

# EXEMPLAR



College of Engineering

FALL/WINTER 2016

***PROCESS***

A woman with glasses, wearing a green blazer over a teal top, is smiling and looking at a laptop computer in a laboratory or workshop. In the background, a man in a blue shirt is working with a piece of equipment.

***PRODUCT***

Two men are in a laboratory setting. The man on the left, wearing a white lab coat and black gloves, is holding a small vial. The man on the right, wearing a plaid shirt, is looking at the vial.

***BEYOND***

A man in a dark jacket is holding a remote control for a drone. The drone is a white quadcopter with a white spherical cage around it, mounted on a red cart. The background shows a workshop or laboratory.

***ADVANCING MANUFACTURING THROUGH EDUCATION AND RESEARCH***

# EXEMPLAR

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## GREETINGS FROM THE DEAN



The mission of Wayne State University is to create and advance knowledge, prepare a diverse student body to thrive, and positively impact local and global communities. In his annual university address at the start of the fall semester, President M. Roy Wilson asked all students, faculty and staff to reflect on how we “live the mission” because it “drives everything we do.” I have proudly served as dean of the College of Engineering for nearly six years, and I believe that our college lives this mission every day.

We put Wayne State students and faculty at the forefront of a resurgent U.S. manufacturing industry by integrating sustainability into engineering education, preparing our graduates to answer the environmental, health and societal challenges facing traditional manufacturers. Others are diligently performing cutting-edge research in connectivity and mobility, accelerating understanding in areas such as connected health; public safety; the environment; traffic management; computing infrastructure; and food, energy and water distribution. Such projects are a microcosm of the college’s commitment not only to advancing knowledge but to improving quality of life.

The James and Patricia Anderson Engineering Ventures Institute continues to provide a platform for students to get a head start on their careers and a solid foundation for startup businesses. In the last two years since the inception of Student Design and Innovation Day, students have showcased more than 100 senior capstone and research projects. Other students preparing to join the workforce benefited from connections with 150 employers over four career fairs last year.

President Wilson has outlined that boosting enrollment is one of the university’s key goals, and I am pleased to say that our college, which today serves nearly 4,000 students, is doing its part. We welcomed 483 freshmen this fall as our overall enrollment increased by 7.1 percent. Since 2011, enrollment in the college has skyrocketed by 72 percent at the undergraduate level and 83 percent in graduate programs. The College of Engineering is attracting more high-caliber students both domestically and internationally each year.

Wayne State engineers play a pivotal role in revitalizing and sustaining communities. Our college is committed to narrowing gender and socioeconomic gaps through various programs in STEM education and careers, promoting discovery and exploring technology with over 3,000 K-12 students annually. HackWSU attracted 240 aspiring young developers to our campus. Student organizations have initiated numerous efforts, from blood drives to urban gardening. And faculty research is tackling important issues in water quality, particularly in troubled areas such as Flint.

I am excited to share our success stories in this and future editions of Exemplar. Naturally, the support of our alumni, the generosity of our donors, the inspiration of our city and the motivation to be leaders among our peers make it possible for us to do what we do in the Wayne State University College of Engineering.

We are indeed driven by our mission, and we will continue to live it to the fullest.

Sincerely,

Dean Farshad Fotouhi




# Advanced materials and manufacturing FACULTY EXPERTS

Wayne State University offers exceptional strength in a number of key advanced manufacturing areas, many of which are multidisciplinary, with faculty collaboration among various departments. Wayne State is a partner in the Obama administration-initiated national manufacturing consortium LIFT (Lightweight Innovations for Tomorrow), and a key member of Advance Michigan, an Investment in Manufacturing Communities Partnership program.

WSU faculty members are experts in some of the important advanced manufacturing technologies, including:

- Nano-micro manufacturing (biomedical and energy devices)
- Advanced materials thermal-mechanical processing (including additive manufacturing)
- Automation in manufacturing
- Lightweight materials (composites and mixed materials) manufacturing
- Design for sustainable manufacturing


Digital and quality control aspects including nondestructive evaluation are embedded in all of these areas. Real-time monitoring and application of statistical controls also are strongly emphasized. In many instances, Wayne State faculty members take a systems approach to solve manufacturing problems.




**Emmanuel Ayorinde, Ph.D.**  
Associate Professor, Mechanical Engineering  
Nondestructive evaluation, composites and mixed materials



**Yinlun Huang, Ph.D.**  
Professor, Chemical Engineering  
Sustainability, process control



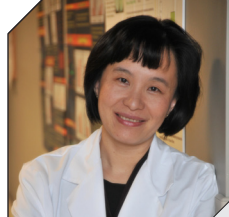
**Amar Basu, Ph.D.**  
Associate Professor, Electrical and Computer Engineering  
Nanomaterials, micromanufacturing, medical devices




**Kyoung-Yun "Joseph" Kim, Ph.D.**  
Associate Professor, Industrial and Systems Engineering  
Joining and bonding, theory and computational modeling, systems design




**Wen Chen, Ph.D.**  
Associate Professor, Engineering Technology  
Robotics, control systems, process and quality control




**Guangzhao Mao, Ph.D.**  
Professor, Chemical Engineering  
Nanomaterials, micromanufacturing and biomedical devices



**Mark Cheng, Ph.D.**  
Associate Professor, Electrical and Computer Engineering  
Nanomaterials, micromanufacturing, medical devices



**Golam Newaz, Ph.D.**  
Professor, Mechanical Engineering  
Micromanufacturing, joining and bonding, nondestructive evaluation, composites and mixed materials




**Guru Dinda, Ph.D.**  
Assistant Professor, Mechanical Engineering  
Nanomaterials, additive manufacturing, joining and bonding, processing and microstructure, 3-D printing




**Jeremy Rickli, Ph.D.**  
Assistant Professor, Industrial and Systems Engineering  
Process and quality control, systems design and sustainability



**Ana Djuric, Ph.D.**  
Assistant Professor, Engineering Technology  
Automation, robotics, systems design



**Xin Wu, Ph.D.**  
Associate Professor, Mechanical Engineering  
Processing and microstructure, joining and bonding, theory and computational modeling, process and quality control, composites and mixed materials



**Xiaoyan Han, Ph.D.**  
Professor, Electrical and Computer Engineering  
Nondestructive evaluation, joining and bonding, composites and mixed materials, process and quality control



**Qingyu Yang, Ph.D.**  
Assistant Professor, Industrial and Systems Engineering  
Processing and microstructure, theory and computational modeling, process and quality control, reliability and optimal maintenance, sustainability



## Sustainability education and innovation at heart of rebuilding U.S. advanced manufacturing

Yinlun Huang believes manufacturing is the heart of the U.S. economy. Through his efforts in sustainability education in the Wayne State University College of Engineering, he wants to make sure that statement remains true for many years to come.



Huang, a professor of chemical engineering and materials science, has devoted much of his career to sustainable systems engineering. His work aims to answer many serious questions that have been raised about the environmental, health and societal impacts of traditional manufacturing methods.

“Manufacturing should not sacrifice the resources for future generations,” said Huang.

Huang has monitored domestic and international trends in manufacturing, shaping his educational and research methods to ensure Wayne State University is a leading resource to overcome the challenges associated with global competition and the depletion of natural resources.

“Rebuilding advanced manufacturing is a top priority for both the White House and the National Science Foundation,” said Huang, who has developed a litany of NSF-funded projects and served on numerous NSF committees and workshops focused on sustainability. Regarding government support, Huang cites the Advanced Manufacturing Partnership formed by the Obama administration in 2011 as an example of the national effort to invest in emerging technologies that will create high-quality manufacturing jobs and enhance the country’s global competitiveness.

Huang trusts that the United States

can achieve its manufacturing goals by “moving aggressively towards an economy that is innovation-fueled, opportunity-rich and sustainable, and by training a cohort of future leaders in this area who have mastered the ability to coalesce multidisciplinary components to create sustainable solutions.”

It is perhaps in the training of those leaders where Huang has made the most profound impact. In 2008, Huang founded the college’s graduate certificate program in sustainable engineering. Huang has also developed course materials for sustainable process design, which have been adopted by the senior capstone design course, Chemical Process Integration. Nearly 250 Wayne State undergraduate students have engaged in projects that address issues such as biodiesel and transportation fuel manufacturing as well as energy and toxic chemical reduction in the automotive coating process.

Under the direction of Huang and Jeremy Rickli, assistant professor of industrial and systems engineering, Wayne State also hosts a Research Experiences for Undergraduates (REU) summer academy. This is an extraordinary undergraduate research opportunity and the first of its kind from the NSF in the area of sustainability in advanced manufacturing. The 10-week academy began in 2016 for its first of three consecutive summers. (Read more about the REU site on page 6.)

For his contributions to sustainability education, Huang was selected to receive the 2016 Sustainable Engineering Forum Education Award from the American Institute of Chemical Engineers (AIChE). He also was the recipient of the 2010 AIChE Research Excellence in Sustainable Engineering Award, making him the first in the chemical engineering community to receive both AIChE honors.

Sustainability is an essential component to Wayne State’s overall capabilities in advanced materials and manufacturing research, much of which is multidisciplinary and requires interdepartmental collaboration.

“Integration of sustainability in engineering education has moved to the forefront of undergraduate program enhancement as it becomes widely recognized that the next generation of engineers will face serious sustainability challenges in the practice of their profession,” said Huang.

The United States has seen a resurgence in manufacturing since the Great Recession, and Wayne State is situated in the center of a region that has played a critical role in that recovery. According to the most recent regional labor market report released by the Workforce Intelligence Network, there are over 123,000 people employed in manufacturing engineering and design in Southeast Michigan and another 116,000 in the manufacturing skilled trades. Both groups have experienced a growth of about 35 percent since 2009.

It stands to reason that the prospects for Wayne State engineers to work in this region are great, but not to be overlooked are the opportunities for WSU graduates to solve sustainability problems for many of these companies. Data from the 2010 U.S. Census Bureau indicate that there are approximately 14,000 manufacturing

establishments in the three counties (Wayne, Oakland, Macomb) surrounding Wayne State University, experiencing an average energy loss of 30 percent in their current processes.

Huang believes Wayne State’s location in Detroit, quite literally down the street from these manufacturing firms, makes the university uniquely qualified to tackle the issues in this field.

Many manufacturing companies have already demonstrated a commitment to sustainability, including chemical giant BASF, which will collaborate with Huang and other researchers to jointly study key fundamental aspects of sustainable development of industrial systems. Huang was recently awarded a \$356,000 NSF Grant Opportunities for Academic Liaison with Industry (GOALI) grant to support this joint endeavor, with a goal of developing a theoretical framework and engineering methodology that will be valuable for studying industrial sustainability problems. The project will also spawn educational materials for Huang’s introductory course on sustainability, which is open to all engineering students at Wayne State.

According to Huang, “sustainability is no longer a slogan or concept.”



## UNDERGRADUATE RESEARCH ON DISPLAY AT REU SITE SUMMER ACADEMY IN SUSTAINABLE MANUFACTURING

The first installment of Wayne State's Summer Academy in Sustainable Manufacturing culminated with a symposium in early August, during which 11 participating undergraduate students from different universities had the opportunity to display the results of their hard work over the previous 10 weeks.

This program, the first of its kind to focus on sustainable manufacturing, was made possible through a National Science Foundation Research Experiences for Undergraduates (REU) Site grant earned last winter by Jeremy Rickli, assistant professor of industrial and systems engineering, and Yinlun Huang, professor of chemical engineering and materials science. Wayne State will host similar programs over the next two summers.

The agenda for the summer academy was largely comprised of research seminars, skill-development sessions and project work in 11 laboratories with faculty mentors. Participants presented mid-program technical reports to mentors, industrial collaborators and students during the sixth week.

"One of our goals was to have the

students gain an understanding of what research is and what the day-to-day experience is like for many graduate and Ph.D. students," said Rickli.

The intensive schedule ultimately led up to the final research symposium week, during which students submitted a final report and presented posters depicting the results of their work. Judges rated the students' work based on poster presentation, oral presentation and research achievement. Thalia Quinn, a chemical engineering major from New Mexico Institute of Mining and Technology, and Jovan Morgan, an industrial and systems engineering major at Wayne State, were named co-winners of the Best Poster Award.

"We had a fantastic cohort of students and we truly believe all had award-worthy posters," said Rickli and Huang. "Thalia and Jovan impressed the judges in all three evaluation categories and were deserving of sharing the Best Poster Award."

The strong finish was a particular point of pride for Morgan as the lone WSU representative in the program. Morgan worked in Rickli's lab with

advanced robotics equipment and a 3-D laser scanner to perform condition assessments of components for remanufacturing purposes.

Morgan, a native of Detroit, particularly appreciated the hands-on approach and high level of accessibility he experienced under Rickli's tutelage. He had rave reviews of the summer academy, while being cognizant of his "home field advantage" to continue his project with existing colleagues and mentors and the support of a top research institution.

"These research projects have exposed us to a whole other level of engineering that we didn't see as possible before," said Morgan.

Quinn studied physical properties of fluorinated surfactants used in manufacturing of semiconductors, measuring practicality for either removal or replacement due to the harmful effects they have on the environment and animal life. She worked under the guidance of Jeffrey Potoff, professor of chemical engineering and materials science.

"Dr. Potoff and his grad students helped me out a lot with learning the

simulations and getting used to their specific software," said Quinn, who has connections to Michigan. Her mother's family is from Forestville, located two hours north of Detroit on the coast of Lake Huron. "It was great to work with them and be able to bounce ideas off them."

Rickli hopes most of this year's REU site students have only begun to scratch the surface of their respective research endeavors.

"Ideally, they're interested in the project so much that they continue working in a similar area, either with their home institution or the mentors and graduate students here at Wayne State."

A few students found that their experiments did not work or were not feasible, but Rickli stresses that there is still valuable information in those conclusions.

"Their understanding of why it didn't work is the important part, and using that to make future decisions. That's what happens in research," said Rickli.

Success in this program was measured far beyond experimental results. Most of the students stressed the invaluable time spent in labs performing research and absorbing knowledge from their mentors as their greatest takeaway from this experience.

Paige Smith, an Ann Arbor native and a junior at Miami University, experimented with adding salt to algae for production of carotenoids, which are typically produced synthetically. She appreciated the opportunity to learn through a practical approach with high-tech tools such as a spectrometer and a hemocytometer. She also learned, through seminars and conversations with faculty experts, to see sustainability from a much wider scope, particularly as it relates to economic challenges in the field.

"From a government perspective,

they need to invest money into making it worthwhile for universities to focus on sustainability, because there is a lot of research that needs to go into making costs comparable to traditional methods of manufacturing," said Smith. "That's something I didn't think about before I came here."

One of the ancillary benefits of the academy was the opportunity to showcase Wayne State and its prime location in Midtown Detroit to a largely unfamiliar audience. The students, who lived in the Towers Residential Suites on campus, toured nearby manufacturing plants, including BASF and the Rouge River Assembly Plant. They also enjoyed some of Detroit's cultural institutions, particularly the Detroit Institute of Arts and the African American History Museum.

Chandni Joshi, who worked in Huang's laboratories, performed a case study for her home state of Kentucky examining the utilization of coal and biomass co-fired plants to develop transportation fuel. She noted that any preconceived notions about Detroit were quickly put to rest, primarily because of the consistent police presence on campus as well as the unique opportunity to participate in the "empowering" R.A.D. Systems course for self-defense.

"Before coming here, all my friends and family were saying 'be safe in Detroit.' It's actually much safer than they think," said Joshi.

Stephen Dueck immersed himself in his new surroundings by purchasing a bicycle, per Rickli's recommendation, in order to explore Detroit.

"The more I saw, the more I enjoyed it," said Dueck, who traveled the farthest of any student to join the REU site, coming from California.

He made the 2,200-mile journey

from his home state because of the program's unique focus on sustainable manufacturing, an area he has explored since taking an environmental science class at a local community college years ago. He has a keen interest in "understanding the widespread effect that we can have on the three pillars of sustainability — people, planet and profit."

Dueck worked with Golam Newaz, professor of mechanical engineering, to experiment with a hemp fiber composite, as compared to glass and carbon fibers, exploring lightweight and sustainable solutions in automotive structural parts.

"I wanted to get my hands dirty in the lab, and Dr. Newaz provided that opportunity," said Dueck, who credits earning an associate degree in liberal arts prior to studying chemical engineering for giving him a broad perspective on the field. Through the REU program, Dueck also gained an appreciation for interdisciplinary collaboration by working primarily with mechanical engineers.

The teachable moments were plentiful for a pilot program that, by Rickli's own admission, will not likely need to change much in years two or three. Both Rickli and Huang are inspired to not only support this group of students but also see what is yet to come from future participants.

"We have gained great experience in project development and execution, faculty mentoring, student research training, graduate student participation, and activity design and evaluation," said Huang. "This knowledge will be very valuable for us as we organize next year's summer academy."

"We want (the students) to be successful," added Rickli. "And we're going to do everything we can to give them that opportunity — in sustainability and in research."



## REU SITE STUDENTS

### STEPHEN DUECK

**School:** California Baptist University  
**Major:** Chemical Engineering  
**Mentor:** G. Newaz  
**Project:** Sustainable Composite Manufacturing

### BRIANNA HARTE

**School:** Rensselaer Polytechnic Institute  
**Major:** Environmental Engineering  
**Mentor:** C. Miller  
**Project:** Predictive & Historical Analysis of an Energy Optimization Tool for Emissions Control

### ERIN JOHNSON

**School:** Tuskegee University  
**Major:** Mechanical Engineering  
**Mentor:** X. Wu  
**Project:** Formability of Advanced High Strength Steels for Automotive Manufacturing

### CHANDNI JOSHI

**School:** University of Kentucky, Paducah Campus  
**Major:** Chemical Engineering  
**Mentor:** Y. Huang  
**Project:** Utilization of Coal & Biomass Co-Fired Plants for Generation of Transportation Fuel: A Case Study in Kentucky

### ANDREW LEE

**School:** Carnegie Mellon University  
**Major:** Chemical Engineering  
**Mentor:** L. Arava  
**Project:** Synthesis of Electrocatalytically Active Niobium Sulfide for Lithium-Sulfur Batteries

### NICHOLAS LIN

**School:** University of Michigan  
**Major:** Electrical Engineering  
**Mentor:** C. Wang  
**Project:** High Efficient DC-AC Inverters for Alternative Energy Systems

### JOVAN MORGAN

**School:** Wayne State University  
**Major:** Industrial and Systems Engineering  
**Mentor:** J. Rickli  
**Project:** Condition Assessment of End-of-Use Products for Remanufacturing

### CASEY PEPIN

**School:** Michigan State University  
**Major:** Chemical Engineering  
**Mentor:** E. Nikolla  
**Project:** Steady State Kinetic Isotope Exchange

### THALIA QUINN

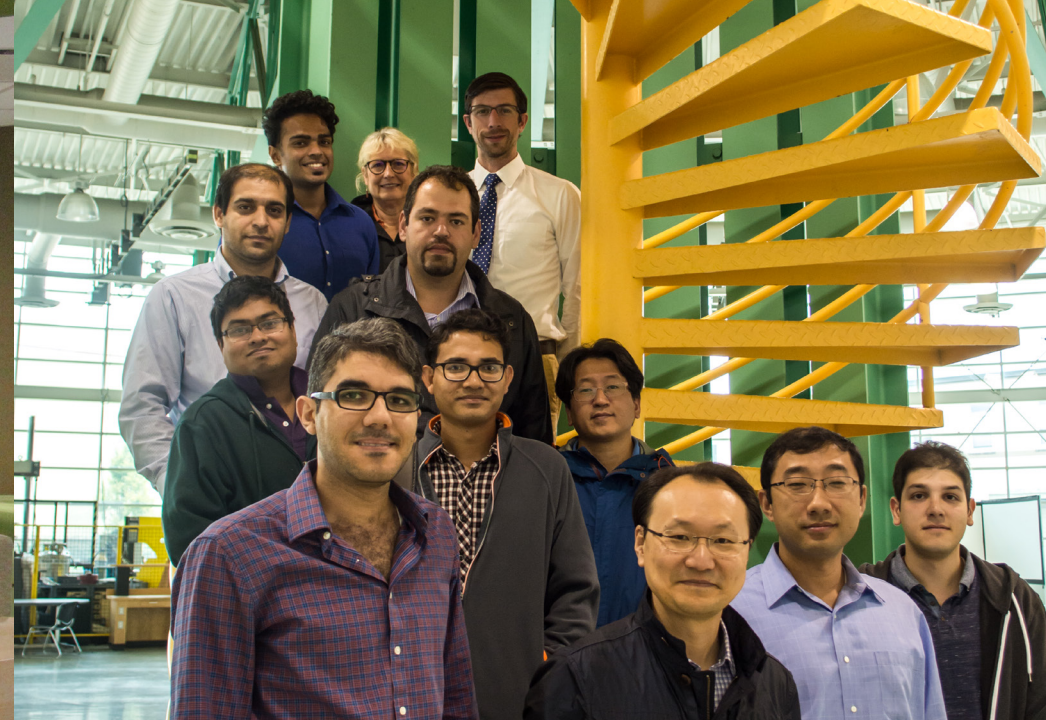
**School:** New Mexico Institute of Mining and Technology  
**Major:** Chemical Engineering  
**Mentor:** J. Potoff  
**Project:** Environmental Fate Prediction via Atom-Based Computer Simulations

### PAIGE SMITH

**School:** Miami University (Ohio)  
**Major:** Bioengineering  
**Mentor:** Y. Zhang  
**Project:** Integrated Algae-Wastewater Systems for Sustainable Bioenergy Production & Wastewater Treatment

### BERTHA WANG

**School:** Princeton University  
**Major:** Mechanical Engineering  
**Mentor:** K-Y. Kim  
**Project:** COOL: SLICE



## Wayne State receives \$1.7 MILLION GRANT to advance virtually guided weldability qualification

Wayne State University has received a \$1.7 million grant from the Digital Manufacturing and Design Innovation Institute — an institute of the National Network of Manufacturing Innovation — for a project that will advance Resistance Spot Welding (RSW) weldability qualification environments. The project, VRWP: Virtually Guided RSW Weldability Prediction, will allow original equipment manufacturers (OEMs) and suppliers to rapidly converge to feasible welded assembly designs during the early stages of new product development.

According to Kyoung-Yun Kim, associate professor of industrial and systems engineering and site director

of the National Science Foundation Center for e-Design at Wayne State University, system integrators and OEMs working with products that have metallic structures currently rely on material suppliers and testing service companies to conduct physical testing of materials for new welded assembly designs. Without timely delivery of test results, the optimal selection of new materials, processes and related design decisions is hindered.

“When new materials or combinations of materials are considered for an assembly, industry often requires new physical tests or numerical simulations such as finite element analysis,” said Kim. “Data-driven weldability prediction will

improve product design efficiency but is underutilized because of existing data inconsistencies. Resistance spot-welding processes and parameters are complex due to coating conditions and surface roughness and give rise to significant data inconsistencies, a well-known reliability issue.”

The Wayne State team is partnering with Ford Motor Company to develop a reliable RSW weldability prediction tool. The end result will be a web-based RSW weldability prediction tool that will improve design and engineering efficiency.

“This prediction tool will ultimately improve product quality through the utilization of advanced materials, allow users to rapidly assess weldment feasibility and reduce the amount of physical testing required for new material candidates,” said Kim. “In addition, communication between OEMs and suppliers will be enhanced because of the standardization of RSW test data and material.”

The proof-of-concept system for the RSW weldability qualification, called Virtually Guided RSW Weldability Prediction, will initially be applied for qualification of automotive body structure joining/welding at Ford.

The co-principal investigators of this project from Wayne State University are Shiyong Lu, associate professor of computer science; Jeremy Rickli, assistant professor of industrial and systems engineering; Xin Wu, associate professor of mechanical engineering; and Qingyu Yang, associate professor of industrial and systems engineering.

The project number for this grant is 15-07-04.



## ***Sonic IR offers manufacturers advanced methods to detect component defects***

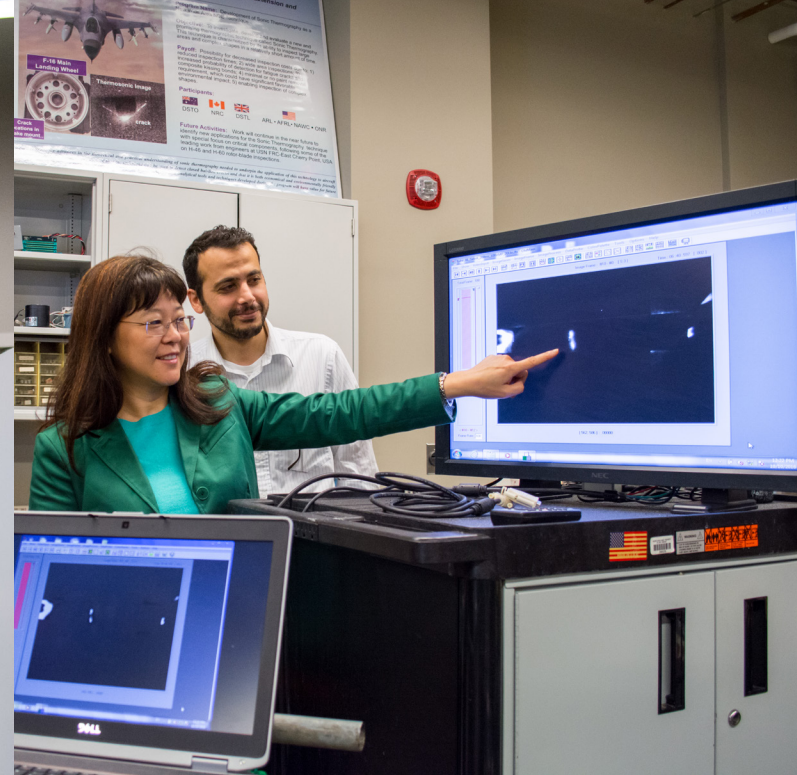
Companies within the vast manufacturing industry continue to assess the quality and capability of nondestructive evaluation (NDE) technology for a number of reasons, including but not limited to safety, reliability and cost effectiveness. Professor Xiaoyan Han's research aims to address all of those factors and more.

Han, a professor of electrical and computer engineering at Wayne State, has developed an NDE method called Sonic Infrared (Sonic IR) imaging. Using this method, defects in materials can be detected by injecting ultrasound into an object to produce localized frictional heating at any defects

that may be present, including cracks, delaminations and disbonds. Sonic IR can detect cracks as small as one thousandth of an inch, and Han notes that a number of innovations are being made with this technology.

"For metal materials, it could take only a second or even a fraction of a second to detect defects," said Han. "It is not only fast, but the technology can image a wide area in each snapshot."

The dark-field imaging is another feature of this technique, in which only defects light up against a dark background, greatly increasing the detectability of deficiencies in materials. Sonic IR can also detect cracks



from any angle — a limitation in previous techniques. Sonic IR technology involves transmitting a short ultrasonic pulse into an object, and heat from friction in cracks or defects is localized. The thermal radiation is detected by a sensor or camera, allowing technicians to pinpoint defects that otherwise may have gone unnoticed.

An early prototype Sonic IR imaging system designed and built by Han's research team was tested several years ago in New Mexico at the U.S. Federal Aviation Administration (FAA) Airworthiness Assurance NDI Validation Center for field inspections.

The FAA and aircraft manufacturers are among the various groups looking at this technology as a means to lower production costs, avoid liabilities and recalls, build a competitive advantage, or grow their workforce. Siemens Power Generation, Inc., which named its version of Sonic IR SIEMAT (Siemens Acoustic Thermography), has licensed the technology exclusively for land-based power turbine applications for years, creating a significant revenue stream for Wayne State University in the process.

Since Han and fellow WSU faculty members Skip Favro and Robert Thomas began working on Sonic IR over 15 years ago, the technology has received widespread acclaim, including the FAA-Airlines for America Better Way Award in 2012. Han was also presented with the Technical Cooperation Program



*"No materials or components are perfect. The application of innovative infrared imaging techniques can be a powerful tool to detect flaws before materials or components are integrated into final products, to prevent system failures in service, or even to save lives."*

Achievement Award from the Department of Defense in 2010 at the Pentagon.

Sonic IR was featured in the 2006 publication *Technology Transfer Stories: 25 Innovations That Changed the World* as part of the Better World Project, an initiative launched by the Association of University Technology Managers. The technology was included in this piece among other innovations such as the nicotine patch, honeycrisp apples, cochlear implants and Google.

Han concludes that Sonic IR imaging will allow for more advanced evaluation and inspection processes, online testing, and quality control to industries such as aerospace, automotive, power and energy, and civil engineering.

"No materials or components are perfect," said Han. "The application of innovative infrared imaging techniques can be a powerful tool to detect flaws before materials or components are integrated into final products, to prevent system failures in service, or even to save lives."



## Arava Research Group working on ADVANCED BATTERY SOLUTIONS



Over the last several years, a Wayne State University College of Engineering research group has been at the forefront of developing new battery technologies that are more powerful, less expensive, sustainable and capable of operating in extreme conditions. The foci of the research team led by Leela Arava, assistant professor of mechanical engineering, are high-energy lithium-sulfur (Li/S) and high-temperature lithium-ion batteries.

The allure of Li/S batteries lies in the fact that they can theoretically store five times more energy than lithium-ion batteries. Despite the limitless potential Li/S batteries have evinced to be the next generation of batteries, there

are several limitations that have hindered full-scale development. Arava's research group has been working on a new configuration that addresses not only poor cycle-life issues but also enhances other areas such as low sulfur utilization and poor reaction kinetics that impede Li/S battery commercialization.

Arava's group has experimented with a novel electrocatalysis-based approach for Li/S batteries in order to stabilize and extend performance without compromising storage capacity, all while eliminating the use of traditional carbon layer in cell configuration.

"Our novel electrode configuration helps to overcome the major drawback of short cycle-life due to

migration of dissolved polysulfides toward Li-anode in an Li/S system," said Arava. "Such batteries could provide an opportunity to develop electric vehicles that match the power, range and cost of combustion engines."

"This is the simplest configuration that a battery can have. By flooding two metal foils such as nickel and lithium with catholyte (a solution form of sulfur cathode in the electrolyte), you end up having a high-power energy-storage device. The whole battery manufacturing process becomes inexpensive as we don't need any industrial process to make the cathode," said Ganguli Babu, a postdoctoral fellow in Arava's group.

The group, which has had several high-impact papers on this technology published in journals such as *Nature Scientific Reports* and the *Journal of the American Chemical Society*, has adopted a multipronged approach to tackle challenges on multiple fronts associated with battery technology. More recent work from Arava and his colleagues has focused on creating thermally stable lithium-ion batteries and supercapacitors capable of operating at high temperatures, which would have numerous applications in aerospace, defense, biomedicine, and oil and gas exploration.

"As individual battery components and their interfaces are sensitive to temperature, the majority of high-temperature power solutions

are dependent on primary batteries," said Arava. "Our efforts to develop rechargeable batteries and supercapacitors have led to the development of a quasi-solid electrolyte that could sustain temperatures beyond 150 C."

In marked contrast to conventional solid-state electrolytes that are limited to thin-film technology, quasi-solid electrolytes formulated using certain ceramics and ionic liquids offer a unique solution to all forms of battery technology.

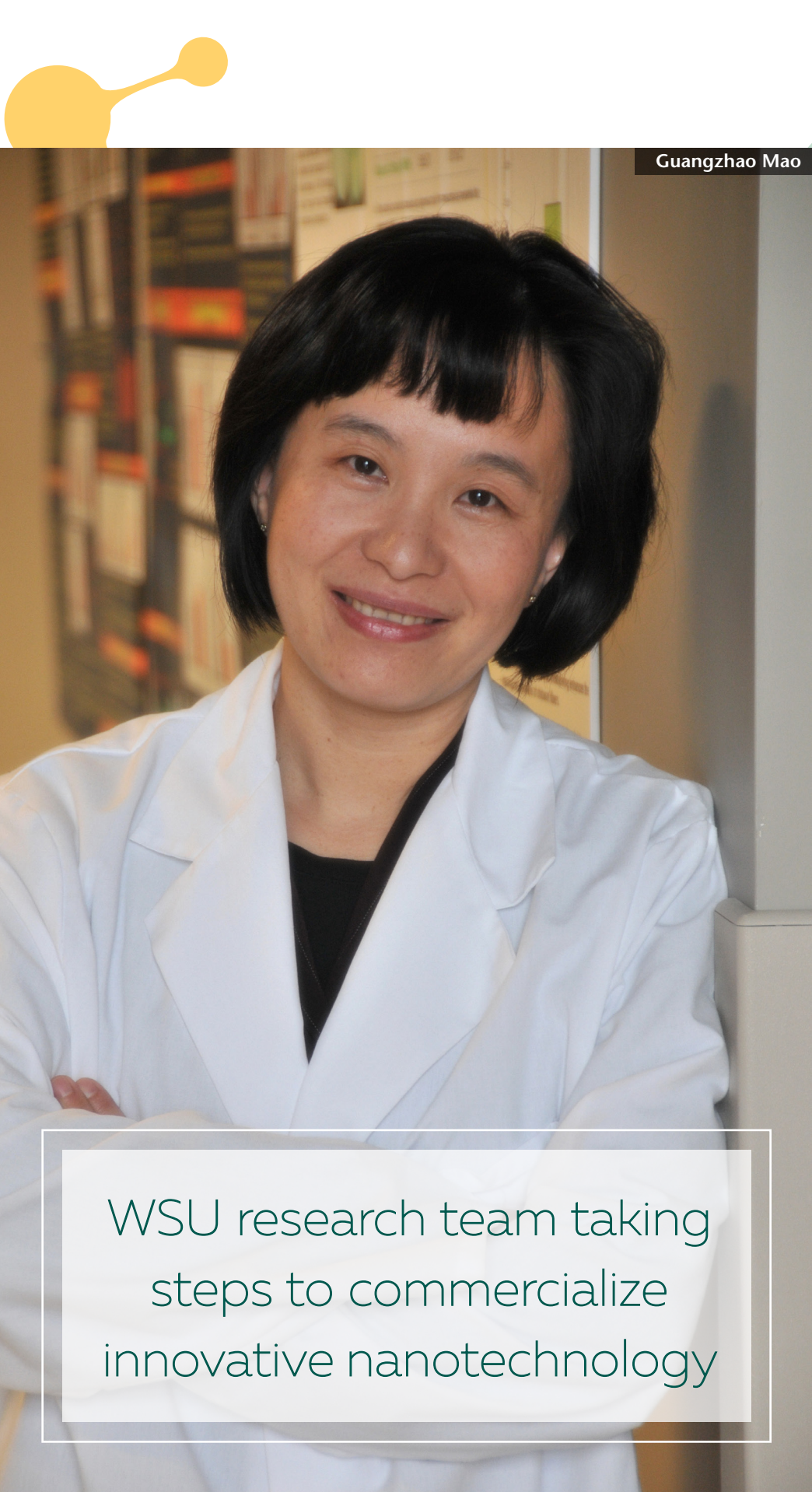
Arava's group is now moving toward transforming these nascent findings into a mature technology. Using emerging 3-D printing

technology, Arava's lab is working on the bulk production of high-temperature, rechargeable lithium-ion batteries in various forms, including miniaturized batteries for microsensor applications.

"Such batteries could provide an opportunity to develop electric vehicles that match the power, range and cost of combustion engines."

Combined together, these research endeavors represent a holistic approach aimed at realizing the next generation of lithium-based batteries.





Guangzhao Mao

Research findings made in the laboratory of Guangzhao Mao may result in a significant shift in manufacturing on the nanoscale. Mao, a chemical engineering and materials science professor in the WSU College of Engineering, and her team have been working over the last year on a proof-of-concept project that introduces a new fabrication approach to nanosensor devices. They are developing a one-step technique that allows for controllable growth of nanocrystals directly on microfabricated substrates.

This low-cost, room-temperature process is based on Mao's basic research in the last decade, currently funded by a \$330,000 National Science Foundation (NSF) grant, which explores an innovative, solution-based process using nanoparticles as seeds. This technique was adapted from a seed-mediated crystallization process used in the manufacturing of medical drugs.

The original premise was that small seeds can make small crystals that can form nanowires. The next step is to commercialize this methodology.

"Nanowires have been applied to sensing for over 10 years, but few nanowire sensors have reached the market," said Mao. "The major barriers are the complexity of manufacturing and difficulty in manipulating and connecting nanowires in microelectronic devices."

Mao recognized that there is a lack of manufacturing methods to connect different nanomaterials into one device. Nanomaterials are currently

being put into sensors mostly through photolithography, which is very expensive and limited by the need for cleanroom environments and nanoscale precision.

"Our technology can potentially overcome these barriers by using a different fabrication approach and with materials not previously used in nanowires," said Mao.

The new process is based on the patented solution-based approach that consists of mixing organic crystalline compounds with nanoparticles, which nucleate upon solvent evaporation.

Among the benefits of this new system are reduced capital investments, a simpler fabrication process and the creation of a broader range of nanowires.

To further prove this concept's suitability, Mao's research team is constructing and testing an organic electrochemical nanosensor for gas and vapor sensing. With this tool, they will be able to measure the electrical conductivity change of nanowires when exposed to gases, as well as demonstrate functionality and scalability of this process.

Nicholas Cucinelli, an experienced technology entrepreneur in the Detroit area, has played an important role in his position as an advisor and mentor in the Tech Transfer Talent Network (T3N), a program funded by the Michigan Economic Development Corporation that aids in launching technology-based startups and reaching commercial licensing agreements for university inventions. Wayne State is among seven T3N universities in the state of Michigan.

Cucinelli first met Mao through the Technology Development Incubator program, where he served as a proposal reviewer. After assessing her work, he collaborated with Mao to obtain additional funding through the Partnerships for Innovation: Accelerating Innovation Research-Technology Transfer program, an NSF initiative that helps bridge the gap between scientific discoveries and market-valued solutions.

Today, Cucinelli is a co-principal investigator on this project, primarily charged with helping the research team zero in on the best applications for this technology for commercialization.

Cucinelli noted that under the Bayh-Dole Act, a piece of legislation dating back to the late 1970s, universities own intellectual property created with federal funding. As long as the universities act as good stewards to that technology, they can pursue ways to monetize it.

"So aside from the societal benefit of generating new knowledge and solving human and environmental problems, this is about creating some kind of deeper, longer-term return on investment for those taxpayer-funded basic and applied research projects," said Cucinelli. "This is a pathway to getting additional dollars back into the economy and the university's ecosystem through the commercialization process."

Also joining Mao in this pursuit is Fulbright Scholar Mohamed Kilani, who arrived at Wayne State from Tunisia last fall. According to Mao, working on this project has enabled Kilani "to develop tech transfer

and business knowledge and skills, which is well beyond the traditional graduate training."

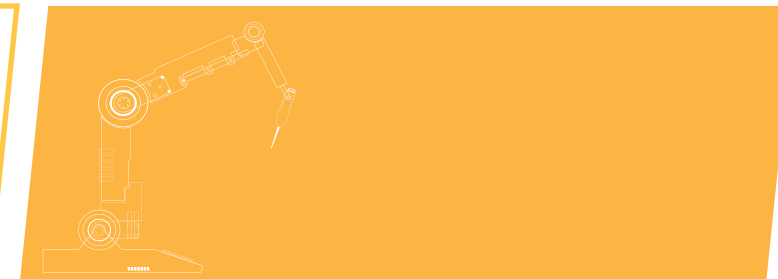
"This is a pathway to getting additional dollars back into the economy and the university's ecosystem through the commercialization process."

Kilani, who is pursuing a master's in materials science, is following up on years of research performed by graduate students who came before him, but is excited to be part of the applied research phase. One useful pathway for the technology is measuring air quality, which could impact many industries concerned with environmental or health safety issues.

"We conducted many tests for selectivity. We tried many types of gases — water vapor, ammonia, many types of alcohols," said Kilani. "We also tested the sensitivity to determine the lowest concentration that can be detected by our sensor. We found that you can detect less than two parts per million, and I think we can get lower than that."

"It's extremely valuable to have a platform technology like this that has multiple applications, but you can't work on all of them at the same time," adds Cucinelli. "You have to latch on to something and show real market value before you can commercialize the entire platform and the full potential of the technology."

WSU research team taking steps to commercialize innovative nanotechnology



## New additive manufacturing process keeps WSU on pace with evolving global industry

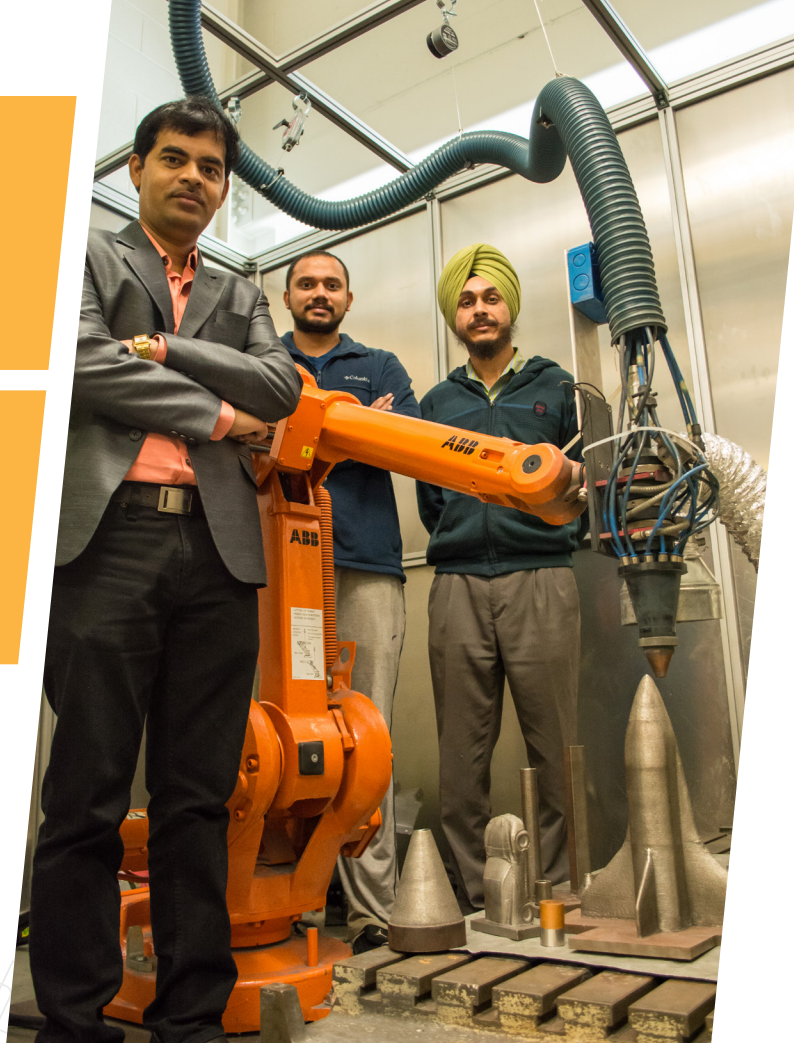
Additive manufacturing, or 3-D printing as it is commonly known, is still a relatively young technology. But a global industrial shift toward internet technology, sustainability and renewable energy means that additive manufacturing has the potential to significantly change the world.

Among the researchers seeking to widen the knowledge base of additive manufacturing is Guru Dinda, assistant professor of mechanical engineering at Wayne State University. His lab has developed a 3-D printing process called Laser Metal Deposition (LMD).

In the LMD process, “material addition can be controlled at a pixel level to meet design and functionality requirements,” said Dinda. “The LMD process combines laser cladding with rapid prototyping into a solid freeform fabrication process, which can be used to fabricate porous or solid metallic parts directly from a CAD model.”

A robot-controlled laser beam follows a path generated from the computer-aided design (CAD) model to create a three-dimensional component layer by layer. This substrate-focused laser forms a melt pool, to which metal powders are simultaneously delivered by a specially designed coaxial nozzle.

Dinda and his students have used this LMD system to experiment with a variety of metals in an effort to determine best practices for additive manufacturing methods. According to their research, iron, cobalt, nickel and titanium are among the metals and alloys that can be used in 3-D printing, while others such as aluminum, magnesium, zinc and tin are not yet



suitable. Dinda’s team has created a number of stainless steel and superalloy components with LMD.

Additive manufacturing processes such as LMD can be applied to many industries, from biomedicine to aerospace. It can be used for surface coatings as well as remanufacturing, and it uses a fraction of the energy and raw materials necessary with typical factory productions.

However, according to Dinda, “the main advantage of 3-D printing is its potential to make very complex objects — almost any shape one likes — which cannot be fabricated by conventional manufacturing processes.”

Dinda believes additive manufacturing is at least five years away from competing with conventional processes for small-batch production of complex and custom design components and about 25 years from mass production capabilities. However, the possibilities for 3-D printing are numerous, ranging from the fabrication of organs for patients awaiting transplants to making the idea of living on Mars or the moon feasible. The projected economic and social impact of 3-D printing speaks volumes as to how Dinda’s research plays a critical role in the global development of additive manufacturing.

## Chemical engineering undergraduate student tackles summer projects in STEEL INDUSTRY



Garrett Baker

Garrett Baker is still fairly new to the world of engineering, which is one of many reasons why he was so proactive in his pursuit of a summer internship. Seeking some practical experience to supplement his coursework at Wayne State, Baker had been on the hunt since January, and three months later he had secured a 12-week position at AK Steel.

The Dearborn Works facility, located on a 350-acre site in Southeast Michigan, is one of eight steel plants AK Steel operates in the Midwest. Its main products are carbon, stainless and electrical steels, as well as cold-rolled and aluminum-coated stainless steel for automakers.

One of the selling points of this opportunity for Baker, who was one of eight summer interns at AK Steel and the only one from Wayne State, was the level of hands-on field experience he would receive. He also noted the high level of professionalism exhibited by his superiors.

“They treated us very much like real, full-time engineers in a sense of responsibility and what we were able to accomplish,” said Baker, who in addition to his duties at AK Steel was taking summer classes two nights a week.

“We got to go out in the mill and see how things are done,” he continued. “And when I completed my projects, I was able to go out and see how that was affecting operations.”

Baker was assigned to process engineering, and his biggest project involved working on a specific piece of machinery for the casting process.

“It was my job to draft a design and get input from operators and other engineers. Then we met with contractors to figure out what was most cost-effective,” said Baker. “Once it was installed, I was able to monitor its progress to see if what I did is actually helping the company or not.”

The internship taught Baker several lessons that he believes are best learned through real-world experience, including cooperation and teamwork, flexibility with project deadlines, and the value of professional and social connections in the workforce.

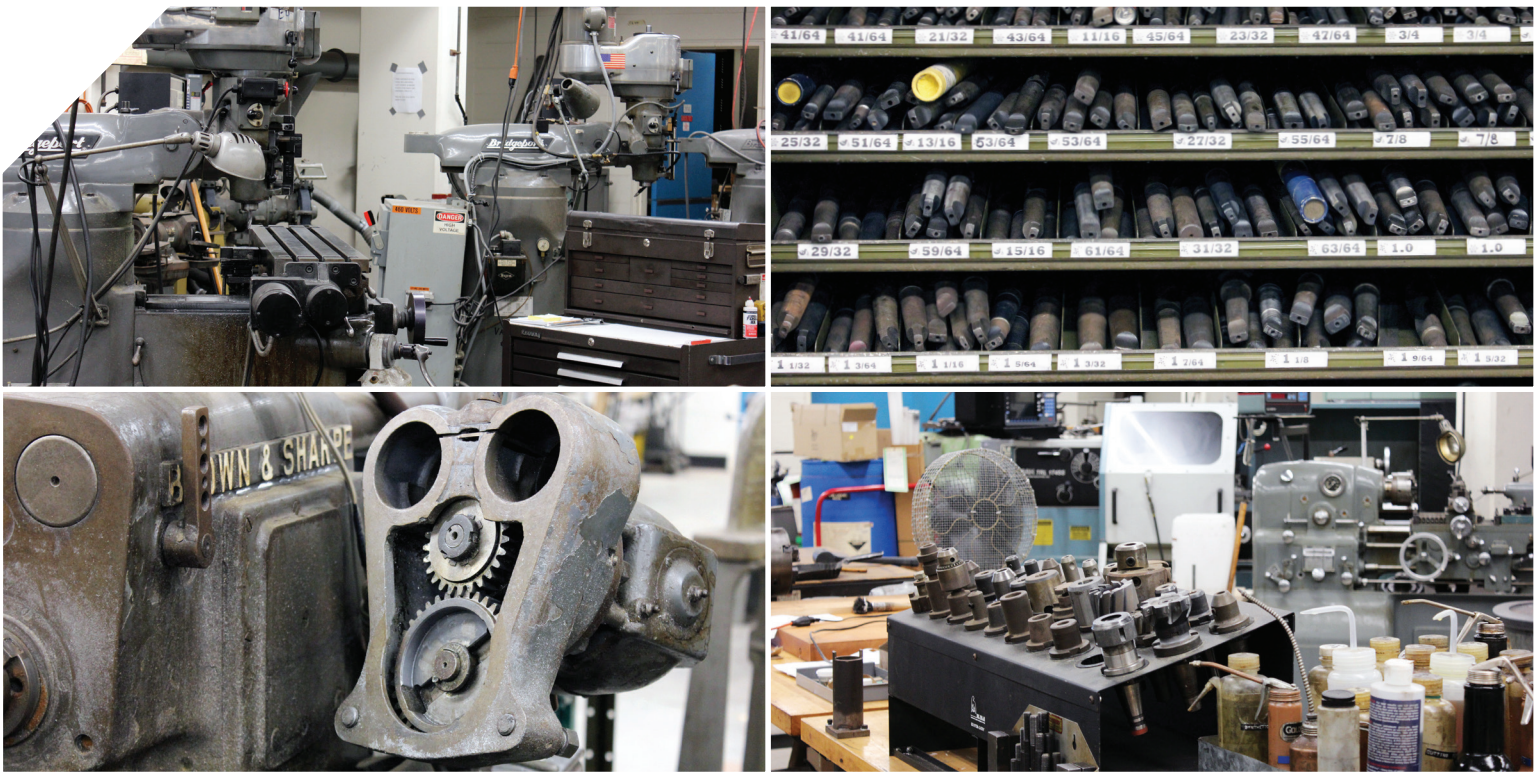
“Now I feel like I’m more prepared for when I graduate in a couple of years — I can hit the ground running,” said Baker.

Baker originally came to Wayne State as a chemistry major. After some introspection on his academic path and hearing positive things about the College of Engineering, he switched his major to chemical engineering following his sophomore year.

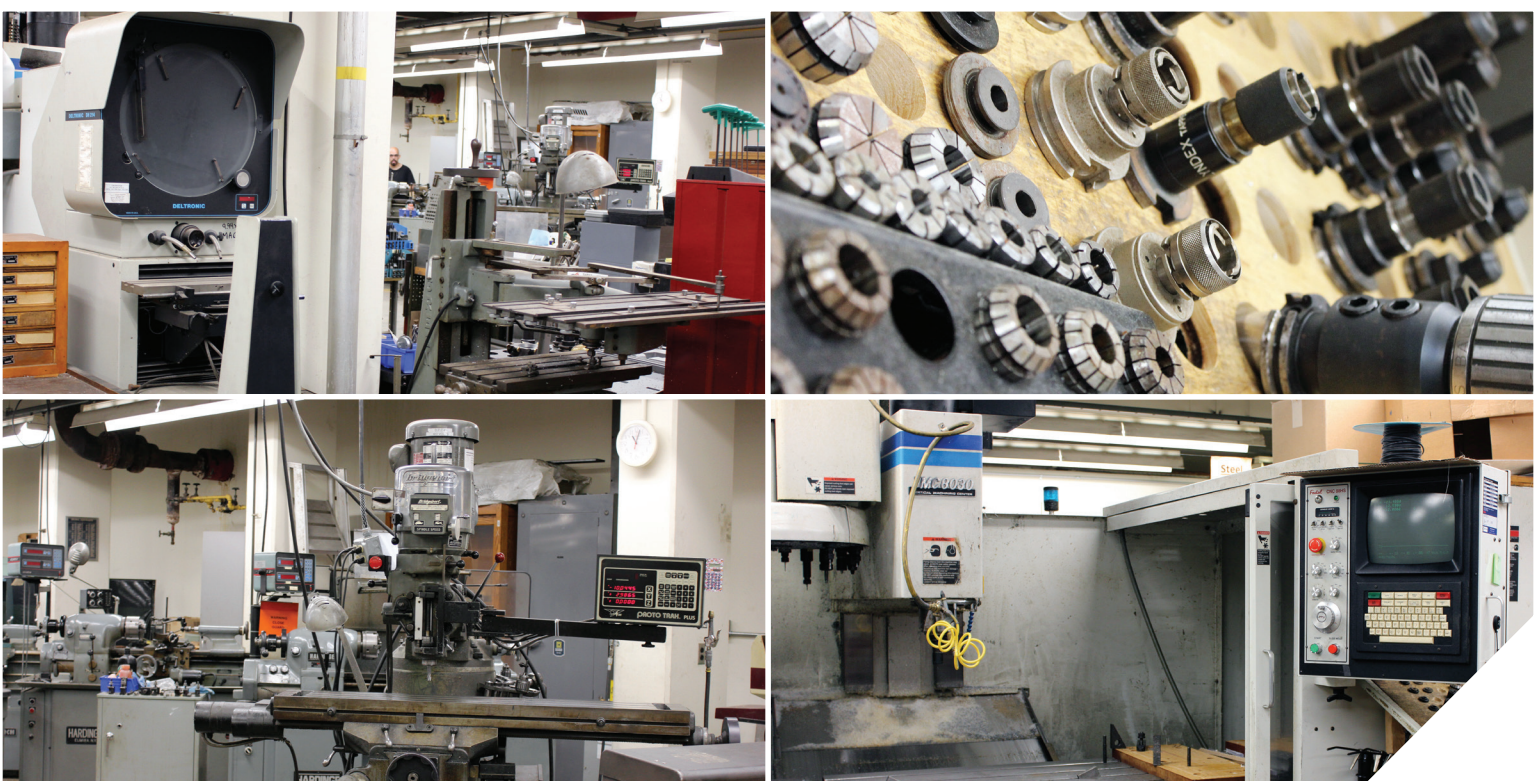
“I can definitely say after a year now that it is one of the best choices I’ve made in my academic career,” said Baker.

As for his fledgling professional career, Baker enjoyed many aspects of process engineering in the steel industry, but is looking forward to branching out and trying other things, including research and development. He also would recommend his peers and classmates take advantage of internship and co-op opportunities whenever possible.

“If you even have a slight interest in going for (an internship), just go for it. You never know how much it’s going to pay off in the long run.”



Previously located in the College of Engineering, the Machine Shop has moved over 200,000 pounds of equipment to the Physics Building. Thanks to an agreement with the College of Liberal Arts and Sciences, students and professors have a breadth of equipment and over twice the space to create anything from class projects to research prototypes. Nearly half of College of Engineering students utilize the machine shop each year. This year, the lab will add a 3-D printer and a CNC plasma cutting machine to its facilities.



# Public Health and water quality experts begin 18-month plan to address risk for Legionnaires' disease in flint

FLINT  
(B M 794)

The Flint Area Community Health and Environment Partnership (FACHEP), a multi-institutional team of environmental engineering and public health experts led by Wayne State University, recently announced it will implement phase two of its independent study evaluating the possible link between Flint's water system and an increase in reported Legionnaires' disease cases in Flint and Genesee County.

Phase one of the study was completed in May after FACHEP finalized an assessment of the resources needed in Flint and Genesee County to understand the risk of Legionnaires' disease outbreaks. The team — which includes nationally renowned experts in engineering and water quality, epidemiological investigation, microbiology, social work, and public health communication — has begun implementing an 18-month plan to address community risk for Legionnaires' disease.

"During the next two years, FACHEP will work with local, state and federal health officials to actively explore and address the threat of Legionnaires' disease in Flint and Genesee County," said Shawn McElmurry, FACHEP's lead principal investigator and environmental and civil engineering professor in Wayne State's College of Engineering.

McElmurry outlined three critical areas experts will focus on during phase two of the study.

"With input from the community and a number of health care partners in Flint and Genesee County, we developed a three-pronged approach to investigating the cause of these outbreaks and reducing the community risk of more illness in the future," said McElmurry. "Environmental monitoring of the water supply, enhanced environmental monitoring of at-risk populations, and open communication are the areas FACHEP will focus its resources on over the next year."

Environmental sampling, testing and monitoring of water in Flint households will be led by McElmurry, who has extensive experience working in Flint, where he has led multiple sampling campaigns and evaluated

the area's ongoing drinking water quality crisis. He began conducting environmental assessments of water sources in statistically representative homes in Flint this summer.

Paul Kilgore from Wayne State's Eugene Applebaum College of Pharmacy and Health Sciences will lead efforts to provide technical assistance in epidemiologic surveillance for Legionnaires' disease. Most notably, he will work with local health care providers, the Genesee County Health Department (GCHD), and state and federal partners to reach populations most at risk for Legionnaires' disease.

"We value our collaborative relationship with WSU in supporting GCHD's work to prevent Legionnaire's disease in Genesee County. GCHD looks forward to future collaborations and research projects with WSU," said Mark Valacak, Genesee County health officer.

Community engagement, communication and social services support will be led by Kettering University's Laura Sullivan, WSU communication professor and crisis and emergency risk expert Matthew Seeger, and WSU social work professor Joanne Sobock. FACHEP will help provide social-behavioral support by connecting to existing local and state resources during household visits to collect water samples. Additionally, the team will work with community leaders and service organizations to identify high-risk groups, including the disabled and the elderly, to enhance understanding of Legionnaires' disease.

FACHEP is a team led by Wayne State researchers specializing in environmental engineering and public health conducting an independent study to evaluate the possible association between changes in Flint's water system and public health, specifically the recent Legionnaires' disease outbreak. The team includes participants from Michigan State University, the University of Michigan, Colorado State University and Henry Ford Hospital. Funding for phase two of FACHEP's independent study is provided through a contract between the Michigan Department of Health and Human Services and Wayne State University.

## WSU professor earns prestigious NSF CAREER Award to improve MICROWAVE RADAR-SENSING TECHNOLOGY



Chung-Tse Michael Wu

Chung-Tse Michael Wu of the Wayne State University College of Engineering has been awarded a National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award, the agency's most prestigious award for up-and-coming researchers in science and engineering.

Wu, assistant professor of electrical and computer engineering, is the recipient of a five-year, \$500,000 grant for the project "Spectrally-Encoded Ultrafast Microwave Panoramic Camera." This was his first NSF CAREER application.

Microwave radar systems, used in sensors and wireless communications, detect targets using beam-scanning antennas. Traditionally, the antennas are powered by motors or electronic phase shifters, which Wu states can be slow, expensive and provide only a limited field of view. Through this research project, Wu plans to develop antennas made of novel transmission line-based metamaterials that would enable a high-speed, microwave panoramic camera (MPC).

"The new type of transmission line has a unique property in that it can map different frequencies to particular angular locations — what is known as frequency space mapping," said Wu. "We can build the antenna on a printed circuit board and have a 180-by-180 degree field of view for the microwave panoramic camera."

The main use for a microwave panoramic camera is automotive safety for both conventional and autonomous vehicles. "The proposed MPC will be applied, in particular,

to automotive radar to provide driver assistance, making driving safer and more convenient," said Wu. "The fast sensing and panoramic field of view enabled by MPC-based radars will provide early warning of potential collisions to drivers and continuously monitor road conditions." Other uses include medical imaging as well as security and defense systems.

Through this project, Wu is applying optical imaging concepts — namely spectrally encoded confocal microscopy, a fiber-based optical imaging method for high-speed scanning — to microwave and millimeter-wave research. He will use the nFAB Laboratory, a semiconductor fabrication cleanroom facility at the College of Engineering, to create the prototype.

Wu, who earned his Ph.D. from UCLA and focuses on microwave circuits, wireless electronics, radar imaging systems and applied electromagnetics, will recruit five undergraduate students from WSU and partner community colleges each year to assist in this project. He is currently involved with Wayne State's University Bound program, which assists community college students with completing their programs and transferring to a four-year university.

"Congratulations to Dr. Wu on receiving this prestigious award from the National Science Foundation on his first try," said Farshad Fotouhi, dean of the College of Engineering. "His research in microwave radar systems and its applications will enhance lifesaving technologies and continue to demonstrate Wayne State's leadership in automotive safety.

The National Science Foundation award number for this grant is 1552958.

## Engineering students tour and network at NORTH AMERICAN INTERNATIONAL AUTO SHOW



Wayne State engineering students know how to make the most out of any situation, and the North American International Auto Show (NAIAS) in Detroit was no exception. While students experienced VIP treatment and checked out the new cars, they also networked with industry professionals and learned about upcoming automotive trends.

Students from the College of Engineering and Mike Ilitch School of Business were invited as Ford Motor Company's guests to media day. Students met with Ford President and CEO Mark Fields and Hollywood personality Ryan Seacrest. College of Engineering

alumnus and Ford engineering supervisor Benny Wong assisted students with networking.

Several Wayne State students attended the auto show through the Yazaki Student Liaison Program. They worked on an assignment, toured the showroom and gave a small presentation, all while enjoying Yazaki's hospitality suite.

Thirteen students were also recruited by the Schaeffler Group for the NAIAS Industry Preview Days. While enjoying the show, students were able to meet with the group's recruiting team. "I thoroughly enjoyed witnessing the evolution of each brand at the 2016 Auto Show," said mechanical engineering student

Austin Bontaz. "The show allowed me to strive forward in my ideas and design aspirations for the future of my career in the industry."

Wayne State's Formula SAE team, Warrior Racing, also participated in NAIAS as part of the SAE International booth. "Our team attends the Auto Show each year to raise awareness for our organization and thank all the sponsors that support the team," said Warrior Racing President Tirath Matharu. "Donations from our sponsors are used directly to design, build and compete our race car each year. We take this opportunity to thank them for their contributions to the team and share our progress for the new designs."

# EOS

## Engineering program gets new name, new opportunities to help students succeed

The successful WSU Engineering Bridge Program, now in its 12th year at the College of Engineering, is crossing a transitional bridge of its own.



Jeffrey Potoff

The program, which provides educational and counseling support to first- and second-year students with a strong interest in engineering, has been slowly undergoing a name change from Engineering Bridge to EOS. It operates under the leadership of Jeffrey Potoff, professor of chemical engineering and materials science who in August was promoted to associate dean for academic and student affairs.

In March, executives from DTE Energy — including Steve Kurmas, DTE Energy president and chief operating officer, College of Engineering alumnus, and member of the Executive Committee for the college's Board of Visitors — came to the Marvin I. Danto Engineering Development Center to announce \$1.4 million grants

to the College of Engineering from the DTE Foundation. The majority of this funding was earmarked for the rebranded EOS.

"EOS is a new name, and we've been kind of sitting on it," said Potoff. "The current students in the program probably know it as Bridge, but going forward it's going to be branded as EOS."

In mythology, EOS is the Greek goddess of the dawn, who opened the gates of heaven each day for the sun to rise. For the College of Engineering, the name is meant to symbolize the awakening of young minds to the bright possibilities that engineering holds.

More than 60 students are currently involved in the program, which provides hands-on experiences in engineering. "I get my TAs and peer mentors together to work on projects and brainstorm ideas," explained Kristina Lenn, program instructor and College of Engineering lecturer. "We make sure the projects are manageable for the students, that the timeline we give them is workable, and get all the materials together. Then I'm in charge of scheduling everything."

The projects, incorporated as part of Lenn's Introduction to Design course, differ each semester.



"We've had groups build bottle rockets and compete with each other or build a drone that can carry out specific tasks," said Monica Prasad, a biomedical engineering student who is one of eight peer mentors in the program. "It's more about focusing on the core of engineering, learning skills that students need for the rest of their engineering careers."

"A big part of what we've learned over the years is that when students show up, they don't want to write papers about being an engineer," said Potoff. "They want to do things that are connected to engineering. We've developed these hands-on design projects so as soon as they show up on campus they are thinking about engineering, practicing engineering in a tangible way, and that has been very popular."

So popular that in at least one instance, the program convinced an incoming student to change her educational focus. Brianna Nolasco intended to be a film major, but some reluctance about that decision prompted meetings with academic advisors, including College of Engineering Advisor Casey Rue.

"He explained the Bridge program and I thought, 'That would be perfect for me,'" said Nolasco. "We did projects I enjoyed because I got to work with other

people and experience what it's like being part of a team and having to build something. It really helped me realize that engineering is what I want to do."

Peer mentors are key to the program's success, providing role models for incoming students as well as one-on-one tutoring and guidance. "The mentors who helped me were there for everything — not only engineering but also the classes that related to engineering like chemistry and mathematics," says Mohamed Elnour, a mechanical engineering student who is now a mentor himself. "They wanted to make sure that the first steps I took toward considering engineering were solid ones."

Student feedback regarding the program has been consistently positive, and Potoff said he and his team meet to discuss the program nearly every day, seeking to expand and improve its impact. Lenn, a College of Engineering graduate who was once a student and peer mentor under Potoff, said the program has changed significantly since Potoff took it over.

"I left for a few years and came back, and I can see all the ideas he's had and what he's wanted to do. The students are so much more engaged now and have a much better idea of what engineering is supposed to be."



## Anderson Engineering Ventures Institute board recommends \$178,500 in funding for new technologies

As part of its activities to advance innovation and entrepreneurship in the College of Engineering, the James and Patricia Anderson Engineering Ventures Institute also makes investments in the development of new ideas and technologies created by faculty and students. In late September, the institute's advisory board met to review and discuss some of the most promising new ideas, and recommended more than \$178,500 in funding to be divided between six projects.

Over several months, Anderson Institute Director Sorin Draghici and Associate Director Gary Witus helped aspiring faculty members and students develop their applications. A total of 23 applications were submitted — four from students and 19 from faculty. The field was narrowed to eight finalists, six of whom were competitively selected to present to the Advisory Board,

an 18-member panel of professionals with expertise in technology commercialization, entrepreneurship and innovation. The board includes partners or managing directors of venture capital firms in Southeast Michigan, lawyers with expertise in IP and startup companies, several successful entrepreneurs, angel investors, and former high-ranking executives from large companies.

Each of the funded projects will receive further support through the Anderson Institute, including introductions to other early funding opportunities, guidance in the preparation of grant applications and help in structuring the startup companies.

As the college embeds innovation and entrepreneurship into its curriculum, additional requests for funding are expected, and more technologies are already under consideration for the next Advisory Board meeting.

## PROJECTS

### ADVANCED HIGH-STRENGTH STEEL (decision pending)

Professor Susil K. Putatunda, Chemical Engineering; Shashank Nellikuppam, Chemical Engineering  
Nanostructured steel that is high strength, high fracture, low weight and low cost.

### BÉBÉ BEAT

Emily Baughman, MSPH, CHES; Kamaljit Chalal, Computer Engineering; Mojgan Mehrabi, Computer Science; Brandon Wong, Electrical Engineering  
A haptic device that offers peace of mind to parents having their first child by keeping in constant touch with their infant.

### CARBON FOOTPRINT MANAGEMENT SYSTEM: LOCATIONAL EMISSIONS ESTIMATION METHODOLOGY (LEEM)

Professor Carol Miller, Civil Engineering; Loch McCabe, Shepherd Advisors; Stephen S. Miller, Commonwealth Associates; Guoyao Xu, Ph.D. Candidate; Todd Sykes, LEED; Professor Caisheng Wang, Electrical and Computer Engineering  
A software tool to monitor the emissions and carbon footprint associated with energy consumption in real time.

### CELL-BASED CARTILAGE REPAIR SOLUTION

Professor Howard Matthew, Chemical Engineering; Kevin Miles, Chemical Engineering  
A mesenchymal stem cell augmented material solution that repairs and regenerates joint cartilage by using a pair of injectable or 3-D printable "inks" using patient-derived, adult stem cells.

### ITCH-FREE NATURAL INSECTICIDE

Iyinoluwa Omishope, Industrial and Systems Engineering  
A DEET-free, natural, carrier-oil-based mosquito and insect repellent that also serves as a skin moisturizer and sunscreen.

### NOVEL SYSTEM OF SUPERCRITICAL CO2 DRYERS

Michael Golfetto, Chemistry; Grant Lorimer, Biomedical Engineering  
A supercritical CO2 dryer for low-cost, high-volume, high-quality graphene.

### POLIDBONE CEMENT FOR THE REPAIR OF BONE DEFECTS

Professor Weiping Ren, Biomedical Engineering; Rose Carmichael, BONWRX; Wei Song, Biomedical Engineering; Dr. David Markel, Providence Hospital  
PolidBone is an injectable, high-cohesion, high-strength bone replacement/cement that lowers the risk of infection and reduces health care costs by decreasing surgery and recovery times.

### SKYPERSONIC SAFE DRONE TECHNOLOGY KIT

Professor Giuseppe Santangelo, Mechanical Engineering  
A drone development toolkit that enhances STEM education.

# Design Day 2016

## Innovation and Entrepreneurship

The Wayne State University College of Engineering hosted the second annual Student Design and Innovation Day on May 3, with more than 100 Wayne State students representing 59 unique projects from all eight of the college's departments. Student projects ranged from a virtual reality strategy game to photoacoustic imaging for detecting breast cancer.

Sponsored by the James and Patricia Anderson Engineering Ventures Institute, the event offered cash prizes of up to \$1,000 to top projects, as determined by a panel of judges comprised of local industry leaders.

"It's absolutely amazing what new things the students have come up with and possibly turned into prototypes that are ready to go to market," said Jim Anderson, CEO of Urban Science and founder of the Anderson Institute, a program to promote engineering entrepreneurship in Detroit. "The work that's going on is very remarkable and marketable."

The Anderson Institute, which is housed in the College of Engineering, was established through a gift from Anderson, a WSU engineering alumnus, and his wife, Patricia. Its goal is to serve as a beacon of the entrepreneurial spirit of Detroit by investing in ideas that become marketable technologies with potential to change the world.

"This is the second annual Design Day, and the purpose of this event is to showcase the talent of our students to our industry partners who are recruiting them," said Farshad Fotouhi, dean of the College of Engineering. "This is a very exciting day for the college, and you can see how much we're growing."

Judges, including Anderson, evaluated the exhibits by asking students to describe the nuances of their projects and the impacts they might have on their disciplines and society at large.

### THE WINNING TEAMS

#### FIRST PLACE: Scalable Intelligent Air Quality Monitoring

A drone that uses Internet of Things technology to monitor air quality and pollution.

**Students:** Pranav Chokda and Kamaljit Chahal, Electrical and Computer Engineering; Chris Gregory, Engineering Technology

**Team statement:** "We learned many things while taking on this endeavor, from the basics of IoT (Internet of Things) to convoluted networks, machine learning, drone programming and cloud analytics. There were many impressive entries, and we were honored simply to compete among our peers and friends. We can't wait to see what will be showcased next year!"

#### SECOND PLACE: Project Telehealth

An app created to measure vital signs of patients with chronic diseases and communicate with doctors.

**Students:** Anthony Azzi and Jon Swierczynski, Computer Science

**Team statement:** "We are very grateful to both Urban Science and Wayne State for providing us with this opportunity to learn and showcase our skills. The work was challenging, and it feels awesome to be recognized by the College of Engineering as one of the top projects!"

#### THIRD PLACE (TWO TEAMS): A Leg for Brock

As part of their biomedical engineering design class, three freshmen designed a prosthetic leg for a dog that could be mass produced for other dogs.

**Students:** Tiffany Raetzl, Ammar Chishti and Darpan Sodhi, Biomedical Engineering

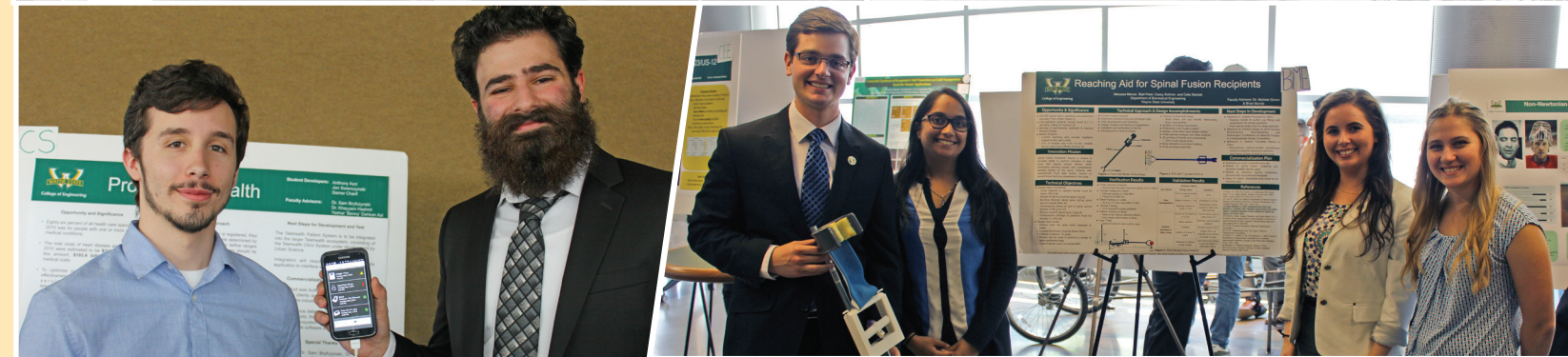
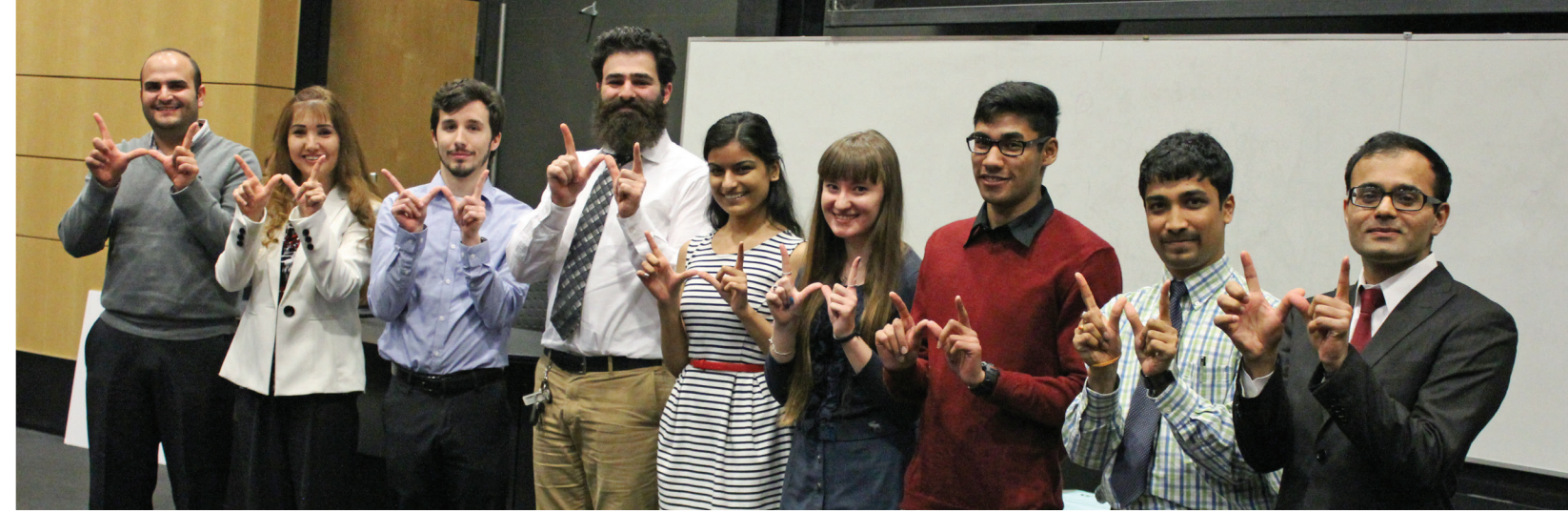
**Team statement:** "Designing a prosthetic leg for Brock was a really rewarding experience. We learned a great deal, and in the process we were able to help a dog walk again."

#### Automotive Control to Monitor Driving Behavior

An alert system that lets parents know if their teenagers are driving dangerously.

**Student:** Bashar Najjar, Electrical Engineering

**Team statement:** "Design Day is a great learning experience that allows students to meet engineers from the entire College of Engineering and learn from each other. It was an amazing experience for me and I sure learned from it."



The first-place team, Scalable Intelligent Air Quality Monitoring, demonstrated how drones can be used to track the quality of air. The team — made up of two electrical and computer engineering majors, an engineering technology major and advised by computer science professor Weisong Shi — is an example of how engineers across disciplines can work together to create innovative new ideas.

At a post-event award ceremony, teams that received prizes introduced themselves and their projects. "Design Day is like a hackathon on steroids, a chance to show off our innovative thinking, research, development skills and collaboration," said Chris Gregory, a member of the first-place team.

Many of the teams worked in partnership with real corporations. Saratteja Karra and his team of biomedical engineering students created a machine for Life Beyond Barriers to help paraplegic patients walk in aquatic rehabilitation. The team also got to meet the owner of the company.

"We were presenting to various people passing by and this one gentleman started asking us about our project. He was pretty interested, seemed very knowledgeable and asked detailed questions," said Karra. "And then he said, 'You know, I actually own this company' and I was completely floored."

From left: Ramy Habib, Sean Carroll, Gregory Apers



## Biomedical startup EnBiologics puts trio of students on entrepreneurial fast track

Sean Carroll, Ramy Habib and Gregory Apers didn't envision an entrepreneurial career path for themselves two years ago when they met through a clinical engineering internship at Beaumont Hospital. However, most engineers are fundamentally problem solvers, and the notion that "there has to be a better way" often resonates deeper than a common catchphrase.

What began with a momentary observation in an intensive care unit has blossomed into a startup called EnBiologics, for which the Wayne State biomedical engineering graduate students received the On the Mark award at the DTX Launch Detroit 2016

Showcase at TechTown in early August. The trio was subsequently invited to TechTown's Business Incubation Center.

DTX Launch Detroit is a program of the Detroit Technology Exchange (DTX), a partnership between TechTown and other leaders in industry, entrepreneurship and technology. The On the Mark award is presented to the team with the best value proposition for their business.

EnBiologics was founded based on burn and wound care technology that Carroll, Habib and Apers have been working on since the former two were part of a class at Wayne State doing clinical observation

work at Detroit Medical Center. Carroll was watching an infant who had burns over 80 percent of her body undergo a painful dressing change on her injuries.

He learned that such procedures dated back to the 1950s. Being part of the emergence of biomedical engineers looking to influence the health care industry, Carroll was inspired to find a better solution for burn applications, but it was his collaboration with Habib that led to a breakthrough.

"Where I come from (in Egypt), we've used honey as a treatment for 7,000 years," said Habib. "So I said, 'why not use honey?'"

Hours of research led the group to Manuka honey, which is produced in New Zealand and is noted for having particularly high antibacterial and antifungal medicinal properties. Habib worked to cross-link this honey with other ingredients to complete the formula for EnHoney, a hydrogel-like topical substance they believe will be easier to apply and offer superior moisturization and scar reduction.

Carroll and Habib brought Apers into the fold to assist with design and operations. As the group did some preliminary testing and realized they had a potential business opportunity, they sought guidance through Blackstone LaunchPad, which offers career resources to entrepreneurs and inventors at Wayne State.

It was the advisors at Blackstone LaunchPad who recommended the group participate in DTX Launch Detroit, an intensive summer accelerator for college students and recent graduates aspiring to launch a technology startup.

With 10 weeks and a \$7,500 stipend with which to test out their business model, the fledgling entrepreneurs went through a crash course in customer discovery, value proposition and market analysis.

"When we started the program, we figured that we were going to be burn care solution manufacturers," said Carroll. "We were going to make our solution, patent it, mass produce it and sell it to hospitals."

Joe Licavoli, the group's coach in the DTX Launch Detroit program, noted that the EnBiologics team came in very aggressive, yet wide open to learning as much as they could.

"It wasn't hard to motivate them. They did a really nice job of doing that themselves," said Licavoli, who also works with entrepreneurs as director of the SPARK East incubator in Ypsilanti. "Every time I gave them a suggestion, they took it and ran with it well. They were extremely coachable."

The coaching was particularly crucial through the customer discovery process, during which teams are required to conduct over 100 interviews before making decisions as to whether or not to adjust their business approach.

"They've learned a lot in the programs at Wayne State and they put that into practice in doing their customer discovery," said Licavoli.

The group learned that burn treatments are a small segment and difficult to break into. They decided to expand to wound care in general, which is a large market by comparison and, according to Carroll, more accepting of new ideas. However, that wasn't the only pivot to their business plan.

With the realization that U.S. Food and Drug Administration approval is extraordinarily expensive and takes years to process, they focused instead on veterinary medicine, a field in which burn and wound care is very similar while also being cheaper and more accessible.

DTX Launch Detroit was an invaluable experience, as the lessons learned there prevented the group from making hasty decisions and having too broad of a focus. Apers thinks that the connections he has made with mentors and coaches along the way will be particularly helpful as he learns

to navigate unfamiliar territory in the business world.

"I'm very much focused on design, develop and then let someone else sell it. In this case, you have to do it all yourself," said Apers. "They were very good at helping us not only learn how to do that but also how to network with the right people who have done that already and are willing to help us keep going forward."

***"Where I come from, we've used honey as a treatment for 7,000 years. So I said, 'why not use honey?'"***

EnBiologics has grown to a full-fledged company with an opportunity to develop further under the umbrella of the TechTown Detroit Business Incubator, which nurtures tech-based startups that have demonstrated an understanding of what their company offers, who their market is, who their competitors are, and how their technology presents an opportunity to gain significant market share.

The next steps for Carroll, Habib and Apers are to pursue a patent and collect more research data about their product, with the hope that EnHoney is the future of burn and wound care for animals — and eventually humans.





## WSU and Camp Infinity work to close gender gap in STEM fields

Each year, the Michigan Council of Women in Technology (MCWT) awards a \$5,000 renewable scholarship to a high school senior pursuing higher education in technology. Julie Patterson recently heard a story about a past scholarship recipient that served as a wonderful testimonial for a program that is very special to her.

“When she accepted her scholarship, she said that the first line of code she ever wrote was at Camp Infinity,” recalls Patterson.

Camp Infinity is a weeklong summer technology camp for girls ages 9 to 13 that introduces STEM concepts through fun and hands-on activities related to video game design, robotics, web design and more. Camp Infinity also features visits from leading professionals in the engineering and technology spaces, which allows campers to explore potential education and career options.

In her role as camp director, Patterson has worked with Jasmine Roberson, director of community engagement

for the WSU College of Engineering, to bring Camp Infinity to Wayne State for the last three summers. Many of the activities take place in the computer labs of the Science and Engineering Library. The campers also get to enjoy lunch in the Towers Café.

“Wayne State has been a wonderful host,” said Patterson, who has directed Camp Infinity for 11 years. “It provides such a great opportunity for the girls to see the campus.”

Camp Infinity was held at just one site in its infancy, but due to high demand it has grown to five sites. In mid-July at Wayne State, approximately 50 campers participated in Camp Infinity, which is one of many programs and partnerships Roberson has cultivated to broaden the College of Engineering’s community outreach.

“The college runs 27 engineering summer camps and impacts over 500 students from kindergarten to 12th grade,” said Roberson.

“Summer camps like WSU Camp

Engineering and Camp Infinity are essential in promoting discovery and understanding of STEM fields while closing the technology gap for girls.”

This program was created in 2004 by the MCWT Foundation as a means to bolster confidence, social relevance and peer acceptance of engineering and technology among young females.

“Oftentimes the girls get overshadowed or tend to defer to the boys,” said Patterson, who is also an educator in the Ferndale Public Schools. “Boys are tasked with the tech side, while the girls are put toward design. There is a lot of subtle messaging like this in our society.”

According to the Bureau of Labor Statistics, computer science jobs will increase 15 percent by 2022. Roberson wants to ensure there is a strong crop of females eager and ready to fill those positions.

“One day, these young girls may grow up to be the next computer programmer or discover technological advances,” said Roberson.

Patterson estimates that over 1,000 young girls have been directly impacted by Camp Infinity since its inception.

Camp Infinity is largely supported by sponsorship funds raised by MCWT, a philanthropic organization that provides women and girls with opportunities in Michigan’s technology community for mentoring, leadership development, networking, technology experiences and college scholarships.

For more information on Camp Infinity and the Michigan Council of Women in Technology, visit [mcwt.org](http://mcwt.org).



## Mechanical engineering professor brings STEM education to DETROIT PUBLIC SCHOOLS

Leela Arava, assistant professor of mechanical engineering, is doing his part to bring STEM education to Detroit Public Schools (DPS) through his Mobile Energy Lab.

With a team of nine graduate and undergraduate students, Arava travels to schools in the Detroit area to teach students the importance of green energy through hands-on experiments.

“We were assembling small solar panels in the classroom and the students wanted to take it into the field,” said Arava. “We hooked up some low-power LED lights to the panel, but they couldn’t handle the increase in power, so we explained to the students why it wasn’t working and changed our LEDs to ones that could support the power, and we also stored part of solar energy in the battery.”

Arava was inspired to create the Mobile Energy Lab after seeing that DPS students were below the state average in science proficiency.

“It was really eye-opening for me. I wanted to do something in the community,” said Arava.

The idea behind the Mobile Energy Lab was based on Arava’s own research on energy storage and batteries. He is developing a miniaturized lithium-ion rechargeable

battery that can withstand temperatures up to 150 C for oil and gas studies, and high-energy sulfur batteries for electronic vehicles and consumer electronics. Arava hopes to use his research to inspire DPS students to consider STEM fields.

“As Michigan’s only public, urban research university, Wayne State is uniquely positioned to address this issue and help propel these young individuals into successful careers in the sciences,” said Arava.

View more photos and find more information about the Mobile Energy Lab at [blogs.wayne.edu/arava/outreach](http://blogs.wayne.edu/arava/outreach).



Graduate advisors Eric Scimeca (left) and Ellen Cope (right) took the five TU Graz students on a tour of the WSU campus.



## College of Engineering welcomes five TU Graz students to Detroit

The Wayne State University College of Engineering welcomed five international students participating in the Study Abroad program in conjunction with Graz University of Technology (TU Graz) in Austria this summer. These students, all of whom were visiting Detroit — and some the United States — for the first time, spent six weeks studying and taking on research projects alongside several top WSU faculty members.

Thomas Bohnstingl, Johanna Ranninger, Peter Schuster, Julia Wasserbacher and Andreas Wurm were greeted by faculty and staff from the College of Engineering, including Associate Dean Simon Ng, who initiated this exchange program with TU Graz over three years ago.

Ng sees the potential for the program to enhance the international reach of WSU through research and collaboration.

“One of my goals for this program is to see more of our students and faculty connect with theirs on various research projects,” said Ng, who noted that the exchange with TU Graz is one of several successful exchange programs the College of Engineering offers. Students have participated in programs through partnerships in China, France and Spain, among others.

“I also see this as a great networking opportunity for our students,” added Ng.

Despite being from the same university, the students had not previously met. They arrived on July 8 and spent the weekend getting to know one another and exploring Detroit. The shared experience of being in a foreign land, and both the excitement and trepidation that goes along with it, galvanized friendships between this group, which Ng feels is another positive result of this program.

“This is a great opportunity because it opens your mind to new cultures. I think that’s very important for personal development.”

— Peter Schuster

TU Graz selected the group through a process that allowed the university to evaluate qualified applicants against a list of over 20 potential research projects presented by Ng and other WSU faculty members. As a result, the research projects and programs with which they intersect were varied. For instance, while Ranninger worked with Professor Eranda Nikolla on the development of electrocatalysts for conversion of carbon dioxide and water to hydrocarbon fuels, Wurm joined Professor Xuewen Chen in studying Big Data applications.

Graz, which is the second-largest city in Austria, is located 120 miles southwest of the capital, Vienna — and 4,500 miles east of Detroit. One of eight institutions of higher education in the city, TU Graz combines its research into five fields of expertise: advanced materials science; human and biotechnology; information, communication and computing; mobility and production; and sustainable systems.

Ng believes the similarities in focus areas between Wayne State and TU Graz, particularly the connections to the automotive industry, are part of what makes the relationship between the institutions unique. This connection is not lost on Wasserbacher, who’s focused her studies at TU Graz on vehicle safety and worked with Professor King-Hay Yang during her six-week visit to Wayne State.

“I feel Wayne State and Detroit are a great match for my interest in automotive engineering,” said Wasserbacher,

who noted innovative ideas such as the WSU Tolerance Curve as a reason Wayne State was on her radar as a place to study.

Not only did the synergy in research appeal to these students but also the opportunity to immerse themselves in a new culture and brush up on their English-speaking skills.

“I’ve always wanted to visit the United States and see how people are living and working here,” said Bohnstingl, who worked with Professor Mark Cheng on the development of flexible sensors and electronics. Bohnstingl hopes his research will advance treatment options in hospitals and the health care industry.

“It’s great to learn the language and talk to native speakers. We don’t get those opportunities in our country,” said Schuster, who researched additive manufacturing with Professor Guru Dinda and visited Washington, D.C., before returning to Graz. “This is a great opportunity because it opens your mind to new cultures. I think that’s very important for personal development.”

Ng noted that this group was the largest to come from TU Graz so far, and is optimistic that there will be a high level of reciprocation from Wayne State students in the future who see the benefits of an opportunity to visit Austria.

For more information on Wayne State University’s Study Abroad and Global Programs, visit [studyabroad.wayne.edu](http://studyabroad.wayne.edu).



## Wayne State students learn valuable cross-cultural skills studying in china

Electrical engineering student Shaan Sarkar understands the importance of learning to work in a diverse workspace. That's why he and 20 other students from Wayne State signed up for the opportunity to spend their summer working with students from the Zhejiang University of Technology (ZJUT) in Hangzhou, China.

The students were divided into six teams to solve problems in global engineering. Students were challenged to complete a technical project focused on sustainable transportation.

But the goals of the program reach beyond academics. "The focus of the class was working with disciplines and cultures," said Sarkar. "It was really focused on teamwork."

"[Chinese] education is very disciplined. You take class A, followed by class B, followed by class C," said Farshad Fotouhi, dean of the Wayne State College of Engineering. "American students use a lot more critical thinking and problem solving in their learning, so that style of learning is very interesting to them."

"Being able to finish the project and overcome the difficulties we had, whether it was the time constraints or the language barriers, was a great outcome," said

Sarkar. "At any large corporation, there's going to be people from all parts of the world. The program helped me to be more prepared to understand that."

Outside of the classroom, students were able to visit large international companies such as Volvo, A123 and many more. The ZJUT students were very excited to show their American counterparts around and help them explore China.

When the ZJUT students visited Wayne State, they toured Ford, Chrysler and General Motors, and got to experience baseball, burgers and more. Many of the Wayne State students offered the ZJUT students a place to stay during their visit.

The program began three years ago as a collaboration between Professor Chin-An Tan and an alumna who now teaches at ZJUT. Wayne State students spent their summer in China, and four Chinese students visited campus at the beginning of the fall 2015 semester.

The ZJUT students will take part in the university's 3+2 program through the Graduate School. ZJUT students will finish their bachelor's degrees in three years and will receive their master's degrees in two years from Wayne State.

## Welcome our new alumni officer!

The College of Engineering is pleased to welcome Mari Jackson as its new alumni and donor relations officer. Jackson, who formally started her new position July 5, has jumped right into working with our alumni, specifically the Engineering Alumni Council and the Engineering Alumni Volunteer Corps.

After receiving a B.A. from Saginaw Valley State University in 2010, Jackson held an internship at The Henry Ford. After falling in love with nonprofit and development work, she quickly realized it was time to pursue it as a full-time career. Jackson earned an M.M. from Walsh College in 2012. After assuming a board position on the Alumni Association, Jackson was recruited for the role of student life coordinator and development officer at Walsh College.

Jackson is a fundraiser at heart. Using her passion for philanthropy and fundraising talents, she established a student-focused culture of philanthropy at Walsh College. Securing endowments for student success and raising funds and awareness for student life, Jackson created a partnership with students and alumni and honed in on finding ways they could give back together.

In her role at the College of Engineering, Jackson will work to strengthen the partnerships and opportunities students and alumni will have together. She will work to grow and sustain the Engineering Alumni Volunteer Corps, creating meaningful opportunities for alumni to volunteer their time and talents. "Having an alumni volunteer program is at the heart of our mission for the Engineering Alumni Council. I will work hard to find ways to engage willing and able volunteers to give back to the Wayne State University College of Engineering family," said Jackson.

Jackson can be reached by email at [mari.pionk@wayne.edu](mailto:mari.pionk@wayne.edu) or by phone at 313-577-4707. She welcomes all alumni to reach out to her with any questions, comments or ideas that would benefit our engineering and computer science family.



Mari Jackson

## ALUMNI UPDATES

SHARE YOUR STORY

IGNITE THE SPARK

MAKE A GIFT

The Engineering Alumni Association encourages all alumni to share their story...

## “I am a Wayne State Engineer”

Telling a story for some means opening up and sharing bits and pieces of their life with another person. Sharing your story is personal, it's special, and it has the power to shape and at times even alter the course of someone else's journey. For all alumni, we encourage you to share your story — share why you call yourself a Wayne State Engineer.

Zachary Carr, B.S. '96, BSCE '99, MSCE '01, was willing to share his story. Carr has a special journey — a special affinity for not only the College of Engineering but for Wayne State University as a whole. Having initially received a bachelor's in geology, Carr needed to fulfill some additional requirements by completing a field study.

Unsure of what direction to take, Carr decided to participate in a field study at Western Michigan University. There, he fell in love with the idea of pursuing a civil engineering degree. “I quickly realized the strong

link between geology and civil engineering, and the engineering aspect was exciting to me,” said Carr.

Carr knew that the only place he could pursue this journey would be at Wayne State. He wanted to speak to someone who could help him develop a path suitable for him. At that time, Professor Mumtaz Usmen was dean of the civil engineering department. Little did Carr know that he and Usmen would remain close friends throughout his academic and professional journey.

“If it involved soil and rock and support of structures, that's what I focused on,” said Carr. He learned in a short time that his education from the College of Engineering would take him further than he could have ever imagined. “With heavy course loads and the skills we acquired throughout our program, I graduated college feeling prepared to meet real-world challenges.”



Zachary Carr

*“It's always a good sign of a solid program when you're hired before you even graduate.”*

Shortly after completing his bachelor's, Carr revisited the idea of coming back to graduate school. “I had looked at other schools, but only Wayne State took an interest in my field of employment and helped me tailor a master's program that would best benefit me professionally.” While going back to school as a part-time master's student, Carr was working full time at a local consulting firm, where he was hired before he even completed his bachelor's. “It's always a good sign of a solid program when you're hired before you even graduate.”

Carr attributes his ability to obtain a professional engineering license to his time spent at Wayne State. “In my opinion, my Wayne State education was vital in preparing me for the rigors of the multistep professional license exam process.” With 17 years of professional engineering experience under his belt, Carr takes pride in the many important relationships he's cultivated throughout the years. “The last couple of years have been quite unique, as I joined FK Engineering Associates, a new infrastructure engineering company based out of Troy, Michigan. Helping build a new company from the ground up has brought a new host of challenges and has been

a great opportunity for me to grow personally and professionally,” said Carr.

Carr has been working on many challenging projects, including major infrastructure efforts in Detroit such as the Gordie Howe International Bridge, Detroit-Windsor Tunnel and Raw Water Intake System with the Great Lakes Water Authority. “This excites me, being back in Detroit and taking part in the resurgence of the city. I'm enjoying reconnecting with my alma mater and volunteering whenever and wherever I can. I gained a great deal from the university and love giving back.” Carr serves on the board of the Southeast Michigan branch of the American Society of Civil Engineers (ASCE). ASCE gives Carr the opportunity to stay connected and serve with other exceptional industry professionals.

“I'm still in regular contact with many of the friends I made during my time at Wayne State. These were the types of relationships I had hoped to get out of my college experience in addition to my degree,” said Carr.

Whether your story is big or small, just beginning or coming to an end as you near retirement, remember that one thing remains constant: You will always be a Wayne State Engineer.



# IGNITE the SPARK



Vanessa Alexander

Volunteer programs are the heart and soul of many philanthropic programs around the world. Our goal in creating the Engineering Alumni Volunteer Corps is to engage alumni to find purpose and meaning through a network of volunteers who support engineering education in Detroit. We're looking for like-minded individuals who have real-world skills and are enthusiastic about reconnecting and giving back to the future of engineering at Wayne State University.

Vanessa Alexander, BSME '05, MSME '07, is a quintessential leader. Within minutes of meeting Alexander, her enthusiasm and excitement for giving is contagious. It has become a way of life; a simple routine in her day-to-day functions both professionally and personally.

In her role at Fiat Chrysler Automobiles (FCA), Alexander has had the opportunity to influence the lives of those she works with, as well as College of Engineering students and alumni.

"As a leader at FCA, they sponsored the continuation and growth of my academic career by allowing me to earn my executive M.B.A. at Michigan State University. I was one out of 11 sponsored to participate. It's allowed me to expand my networking, strengthen my business acumen and heighten my intellectual curiosity," Alexander said.

Alexander has applied these skills inside and outside of the engineering world. On May 10, she watched as the first-ever International Symposium Promoting Italian Technological Excellence (ITEUS) came to life. The event, held at the McGregor Memorial Conference Center on Wayne State's campus, brought together an inspiring group of Italian automakers and innovators. Presented by Leonardo International and sponsored by companies such as FCA, Comau, Brembo, Magneti Marelli and Esaote, as well as the James and Patricia Anderson Engineering Ventures Institute, the event sparked statewide attention.

Alexander worked as the champion and ambassador for FCA and the College of Engineering. Throughout the planning and execution of ITEUS, she worked with executives from various organizations in systems and components, advanced engineering, quality and power train to organize projects for Wayne State engineering students.

"Our goal at FCA was to create out-of-the-box thinking for WSU students and to bring new and innovative ideas to life that would promote Italian-American partnerships," Alexander said. "We are working to continuously increase and strengthen the relationship between FCA and Wayne State's College of Engineering. In turn, we're leveraging engineering students to apply their knowledge toward industry needs."

The event also brought to light the importance of creating a STEM presence within middle schools and high schools throughout the state, finding ways to impact youth by exploring the engineering field.

"The key thing for FCA is to build our relationships with the College of Engineering. We need to stay competitive in our field. These students can contribute, and we need to engage them. This was the perfect opportunity," Alexander added.

Aside from her leadership and volunteer roles at FCA, Alexander is a beacon of light for philanthropic work that expands outside of the city of Detroit's limits. Alexander believes that through her engineering education, her M.B.A. and professional journeys, she has been able to truly touch the lives of others. She applied what she has learned into the nonprofit world as a volunteer, community service ambassador and missionary.

"I was able to start a nonprofit named Mission Youth Detroit, which provides people and missionaries opportunities to serve in underprivileged areas locally and internationally. This experience has been invaluable," Alexander said.

Her involvement with Wayne State University in a volunteer capacity and as an ambassador has given Alexander the opportunity to provide professional input in order to improve the engineering industry experience.

"It's important for me to show through speaking engagements and volunteer opportunities that as engineers — women engineers — we are focused on more than the day-to-day operations. We are focused on the big picture and community involvement," she said.

As a Wayne State Engineer, Vanessa Alexander leads with purpose and volunteers with a clear mission and vision.

"Adding value to society is what drives me, not cars," Alexander said.

If you're looking to inspire, give and become a leader through a philanthropic movement that is "Igniting the Spark" in the lives of our students, this is your chance to come back and commit to being a volunteer within the Engineering Alumni Volunteer Corps. We have countless opportunities for you to make an impact — all you have to do is raise your hand.



# Make a Gift

## Support engineering education in Detroit



Nancy Philippart

Nancy Philippart has more than three decades of experience as an engineer and executive in the automotive industry. She credits her Wayne State University education as playing a particularly important role in having such a long and successful career. She also knows it may not have been possible without the generosity of others.

"I was fortunate when I was an undergraduate at Wayne State to be able to go to school on a scholarship," said Philippart, who was the executive director and general manager of the GM Accessories business unit until retiring in 2008. Today, she wears many different hats as a business consultant, advisory board member to several startups, member of the WSU College of Engineering's Board of Visitors, and co-founder of Belle Michigan, an early stage investment fund for women-led companies.

She also supports Wayne State University engineering students with a scholarship of her own. Naturally, it was her own experience as a scholarship recipient that inspired her.

"It really set up a mentality for me to want to pay it forward."

Philippart's gift was made with some very clear goals in mind. She felt very strongly about wanting to give engineering students, particularly women, an opportunity to study abroad.

*"I wanted them to see the world and get a taste of what it's like to be a global citizen."*

"In my own career, the ability to work internationally and to understand some of the cultural differences and similarities of people across the globe was really important," said Philippart.

One day, Philippart received a phone call from Chin-An Tan, professor of mechanical engineering. The two of them discussed the idea of a program that would ultimately become Cross-Cultural Engineering Problem Solving, a five-week course that brings students from WSU and Zhejiang University of Technology (ZJUT) together in China.

Not only was Philippart thrilled to have found the perfect fit for her gift, but she also volunteered to help prepare students to be able to work effectively with their Chinese counterparts.

Philippart meets with students before they go to China and after they return, collecting data through cultural intelligence assessments, which serve as a great tool to measure the impact of the program as well as the return on her investment.

"They are technically prepared, but I want them to be culturally and socially prepared," said Philippart. "The data will tell you that these students have grown tremendously."

Philippart knows firsthand how valuable cross-cultural preparation can be. She spent the majority of her career having global responsibilities, developing and selling products in multiple international markets, with team members from at least 15 different countries.

"I had to learn through my own hard experiences that cultural differences do matter, and you do have to prepare people to understand and accept those differences and develop strategies to work through

them," said Philippart, who left the auto industry to pursue a doctorate at Wayne State in the global executive management program within the Department of Industrial and Systems Engineering.

Philippart's gift not only reflects a professional philosophy but a personal one as well.

"I wanted to do with students what I did with my own kids," said Philippart, a mother of three. "I wanted them to see the world and get a taste of what it's like to be a global citizen. My hope is that this will alleviate any fear they have of going overseas."

Philippart is also cognizant of the fact that her scholarship presents opportunities to students who might not otherwise have an opportunity to travel. "Most of these students have never even had a passport before," she noted.

When she was an undergraduate student, Philippart found it remarkable that someone would set aside money to help students they likely don't know and may never meet. However, she remembers being encouraged to write letters to donors or their families to thank them for their gift and give them a sense of the positive impact their gift has made. Philippart herself has received similar feedback for her donation.

"I think the notion of making it real to the donor so that you can see on a personal level how your dollars contributed to the success of the student is really important," said Philippart.

Philippart's gift serves as a tremendous example of how alumni support is critical to shaping student success. A gift to the Wayne State University College of Engineering supports engineering education here in Detroit, but its impact is boundless.

## HOW TO BECOME A PART OF THE ENGINEERING ALUMNI VOLUNTEER CORPS

### ALUMNI

Ignite the Spark by giving forward as volunteers

### OUR FOCUS

Engaging alumni to find purpose and meaning through a network of volunteers who support engineering education in Detroit.

STUDENT & ALUMNI PARTNERSHIPS  
NETWORKING  
PHILANTHROPY  
FUN

### LOOKING FOR

- Like-minded alumni
- Alumni with real world skills
- ALL alumni no matter their time commitment or location

### RAISE YOUR HAND!

### VOLUNTEER!

### ANXIOUSLY AWAIT

a volunteer opportunity.

### ENCOURAGE

other like-minded alumni you know to participate.

**GIVE YOUR FEEDBACK,**  
Share your story.

### FILL OUT THE VOLUNTEER FORM

[forms.wayne.edu/551c39845bd3e/](https://forms.wayne.edu/551c39845bd3e/)



# DEPARTMENT NOTES



## BIOMEDICAL ENGINEERING

- Associate professor Michele Grimm has accepted a two-year appointment to serve as program director for biomedical engineering in the Chemical, Bioengineering, Environmental and Transport Systems division of the National Science Foundation in Washington, D.C.
- Assistant professor Harini Sundararaghavan received a \$665,000 grant from the U.S. Department of Defense to use nanofibers as a way to defeat tumors.
- Professor Juri Gelovani had two papers published in *Proceedings of the National Academy of Sciences*, a scientific journal that covers the topics of biological, physical and social sciences.
- Assistant professor Mohammad Mehrmohammadi and a team of students and faculty received the Best Poster Award at the Society of Photo-optical Instrumentation Engineers Medical Imaging Conference in San Diego.

## CHEMICAL ENGINEERING

- Professor Yinlun Huang received the 2016 Sustainable Engineering Forum Education Award from the American Institute of Chemical Engineers.
- Assistant professor Da Deng was one of 42 researchers named a 2016 Emerging Investigator by the Royal Society of Chemistry.
- Department Chair Guangzhao Mao and the Karmanos Cancer Institute received a \$17,000 donation to research the use of nanotechnology to learn more about melanoma.
- Assistant professor Zhiqiang Cao's project "Pairing Novel Chemical Gel Encapsulation Technology and Porcine Islets – a Pilot Study" has been approved for funding by JDRF Diabetes Foundation. This is his third grant from the organization.
- Department Chair Guangzhao Mao gave a presentation at the Envisioning the Future of Undergraduate STEM Education (EnFUSE): Research and Practice symposium on April 27 through 29, 2016, in Washington, DC. EnFUSE was sponsored by AAAS and NSF.

## CIVIL AND ENVIRONMENTAL ENGINEERING

- Professor Shawn McElmurry is involved in an ongoing study of Flint water quality.
- Assistant Professor Eranda Nikolla received the Wayne State University Academy of Scholars Junior Faculty Award for the 2016-17 academic year and the Camille Dreyfus Teacher-Scholar award from the Camille and Henry Dreyfus Foundation, Inc.
- Professor Carol Miller presented at the Michigan's Municipal Water Infrastructure: Policy Choices and Issues conference in Lansing.
- Assistant professor Stephen Remias' paper "Using Real-Time Probe Vehicle Data to Manage Unplanned Detour Routes" was featured in the *Institute of Transportation Engineers* journal.

## COMPUTER SCIENCE

- Professor Weisong Shi was appointed associate editor of the *Institute of Electrical and Electronics Engineers' Transactions on Services Computing* and editor in chief of Elsevier's *Smart Health* journal.
- Professor Sorin Draghici's company, Advaita Bioinformatics, was recognized as one of the 2016 Michigan 50 Companies to Watch by Michigan Celebrates Small Business.
- The department received a \$30,000 grant to come up with Detroit-based uses for Intel's Internet of Things, creating connectivity with everyday devices.
- Associate professors Lihao Xu and Dongxiao Zhu received the college's Excellence in Teaching awards.
- Professor Michael Wu received one of the college's 2015-16 Faculty Research Excellence awards.

## ELECTRICAL AND COMPUTER ENGINEERING

- Assistant professor Michael Wu received a five-year, \$500,000 grant from the National Science Foundation to develop new microwave radar communications.
- Assistant professor Michael Wu also received one of the college's 2015-16 Faculty Research Excellence awards.

## ENGINEERING TECHNOLOGY

- Professor Mukasa Ssemakula received the 2016 Poster Award at the Evidence-Based Teaching & Learning Lily Conference in Austin, Texas. His poster, "The Manufacturing Integrated Learning Laboratory (MILL) as a Model for STEM Education," covered the issue of the lack of hands-on experiences in classrooms.

## INDUSTRIAL AND SYSTEMS ENGINEERING

- The department received a \$1.7 million grant to work with Ford Motor Company to create a way to test strength and weldability of metals.
- Professor Kai Yang received the American Society for Quality Automotive Division's Cecil C. Craig Lifetime Achievement Award in recognition of his writings and academic contributions to the field of automotive quality and reliability, including eight books in four different languages.
- Associate professor Alper Murat's article "A discrete particle swarm optimization method for feature selection in binary classification problems" was recognized as one of the top 25 most cited articles in the *European Journal of Operational Research*.
- The Wayne State University chapter of the Institute of Industrial Engineers hosted the Great Lakes Regional Conference on campus.
- Doctoral student Wujun Si won a Best Paper Award at the 2016 Industrial and Systems Engineering Research Conference for his article, "An Enhanced Functional Linear Model and Application in Reliability Analysis by Utilizing Material Microstructures."

## MECHANICAL ENGINEERING

- Wayne State's Formula SAE team, Warrior Racing, came in 10th place out of 80 teams at the Formula West Competition in Lincoln, Nebraska.



# College of Engineering welcomes new faculty members



Mohsen Ayooobi

The Wayne State University College of Engineering is pleased to announce the addition of seven outstanding scholars to its faculty.

## MOHSEN AYOOBI, ENGINEERING TECHNOLOGY

Mohsen Ayooobi comes to Wayne State from EcoMotors in Allen Park, Michigan, where he has worked since May 2015 as a simulation engineer focused on piston thermal managements through CFD simulations. His research interests include premixed flame dynamics, syngas production and usage, and chemical kinetics. Ayooobi earned his Ph.D. in mechanical engineering from Louisiana State University in 2011.



W. Ethan Eagle

## W. ETHAN EAGLE, MECHANICAL ENGINEERING

W. Ethan Eagle will join the WSU faculty in January after completing postdoctoral research at Sandia National Laboratories Combustion Research Facility in Livermore, California, and in the Wooldridge Combustion Laboratory at the University of Michigan. Eagle will direct the Prometheus Combustion Laboratory at Wayne State, which focuses on combustion system technology improvements. He received a Ph.D. in aerospace engineering from the University of Michigan in 2012.



Mohammed Ismail Elnaggar

## MOHAMMED ISMAIL ELNAGGAR, ELECTRICAL AND COMPUTER ENGINEERING (CHAIR)

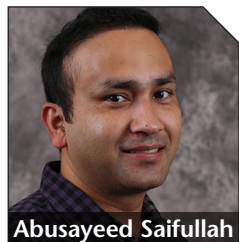
Mohammed Ismail Elnaggar has spent over 30 years in academia and industry, having worked in the United States, Canada, Sweden, Egypt, and most recently at Khalifa University in the United Arab Emirates. Ismail is the founding director of Ohio State University's Analog VLSI Lab, one of the foremost research entities in the field of analog and RF integrated circuits. He was a research chair at the Swedish Royal Institute of Technology and created the Radio and Mixed Signal Integrated Systems (RaMSIS) Research Group. He has served the Institute of Electrical and Electronics Engineers in many editorial and administrative capacities, and has co-founded several startup companies in semiconductor and IC design services. Ismail holds a Ph.D. in electrical engineering from the University of Manitoba.



Fatmir Menkulasi

## FATMIR MENKULASI, CIVIL AND ENVIRONMENTAL ENGINEERING

Fatmir Menkulasi joined the faculty in August following a two-year appointment as an assistant professor at Louisiana Tech University. His research interests include structural systems for buildings and bridges, health and behavior of structures, load-resisting systems, high-performance materials, and infrastructure forensics and rehabilitation. Menkulasi received his Ph.D. in structural engineering from Virginia Tech University in 2014.



Abusayeed Saifullah

## ABUSAYEED SAIFULLAH, COMPUTER SCIENCE

Abusayeed Saifullah comes to Wayne State after a two-year assignment as an assistant professor at Missouri University of Science and Technology. His areas of research include cyber-physical systems, embedded and real-time systems, wireless sensor networks, and distributed and parallel computing. Saifullah earned his Ph.D. in computer science from Washington University in St. Louis in 2014.



Omid Samimi-Abianeh

## OMID SAMIMI-ABIANEH, MECHANICAL ENGINEERING

Omid Samimi-Abianeh was an assistant professor of mechanical engineering at Georgia Southern University prior to joining Wayne State University in August and has over six years of industrial work experience at Chrysler and Irankhodro Powertrain. He is an expert in computational fluid dynamics and reacting flow modeling and experimentation. His research interests include model development of multicomponent fuel surrogates, spray evaporation and droplet breakup, large-eddy simulations of turbulence, combustion kinetics, combustion simulations of internal combustion engines, and turbulent sprays. Samimi-Abianeh holds a Ph.D. in mechanical engineering from the University of Alabama-Huntsville.



Liying Zhang

## LIYING ZHANG, BIOMEDICAL ENGINEERING

Liying Zhang was appointed associate professor following over a decade at Wayne State as part of the research faculty in the biomedical engineering department. Her research interests include injury biomechanics, biomechanical and pathological mechanisms of neurotrauma, orthopedic biomechanics, and finite element modeling of human bodies. Zhang is known internationally for her work on brain injury modeling in automotive, sport and military environments. She received her Ph.D. in mechanical engineering with a major in biomechanics in 2001 from Wayne State.

# HIGH-IMPACT PRACTICES

A major objective of the College of Engineering's strategic plan is to sustain a vibrant culture of learning and discovery so that every student gains the technical and personal skills needed to embark on a successful career. To achieve this, Dean Fotouhi introduced the High-Impact Practices of Student Success.



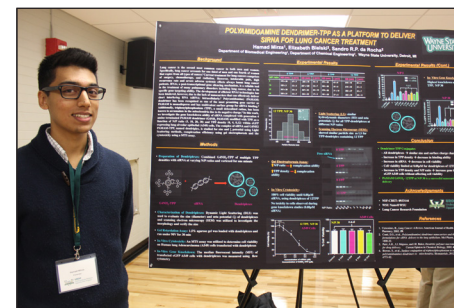
## HANDS-ON EXPERIENCE

Students involved in EcoCAR 3 learn real-world skills and network with automotive professionals.



## GLOBAL PERSPECTIVE

Partnerships with universities all over the world – including in Austria, China, France, Germany, Korea, Latvia and Spain – allow our students to study and research abroad.



## UNDERGRADUATE RESEARCH

Three engineering students received awards at Wayne State's Undergraduate Research and Creative Projects Conference in November 2015.



## CO-OPS AND INTERNSHIPS

More than 80 percent of our graduates have gained experience through at least one internship opportunity.

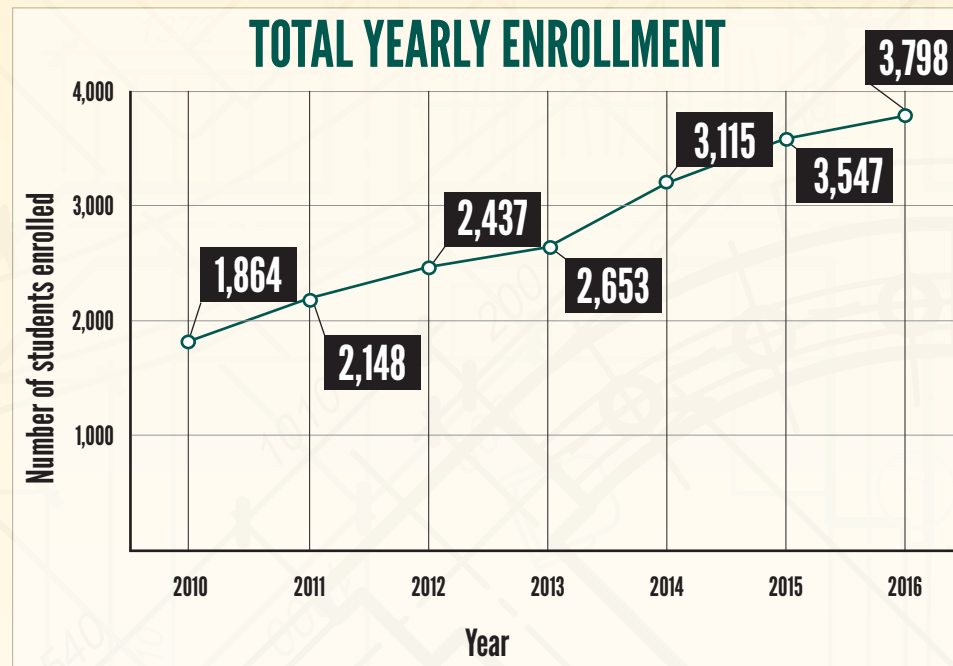


## COMMUNITY ENGAGEMENT

The college impacts over 3,000 K-12 students in STEAM annually.

# FACTS AND FIGURES

**TOTAL ENROLLMENT**  
**3,798**  
**STUDENTS**



## Class level

Freshman: 483 (12.7%)  
Sophomore: 369 (9.7%)  
Junior: 449 (11.8%)  
Senior: 902 (23.9%)  
Master's: 1,292 (34%)  
Doctorate: 298 (7.8%)

## Countries represented by current students

**47**

## Living alumni

**27,104**

## Student organizations and teams

**21**

## Level

**UNDERGRADUATE**

2,208 students (58.1%)

**GRADUATE**

1,590 students (41.9%)

## Full/part time

**FULL TIME**

2,813 students (74.1%)

**PART TIME**

985 students (25.9%)

## Faculty and staff

FULL-TIME FACULTY

**134**

FULL-TIME STAFF

**50**

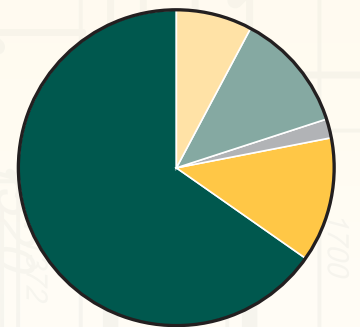
## Research expenditures

2015 fiscal year

**\$18,843,000**

### By Source

- National Institutes of Health (NIH): \$1,499,000
- National Science Foundation (NSF): \$2,246,000
- Department of Energy: \$366,000
- Department of Defense: \$2,469,000
- All other fed/state/local agencies, private industry, etc.: \$12,263,000



## Gender

**MALE**

3,057 students (80.5%)

**FEMALE**

741 students (19.5%)

## Residency and level

**IN-STATE UNDERGRADUATE**

2,077 students

**OUT-OF-STATE UNDERGRADUATE**

131 students

**IN-STATE GRADUATE**

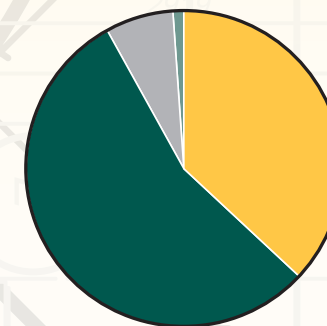
418 students

**OUT-OF-STATE GRADUATE**

1,172 students

## Degrees awarded 2016

- Bachelor's: 244
- Master's: 359
- Ph.D.: 46
- Certificate: 8



\*All figures represent fall 2016 unless otherwise indicated



## COLLEGE of ENGINEERING

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Detroit, MI 48202

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*Exemplar* is published for alumni and friends of the College of Engineering.

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### College of Engineering

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