
LTU in stormwater initiative with Great Lakes Commission

Lawrence Technological University and the Great Lakes Commission have joined forces to create the Great Lakes Stormwater Technology Transfer Collaborative.

The new group aims to spread the use of advanced stormwater technology throughout the Great Lakes and St. Lawrence River region in the United States and Canada—overcoming barriers to getting the right stormwater technology to the right people and places.

Innovations in stormwater management, such as green infrastructure design, data-driven water management systems, and proprietary structural systems, are vital in protecting communities from polluted stormwater and flooding. But smaller or financially struggling communities can face challenges in implementing them.

The collaborative is focused on overcoming those obstacles.

Victoria Pebbles, program director at the Great Lakes Commission, noted the importance of the new group. “In 2014, 22 billion gallons of untreated sewage and stormwater were released into the Great Lakes,” she said. “Innovative stormwater management like green infrastructure can be a cost-effective way to address this crisis, but only if Great Lakes communities know about and can access the appropriate technology. This collaborative will be a powerful resource for communities struggling to implement sustainable solutions to address stormwater management needs.”

Donald Carpenter, professor of practice in civil engineering at LTU and director of the University’s Great Lakes Stormwater Management Institute, is working with the collaborative to...
spread sustainable stormwater management practices and technologies. Carpenter said implementing green infrastructure in communities can greatly reduce pressure on existing “gray” infrastructure—the pipes and pumps that move stormwater to treatment plants or directly to rivers—especially in locales where these systems are outdated or degraded.

“We have an opportunity to share some really innovative solutions with communities throughout the region and have an impact on how infrastructure is developed and sustained into the future,” Carpenter said. “This group will connect a lot of the dots to make it easier for local governments to access and implement the appropriate technologies for their communities’ stormwater management needs.”

The collaborative is supported by the Fred A. and Barbara M. Erb Family Foundation. A sister project, the Green Infrastructure Champions Pilot Program, also supported by the Erb Family Foundation, will create a mentoring network of “green infrastructure champions” and emerging communities across the Great Lakes. The two efforts will work in tandem to reduce physical and institutional barriers to a greener approach to stormwater management. □MR

ESD honors faculty, staff, students

Two faculty members, a vice president, three alumni and three students of Lawrence Technological University were honored by the Engineering Society of Detroit at its annual dinner, held to honor Michigan’s best engineers and technical professionals.

Bruce J. Annett, Jr., vice president of marketing and public affairs, received the TechCentury Image Award, recognizing achievement in promoting engineering and technical professions among the public. It is granted by the editorial board of ESD’s quarterly magazine and website, TechCentury. Annett has worked at LTU for more than four decades and has been in charge of its communications efforts, showcasing the achievements of LTU alumni who are engineers and technical professionals.

Receiving the ESD Distinguished Service Award was Janice Means, PE, LEED AP, associate professor of architecture and design. Means has a long record of accomplishment in green and sustainable construction, while serving ESD and other professional and nonprofit groups.

Receiving the ESD Outstanding Leadership Award was Michael Cloud, associate professor of electrical and computer engineering, who has co-authored 11 books on engineering mathematics and is a senior member of the IEEE.

Named to the ESD College of Fellows were Alex Ivanikiw, BSAr’76, BAr’79, AIA, LEED AP, senior vice president of Southfield-based Barton Malow Co., and John S. Boulananis, BSEE’92, PE, managing member and owner, AJA Quality Services LLC. The rank of ESD Fellow is reserved for ESD members of outstanding and extraordinary technical achievement, professional achievement, and service to ESD and their professional society.

Winning the ESD Outstanding Young Engineer of the Year award was Lauren Bukowski, BSCE’09, GcertPM’12, MBA’12 project manager, Barton Malow Co. Bukowski was also the 2009 recipient of LTU’s Ed Donley Distinguished Graduate Award.

Three LTU students were named winners of the ESD Outstanding College Student of the Year award—Mateusz Gibiec, BSCE’18, Nada Saghir, BSME’18, and Joseph D. Yudasz, BSRE’17. □MR

Programs for your convenience

Many LTU engineering degree programs are available on campus, online, or even onsite. See the full range of degrees on the inside back cover. A wide array of evening programs are especially attractive to employed students. Earn your degree while you work, and apply new skills as you improve job performance.

Visit LTU Admissions at: https://www.ltu.edu/futurestudents/
email admissions at: ltu.edu
or call: 248.204.3160
New motorsports team building the green motorcycles of the future

Members of Lawrence Tech’s new e-Moto Racing team foresee the day when their zero-emission electric motorcycle will win one of the big races, like Isle of Man in the United Kingdom or Pike’s Peak International Hill Climb in Colorado. After all, they figure, an electric motorcycle won’t gasp for oxygen at high altitudes like its gasoline-powered competition.

E-Moto founder Lee Carney, BSME’19, and team member Ben Lenze, BSME’20, agree that the bike they are designing, building and testing probably won’t make it onto the international stage this year. But when it does, they are sure it will bring worldwide attention to Lawrence Tech.

According to team advisor Jim Kerns, robotics laboratory instructor in LTU’s A. Leon Linton Department of Mechanical Engineering, it was their enthusiasm and a well-researched proposal that won team founders Carney, Jordan Klebba, BSME’19, and Adam Copp, BSME’18, approval for the project—not an easy feat, since Lawrence Tech already has five motorsports teams and the faculty was concerned about stretching resources to include another competition team.

“Part of the deal was that we would go out and get our own sponsors,” Carney said, pointing to a wall of plaques to prove their success.

Electric bikes are where the industry is going, carney and Lenze agree.

True to LTU’s mission of enriching theory with practice, e-Moto team members are using what they learn as students in transportation design, and mechanical and robotics engineering.

They are tweaking traditional automotive parts like their aluminum swing arm to strengthen support for the bike’s rear wheel while keeping down the weight. They partnered with Parker Hannifin to find the right magnet motor and worked through five ground-up revisions with Roush to find the right battery. Both companies are among their sponsors, as is AristoCast, which is providing lightweight magnesium-cast wheels able to withstand the high shear stress created by motor acceleration.

As the team works through design decisions, speed and the safety of the rider are always the focus. Lenze likes to pull up a picture of a racer who is leaning into a curve, his elbows just inches from the track.

To ride their bike, LTU’s eMoto team has chosen Elliot Hayward of Calgary, Alberta, Canada. Hayward, known by his YouTube handle “Snowcat,” has 900,000 followers and 152 million views on the video social media platform. Data indicates that he is also drawing interest to the eMoto project, which now has more than 30,000 followers, an important factor as the team continues looking for donors and sponsors.

Snowcat will be in town for test runs, preparing for the eMoto Racing Series Varsity Challenge in August at the Gingerman Raceway in South Haven. Among the schools competing will be RIT, Virginia Tech, Penn State, University of Calgary, Sherbrooke University in Quebec, Ohio State, and University of Michigan.

The eMoto team needs donors and sponsors. For more information, email lcarney@ltu.edu. The eMoto team has a one-year agreement with LTU as a sanctioned racing team. When its official status expires, the current plan is to continue as a club.
More super than super
SAE Supermileage team aims to top last year’s school record

Last year’s SAE Supermileage competition team set an LTU school record by hitting 370 miles per gallon with a new, lighter carbon fiber body.

That record will be short lived, promises Alex Betz, BSME’19, co-captain of this year’s squad.

“Based on what we’ve calculated we can get upwards of 500 mpg,” said Betz, a native of Indianapolis.

The secret, Betz said, is a new monocoque chassis that combines body and frame.

Last year’s competition team used a steel frame under the carbon fiber body. This year, an expanded 10-person team has the manpower to create what Betz called “a carbon fiber and Nomex sandwich,” Nomex being a strong, heat-resistant synthetic fiber used in aerospace and military applications. That sandwich will support the driver, the Supermileage car’s engine—a one-cylinder, 3.3hp Briggs & Stratton—and the rest of the car’s components, without the need for a steel frame.

“It’s lighter and stronger than last year,” Betz said.

Added co-captain Austin Petty, BSME’19: “It’s basically cut the weight in half, so that should help.” Petty said the monocoque weighs just 28 pounds, “so we’re hoping to have the whole car weigh less than 80 pounds.” That 28-pound weight for the one-piece body and frame is down from 70 pounds for the frame and body last year—without the engine, steering system, brakes and wheels.

Betz, Petty and their teammates will compete against other universities at the SAE Supermileage event June 6-7 at the Eaton Corp. proving grounds in Marshall, Mich.

At the competition, teams run six laps around a 1.6-mile track for a total of 9.6 miles. The rules state the cars must maintain a speed between 15 and 25 mph. As a practical matter, Petty said that means “You turn on the engine and get up to 25 mph, then you turn it off and coast—about a mile, actually—until you get down to 15, then you turn the engine back on until you get back up to 25, then you turn it off again, and you repeat that until you’re done.”

The MPG is determined by weighing the car’s fuel bottle before and after the run. “Last year’s team used 76 grams of fuel,” Petty said—not quite three ounces.

Betz predicts good things ahead for LTU’s Supermileage squads, which are advised by Associate Professor of Mechanical Engineering Liping Liu.

“We have 10 members this year,” Betz said. “The past few have had just five or six. And the upcoming team for next year also has 10 members. We’re steadily increasing our numbers and getting more people involved, which lets us make a better car.” □MR
Concrete toboggan team gets top marks for safety, steering

Though they couldn’t quite duplicate last year’s “King of the Hill” award for the fastest sled, members of this year’s LTU concrete toboggan team did take home several top rankings at the 2019 Great Northern Concrete Toboggan Race, held Feb. 1-3 in Edmonton, Alberta, Canada.

Lawrence Tech remains the only United States university to participate in the Canadian-student-managed, concrete-industry-sponsored event, thanks to a personal connection of Edmund Yuen, chair of LTU’s Civil and Architectural Engineering Department.

“Without Dr. Yuen, we couldn’t do this competition,” said civil engineering graduate student and team co-captain Chris Bragg of Fraser. “He’s the backbone.”

In the GNCTR, students design and build a four-person toboggan whose runners must be made of concrete. The maximum weight allowed this year was cut 50 pounds to 300 pounds, and the sleds must demonstrate steering and braking ability.

For the 2019 event, held at Sunridge Ski Area, conditions were brutal—well below zero, with wind chills of more than 40 below. But 24 college and university teams still sent their sleds down the hill. “The comradery was off the charts between the teams,” said Bradley Woods, MAr’19. “The teams all interact in the days before the competition, and on race day all the teams cheer each other on. Another university, Waterloo, needed to borrow our trailer, and we were happy to help.”

LTU finished seventh out of 24 teams in the event overall, but got top marks for both its steering system and its toboggan’s safety features—specifically, an impact-attenuating crumple zone at the front of the sled, made of honeycombed aluminum. LTU also earned third place for its technical display, its best ranking ever in this part of the competition. “Basically that’s a 20-by-20-foot area where you set up a display that represents your theme, and showcases all the different technical concepts involved in your sled—the superstructure, the concrete runners, the technical systems, your concrete formulation,” Bragg said. “You also set up games and fun activities for people passing by.”

This year’s theme involved cartoons, so LTU’s team dressed up as DC Comics’ Justice League, and the sled itself had a Batmobile motif.

While not the fastest in the event, this year’s sled was no slouch, hitting speeds of nearly 35 mph. Its advanced light concrete runners used synthetic fibers and manufactured beads of recycled glass called poraver to cut weight.

Besides Yuen, Bragg and Woods credited team financial sponsors, Inland Diamond Products, a concrete cutting firm in Madison Heights; Ruby and Associates Inc., a structural engineering firm in Bingham Farms; LTU Engineering Dean Nabil Grace; and LTU Engineering Technology Department Chair Ken Cook. Fundraising was more of an issue this year, since the team had to fly to Edmonton, rather than drive as in earlier years when the competition was held outside Toronto.

Someone had to drive the sled, though, and that duty fell to Ray Zeigler, supervisor of LTU’s fabrication laboratory. With the sled in LTU’s Blue Devil Motorsports trailer, Zeigler drove through blizzards and road closures—more than 4,000 miles roundtrip, for a total of 82 hours of driving.

“It was fun,” Zeigler said. “I love to drive, and now I’ve driven...
The team in more conventional cold-weather garb after their run.

In the competition, students were asked to integrate elegant, efficient, and sustainable building systems in the design of a four-story, 70,000-square-foot resort hotel and spa on the Black Sea near Istanbul, Turkey. Architectural and structural design, along with mechanical, electrical and plumbing engineering all played a part in the students’ design, Nelson said.

**LTU takes second place in ASHRAE sustainability competition**

A cross-disciplinary student team from Lawrence Technological University took second place in the 2018 international ASHRAE Student Design Competition.

The five students won in the Integrated Sustainable Building Design category of the competition. Their award was one of just two earned by Michigan schools at the event, held as part of the 2019 ASHRAE Winter Conference and Expo in Atlanta, Ga., Jan. 12-16. Sixty colleges and universities participated in four categories at the event, having been selected from hundreds of entrants.

Team members were London Jocham, MSArE’19, Shawn Kitchen, MAr’18, Erin Moran, MSArE’19, Brittany Davis, MAr’18, and Josie Queary, MSArE’18. Queary and Moran attended the event and displayed a poster on the project. Ralph Nelson, associate professor of architecture, was the team’s faculty advisor.

In the competition, students were asked to integrate elegant, efficient, and sustainable building systems in the design of a four-story, 70,000-square-foot resort hotel and spa on the Black Sea near Istanbul, Turkey. Architectural and structural design, along with mechanical, electrical and plumbing engineering all played a part in the students’ design, Nelson said.

**LTU’s concrete toboggan team won third place out of 24 competing schools for their presentation area before the competition with their theme, Justice League.**

The team’s concrete formulation was shown off in this poster at their presentation.

**Josie Queary (left) and Erin Moran, members of the runner-up Lawrence Tech team, at the ASHRAE Winter Conference and Expo.**

The team’s concrete formulation was shown off in this poster at their presentation.
LTU funds groundbreaking research for undergrads

Winners of the Fall 2018 Presidential Undergraduate Research Awards were honored in January at a ceremony where they were presented certificates and congratulated by President Virinder Moudgil.

College of Engineering projects being funded under the program were:

- Lucas Adams and Sydney Ross, Department of Biomedical Engineering; supporting faculty member, George Pappas. Project: H.E.A.T, Hospital Engaged Augmented Technology. Goal: An improved security camera system to reduce assaults and crime in hospital settings.

- Zachary Carey, A. Leon Linton Department of Mechanical Engineering, and Robert Saltoy, Department of Electrical and Computer Engineering; supporting faculty members, Wuming Jing and Jinjun Xia. Project: Magnetic Manipulation of Submillimeter Microbot Visualized by Ultrasound Guided Photoacoustic Imaging. Goal: Use a novel imaging technique to process images of submillimeter microbots, which have shown potential for transformative biological and medical operations, but which can’t be accurately imaged by current technologies.

- Emily Gandolfi, Department of Biomedical Engineering; supporting faculty member, Eric Meyer. Project: Measuring the Effect of Posture on Lower Extremity Biomechanics During Jump Landing. Goal: Identify the body positions most likely to cause lower extremity injury in a two-legged jump landing.

- Robert Meyer, Department of Biomedical Engineering; supporting faculty member, George Pappas. Project: The Heart Without a Pulse. Goal: To develop better left ventricular assist device (LVAD) technology to improve patient outcome and health informatics.

- Sarah Trapp and Marissa Bradley, Department of Biomedical Engineering; supporting faculty member, Yawen Li. Project: Bioprinting for cartilage regeneration. Goal: Explore tissue engineering to regenerate healthy cartilage tissue in those suffering from osteoarthritis.

- Baily Wills, Department of Biomedical Engineering; supporting faculty member, George Pappas. Project: New Weight Measurement System to Reduce Strain on Recumbent Patients. Goal: Develop a more comfortable and practical method to weigh patients in hospital beds.

Students assist disabled in entrepreneurial design course

Sophomore engineering students once again spent the fall semester designing products to help developmentally disabled people improve their lives.

Students worked with the Dearborn-based Services to Enhance Potential (STEP), which finds and manages job placements for the disabled, and ConnectUs, a Livonia-based nonprofit that provides quality programming for individuals with severe multiple disabilities.

The students are part of a course, EGE 2123, Entrepreneurial Engineering Design Studio, that is required in most LTU engineering programs. Students meet with the nonprofit agencies and their clients to witness, first-hand, the clients’ challenges, and design and build physical products to help solve those challenges.

“Creating a product for a real person—and in particular, a person with a disability—and seeing directly the impact that they can have on that person’s life, really resonates with the students,” said Heidi Morano, director of LTU’s Studio for Entrepreneurial Engineering Design (SEED), who teaches the course with Susan Henson, SEED project engineer. “We often have former students return to the studio to ask if their STEP client is still using their product. The empathy that the students develop for their customer really shows.”

The students presented their products in open houses to LTU faculty, staff, and students, as well as working professionals in engineering and related fields. Attendees cast votes to name first- and second-place teams in both sections of the course.

Winners in the afternoon class that worked with STEP were:

- First place, Ramp It Up, who produced a 3-D printed magnetized bracket to aid the production of roller assemblies used to transport cafeteria trays.

- Second place, tie, Gasket Smashkit, who produced a board...
with cones affixed to it to help workers punch holes out of gas-kets without damaging the gasket.
• Second place, tie, InspectTech, who designed a device to incorporate inspection into the manufacturing process of a component in automotive bumpers.

Winners in the evening class that worked with ConnectUs were
• First place, AMTF, a team that designed a table with jacks and actuators that raised and lowered to accommodate the height of a client’s wheelchair.
• Second place, Ticket Masters, which designed and built a new ticket dispenser for ConnectUs. □MR

Students in the entrepreneurial engineering design class demonstrate their inventions to staffers from Services to Enhance Potential, faculty, and fellow students.

Mechanical engineering prof honored at LTU’s Research Day 2019

Lawrence Technological University’s seventh annual Research Day set more records this year. LTU faculty and students made 17 oral research presentations, and an afternoon poster session featured 95 posters, for a total of 112 projects presented, up from 102 a year earlier.

Topics of the research varied widely, from wind turbine design to the development of flying and hopping robots to teaching techniques.

The presenting sponsor of Research Day was the Howard Hughes Medical Institute. LTU is one of only 23 schools across the country, and the only one in Michigan, to receive an HHMI grant to boost diversity in STEM fields through increased involvement of undergraduates in research, particularly undergraduates from historically under-represented populations. More about LTU’s efforts in course-based research efforts at www.ltu.edu/blogs/cre.

Research Day also includes the LTU Presidential Colloquium, in which a faculty member is honored for their research efforts with a keynote presentation. This year’s honoree was Robert Fletcher, professor in LTU’s A. Leon Linton Department of Mechanical Engineering.

Fletcher’s presentation was titled “People, Relationships, Connections, and Timing…One Professor’s Research Path.” Fletcher highlighted the people who influenced him in his career, starting with a beloved high school chemistry teacher. Several faculty members at the University of Washington also guided his path as a double major in music and engineering—

including the brutally honest music professor who told him he probably wasn’t a good enough trumpet player to make a career of it, and the equally honest engineering professor who told him, when it came to a career in engineering, “I think you can do this.”

Fletcher also credited his doctoral adviser at the University of Michigan, who guided him through a career shift from medical devices to power systems to college professor in the 2000s, a time when much of the buzz in renewable energy centered on hydrogen fuel cells. In the early 2000s, automakers predicted there would be millions of fuel cell cars on the road soon, but now there are virtually none. The reason for this? “Technology took a turn,” he said. “Batteries became very inexpensive.” But in the fuel cell heyday, meetings with federal, state, and utility officials led to Fletcher coming to LTU as the founder of its alternative energy programs.

Today Fletcher and his students continue research on hybrid vehicles and energy systems. Since joining LTU he said he’s brought about $1.7 million in research funding to the University, much of it from the corporate sector and the military. □MR
Severe weather curtails Grand Prix

Sometimes, the weather is just too rough for racing. Such was the case with the annual LTU Grand Prix, cut short in Fall 2018 by a severe thunderstorm warning.

With wave after wave of strong storms moving through southeast Michigan for the October event, nearly 200 college students from 11 universities still managed to put their cars through the paces on a track laid out in LTU’s parking lots.

The event, organized by LTU’s Blue Devil Motorsports teams, showcases SAE competition vehicles, including scaled-down Indy race cars, hybrid electric vehicles, off-road vehicles and more—all designed and built by students. The event is now in its 11th year.

LTU’s autonomous campus vehicle, ACTor, also made an appearance at the event. □MR

Lawrence Tech’s 2018 Formula SAE car, with its newly installed aerodynamics package, zips around the parking lot in front of the LTU Science Building.

No hands! A demonstration of LTU’s autonomous electric vehicle was also a part of the Grand Prix experience.
The sabbatical that didn’t end

For Kun Hua, associate professor of electrical and computer engineering, the research work from a Fall 2017 sabbatical continues.

Hua split the sabbatical between LTU’s campus and Changnan University in the city of Xian in central China.

On both campuses, Hua has a research team that is working on some of the most vexing challenges that are key to an autonomous driving future—vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication.

Hua says his teams have also worked with the Korean automaker Hyundai and Kia on several projects in vehicular communication.

“I believe we have been waiting for this moment,” Hua said. “All of the automakers are turning their attention to autonomous cars and smart cars. Vehicles that can warn other vehicles of road hazards, road conditions. I have not been that interested in autonomous cars, my interest is more in smart cars instead. The cars could be still controlled by drivers but assisted by smart technologies to save lives.”

Women in STEM panel deals with bias, offers hope for the future

The bias women still feel when pursuing careers in the STEM disciplines—science, technology, engineering, and mathematics—was the topic of a “Women in STEM” panel hosted by the Lawrence Technological University Alumni Association in November.

The discussion, held at Alumni House, featured three distinguished women from various sectors of the STEM industry, all Lawrence Tech alumnae—Donna Bell (BSEE’89), Nicole Kennedy (BSEE’95), and Terry Onica (BSBA’90). Along with current student Marissa Bradley, BME’20, they shared their experiences and insights as women in male-dominated fields.

The panelists, led by moderator Julia Elliott, addressed a number of their industry concerns—among them, the current shortage of women, and the persuasive bias still felt against girls who wish to pursue such careers. Building off of one another’s input, they additionally proposed strategies on how to challenge the standards which have given rise to the phenomenon.

“I hope one day people see women in STEM as the norm, and not the exception,” said Bradley, a biomedical engineering student and president of LTU’s chapter of Society of Women Engineers.

Panelists also shared professional advice for women currently in STEM careers. They spoke of their experience-based tactics for maneuvering the workplace—delving into their personal leadership styles and communication methods. They also detailed how they countered any inequalities faced on their road to success. Finally, the women discussed the importance of having role models, while at the same time being role models for today’s young women.

The panel finished on a note of optimism, for women, for the STEM industry, and for societal progress.

“I think this panel was important as it exposed women to other women that have been successful,” said Bell, global product development quality manager at Ford Motor Co. “It’s important to be there (for other women), to be represented, to be present.”
New faculty added for growing programs

A tenure-track faculty member in electrical and computer engineering, as well as an expert in biomedical engineering hired as a project engineer, now a senior lecturer, are the new hires for the 2018-19 academic year in the College of Engineering.

Yongpeng Zhang

Yongpeng Zhang received his PhD in electrical engineering from the University of Houston in 2003. Earlier, he received a Bachelor of Science in electrical engineering and a Master of Science in electrical engineering from Tianjin University, both in China.

From 2004 to 2018, Zhang worked as an assistant and then associate professor at Prairie View A&M University, part of the Texas A&M University system.

His research interests include control theory, electric machines and drives, power electronics, and mechatronics. His research has been supported by multiple grants from the National Science Foundation, the U.S. Army Research Office, the federal Department of Education, and private sector partners like 3M Corp. and Custom Power, now part of Emerson Electronics. He is the author of more than two dozen peer-reviewed scholarly articles on topics ranging from electric controller design to demographic shifts in higher education.

Michael G. Lancina III

In biomedical engineering, the new senior lecturer is Michael Lancina III. Lancina received his PhD in biomedical engineering in 2017 from Virginia Commonwealth University and his Bachelor of Science in biomedical engineering from Michigan Technological University in 2013. He joined LTU as a project engineer in 2017.

His research experience includes the use of dendrimers, polymers with a branching, tree-like structure for drug delivery, particularly to tissues in the eye.

Earlier, Lancina was a research assistant in the Biomaterials and Drug Delivery Laboratory at VCU, and a research assistant at Michigan Tech.

In his young career, Lancina has already been part of 10 publications in peer-reviewed scientific journals, and has made more than a dozen poster and oral research presentations at scientific events.

He is a member of the Biomedical Engineering Society, the Society for Biomaterials, and the Association for Research in Vision and Ophthalmology.

Morano promoted at entrepreneurial engineering design studio

Heidi Morano was named director of the College of Engineering’s Studio for Entrepreneurial Engineering Design (SEED) effective with the Fall 2018 semester. She had been project engineer of the studio.

Prior to her role in SEED, Morano served as an adjunct faculty member in LTU’s A. Leon Linton Department of Mechanical Engineering for 11 years.

Morano earned a Master of Science of mechanical engineering in applied mechanics from the University of Michigan and a Bachelor of Science in mechanical engineering from the University of Michigan-Dearborn.

Susan Henson was named to Morano’s former role as SEED project engineer. Henson has been an adjunct professor at LTU since 2010, specializing in introducing civil engineering students to geographic information systems (GIS) technologies, which she used in the private sector as a GIS consultant in the fields of historic preservation, underwater archaeology, and sustainability. Earlier, Henson worked as a materials scientist for Taylor-based Masco Corp.

Henson earned a Bachelor of Science in earth science and chemistry from Adrian College and a Master of Science in GIS from Eastern Michigan University.

LTU’s SEED is the site of a sophomore-level design studio course, required for most LTU engineering students, in which students work with nonprofit organizations to design and build products to solve real-world problems. (See story, page 26.) The studio also supports other LTU entrepreneurial engineering activities, such as the annual Innovation Encounter, in which teams of students from LTU and other universities help manufacturing companies solve real-world manufacturing engineering and process problems.

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Student Awards

Outstanding Member of a Student Organization

Alpha Eta Mu Beta Honor Society (BME): Rania Anoni
American Society of Heating, Ventilating and Air-Conditioning Engineers (ASHRAE) (Filza Walters): Marissa Mizzwa
American Society of Civil Engineers (Adam Lobbestael): Mallory Grager
American Concrete Institute (Keith Kowalkowski): Ezekiel Mensah Ababio
Architectural Engineering Outstanding Student Member Award (Filza Walters): Ashley Jordan
Biomedical Engineering Society (Yawen Li): Stephen Vernon
Robotics Engineering Students Society (Giscard Kfoury): Evan Szabo
Blue Devil Motorsports (Kingman Yee): Maysara Elazzazi
Chi Epsilon Honor Society (Edmund Yuen): James Theisen
Eta Kappa Nu Honor Society (Dr. Anneberg/Dr. Jaber): Dillon Putrus
Institute of Electrical/Electronic Engineers (Kun Hua): Matthew James McAllister Jr.
Institute of Industrial Engineering Student Chapter (Ahad Ali): Matthew James McAllister Jr.
Paul Michel Award (Ken Cook): Lauren Wosiak
Phi Alpha Epsilon (Filza Walters): Dorian Williams
Pi Tau Sigma Honorary (Hamid Vejdani): Brandon Garcia
SAE Collegiate Chapter at LTU (Kingman Yee): Pablo Ripodas
Tau Beta Pi Honor Society (Elin Jensen): Daniel Tamez Alanis
Society of Manufacturing Engineers (Ahad Ali): Alexandra Sharkey
Illuminating Engineering Society (Ali Fallahi): Nicholas Shyke

Outstanding Service Award

Architectural Engineering: Meckenzie Keogh
Biomedical Engineering: Sarah Trapp
Civil Engineering: Zachary Kelley
Electrical Engineering and Computer Engineering: Matthew James McAllister Jr.
Mechanical Engineering: Alex Betz
Engineering Technology: Nicolas Syltsma

Outstanding Student Award

Architectural Engineering: Amanda Nunnold
Biomedical Engineering: Marissa Bradley
Civil Engineering: Allyson Andrews
Electrical and Computer Engineering: Carrieann Towne
Mechanical Engineering: Dane Fernandez
Engineering Technology: Hope Sheffield

With President Moudgil is Matthew McAllister Jr., a triple major in engineering – electrical, computer, and mechanical. He received three awards at the event – an Outstanding Service Award in electrical engineering, the Outstanding Student Award from Eta Kappa Nu, the international honor society for electrical and electronics engineers, and the Outstanding Student Award from the Institute of Electrical and Electronic Engineers.

Joseph Alvord
Nicole Buckingham
Shane Mudd
Ryan Pakledinaz
Kira Haag
Victoria Pellerito
Nicole Anne Dominique Yu
Joseph Pahke
Hannah Soltsysak
Ryan Geisler
Meredith Adams (BME)
John Bowen (BME)
Alexandra Brinker (ME)
Amar Daboja (ECE)
Naim Shandi (ECE)

Dorian Williams won the Paul Michel Award in the Department of Engineering Technology, and is congratulated by President Virinder Moudgil.

Members of the Tau Beta Phi engineering honor society – officers and new initiates – gather at the March engineering honors banquet.

Winner of the Outstanding Student Award in the Department of Engineering Technology, Hope Sheffield, with LTU President Virinder Moudgil.

Members of the Tau Beta Phi engineering honor society – officers and new initiates – gather at the March engineering honors banquet.

Spring/Summer 2019
By the Numbers

Students finding practice to go along with classroom theory

Lawrence Tech’s longtime motto, “Theory and Practice,” dovetails well with the importance of internships and co-op jobs combined with classroom studies.

Internships and co-ops integrate classroom knowledge and theory with the practical application of that knowledge, as students will use it in the working world after they graduate.

They bring many other benefits to students, including the so-called soft skills needed for success in the workplace, from promptness to team building. Students learn how a professional workplace operates, from workplace culture to leadership to the realities of dealing with colleagues.

Internships and co-ops also provide important economic advantages for students. A 2017 study from the national Association of Colleges and Employers and a 2015 study by the American Association of Colleges and Universities found a broad majority of employers are more willing to consider a graduate with internship experience, and that internships increase the quality of education.

Lawrence Tech also offers undergraduates broad access to the opportunity to participate in competition teams—the University fields Formula SAE, Formula SAE Electric, SAE Supercar, SAE Aero Design, Baja SAE, and eMoto electric motorcycle teams—as well as significant opportunities in undergraduate research.

To find out the state of the art of interning and co-op jobs at Lawrence Tech, the College of Engineering dean’s office sent out a questionnaire last fall asking students to describe their internship and co-op experience. Nearly 80 students responded, from a wide variety of majors, including architectural engineering, audio engineering technology, biomedical engineering, civil engineering, construction engineering technology, electrical engineering, mechanical and manufacturing engineering technology, and mechanical engineering.

Students were asked whether they had had an internship, a co-op job, or other employment related to their major, as well as whether they had participated in an LTU competition team or had been involved in research.

By their sophomore year, 60 percent responded as having participated in one or more of these activities. By junior year, that number hit 80 percent, and by senior year, it nears 100 percent. Internships and co-ops alone approach 80 percent by senior year.

It would appear that the “practice” part of “Theory and Practice” is alive and well at Lawrence Tech. □MR
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 www.ltu.edu/futurestudents.

**Bachelor’s**
- Audio Engineering Technology
- Biomedical Engineering
- Civil Engineering
- Computer Engineering
- Construction Engineering Technology and Management
- Electrical Engineering
- Computer Engineering
- Electronics Engineering
- Power Engineering
- Embedded Software Engineering
- Industrial Engineering
- Mechanical and Manufacturing Engineering Technology
- Mechanical Engineering
- Alternative Energy
- Automotive Manufacturing
- Nanoscience and Nanotechnology
- Solid Mechanics
- Thermal Fluids
- Robotics Engineering

**Master’s**
- Architectural Engineering (combined bachelor’s and master’s program)
- Automotive Engineering
- Biomedical Engineering
- Civil Engineering
- Construction Engineering Management*
- Electrical and Computer Engineering
- Engineering Management*
- Engineering Technology
- Industrial Engineering*
- Mechanical Engineering
- Mechatronic Systems Engineering

**Doctoral**
- Civil Engineering
- Mechanical Engineering

**Minors**
- Aeronautical Engineering
- Energy Engineering
- Nanoscience and Nanotechnology

**Undergraduate Certificates**
- Electrical Power Systems
- Embedded Systems
- Entrepreneurial Skills

**Graduate Certificates**
- Aeronautical Engineering
- Electrical Power Systems
- Energy Engineering
- Telecommunications Engineering

*Also offered online

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Lawrence Technological University’s five-year integrated bachelor’s and master’s degree program in architectural engineering (MSArE) is nearing its 10th anniversary.

Even after a decade, the program remains unique—the only one of its kind in Michigan, and one of only two such programs in the entire United States that are accredited by ABET, the Accreditation Board for Engineering and Technology, for post-secondary education in engineering and science.

LTU’s degree program combines an engineering curriculum with a series of collaborative architectural engineering design studios. Graduates of the program are equipped with the engineering skills to create resilient structures that are energy efficient, reclaim water, and “healthy.”

With so few programs around the country, industry is hungry for these graduates. “Almost all of our students have an opportunity to work in multiple paid internships while they are studying, because companies want to entice the students to come and work for them once they are close to graduation,” said Filza Walters, director of the architectural engineering program. Most students begin working in industry internships early—after their freshman year.

The program has so far produced more than 50 graduates and there’s a 100 percent placement rate into jobs in their field at or before graduation, with many graduates receiving multiple offers, Walters said. The program also is split almost evenly between men and women, a rarity in a STEAM curriculum.

Also, every graduate has been a finalist in an international student design competition, sponsored by such professional groups as the Architectural Engineering Institute (AEI) and the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE).

Architectural engineering has a long history at LTU. The University offered a degree in architectural engineering from shortly after its 1932 founding into the 1960s, when it evolved into a bachelor’s degree program in LTU’s College of Architecture and Design. The current combined bachelor’s-master’s program was introduced in the College of Engineering in response to industry needs. Walters spearheaded the establishment of the program and recruited its first class in the fall of 2009.

Associate professor Edmund Yuen, chair of the Department of Civil and Architectural Engineering, said that LTU programs continue to stay relevant and improve, based on the department’s industry advisory boards consisting of more than 20 executives and experts in the field. These groups meet several times a year to discuss how classroom instruction can keep up with changes in the profession. “We are fortunate to have several individuals as long standing MSArE board members who are committed to our program. This is how they have chosen to give back to their profession,” Walters said.

These busy professionals take the time to keep the civil and architectural engineering curricula up to date because they have hired LTU graduates to fill key positions and are looking for more.