MECHANICAL SCIENCE AND ENGINEERING / FALL 2015

MechSE

$12 MILLION GIFT LAUNCHES

THE CAMPAIGN TO TRANSFORM MEB

ILLINOIS

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What do you think?

The MechSE magazine has a new look—let us know what you think! Email comments to wbowman@illinois.edu.

Join our social networks–just go to mechse.illinois.edu!

From the Department Head

As MechSE's new Department Head, I welcome you to enjoy our Fall 2015 magazine. I joined the department in 1992, and over the past 23 years I have developed a deep appreciation of our very special department. I am truly honored to now lead MechSE, with our incredible students, alumni, faculty, and staff.

What an exciting time it is in MechSE! As you saw on the cover and will read throughout the pages that follow, the "Transform MEB" project has received an enormous boost and is now a reality. In April, we held a press event to announce and celebrate a $12 million gift from alumnus **Sidney Lu** (BSME '81). His generosity and dedication to MechSE and its students have enabled us to launch the Transform MEB project, which includes the east-wing addition that will be known as the Sidney Lu Center for Learning and Innovation.

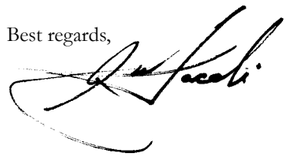
You can read much more about Transform MEB in the pages that follow. I am certain you will be as excited as we are for the students who will become engineers here and the world-class education they will receive. As proud as we are of what the department offers our students today, it is the potential for tomorrow's education, innovation, and community that has us truly inspired. Please read more about the project and consider partnering with us as we realize this shared vision.

In other news that exemplifies the impressive standing of the MechSE Department and its people, the National Science Foundation announced in August a new, $18.5 million Engineering Research Center to be headquartered at the University of Illinois and led by MechSE professor **Andrew Alleyne**. Called P.O.E.T.S., the Power Optimization for Electro-Thermal Systems center will attack the thermal and electrical challenges surrounding mobile electronics and vehicle design. The center's work will have profound societal impacts, and we are proud to count Professor Alleyne among our faculty.

Assuming the role of Department Head at this critical time, with such exciting initiatives starting, is humbling indeed. I promise to work with all my energy to sustain and build on the high level the department reached under the direction of my predecessor, Professor **Placid Ferreira**. He was an incisive and visionary leader of the department for the past six years, and we are all incredibly thankful for his dedication to MechSE.

I hope you enjoy reading this issue of our magazine and discovering even more about MechSE and its students, alumni, faculty, and staff.

Best regards,



Anthony Jacobi
Department Head
Richard W. Kritzer Distinguished Professor

MechSE's Jacobi takes over as Department Head

On August 16, 2015, Richard W. Kritzer Distinguished Professor **Anthony Jacobi** became the Department Head for Mechanical Science and Engineering at Illinois. He took over this role from Tungchao Julia Lu Professor **Placid Ferreira**, who had served as Department Head since August 2009.

A Fellow of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (2009) and of the American Society of Mechanical Engineers (2011), Jacobi has been an Illinois faculty member since 1992 and has been honored with numerous faculty teaching and research awards within the College and the MechSE Department.

Since 2001, he has shared his effective leadership talents as co-director at the Air Conditioning and Refrigeration Center (ACRC), overseeing a multidisciplinary research program involving more than a dozen faculty members, 60 graduate and undergraduate students, post-doctoral and visiting scholars, and companies from around the world. The ACRC is the largest center in the nation devoted to research in heating, ventilating, air conditioning and refrigeration; its research program is supported by approximately 30 industrial sponsors.

Jacobi also served as MechSE's Associate Head of Graduate Programs from 2008 to 2011 and for the 2014-15 academic year.

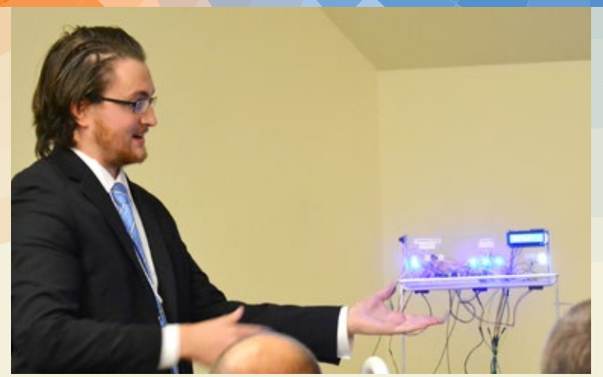
MechSE Student Innovation

Hand prosthetic

MechSE undergrad **Patrick Slade** won the university-funded track in the 2015 Cozad New Venture Competition, teaming up with neuroscience PhD candidate **Aadeel Akhtar** to form the company PSYONIC. They created a 3D printed prosthetic hand that uses electrical impulses generated by forearm muscles to perform multiple grasping movements, and costs 10 times less than existing prosthetic hands. They hope to improve the lives of people with amputations worldwide; their work already has been tested successfully by amputees in Ecuador.

Gesture-recognition technology

Rithmio, the company of PhD candidate **Adam Tilton** (BSME '10) and Associate Professor **Prashant Mehta**, announced that it has secured $3 million in seed round funding. In 2014, Rithmio's gesture-recognition platform for wearable devices won the university-funded category of the annual Cozad New Venture Competition at Illinois. The company has opened offices in both Champaign and Chicago.



Touchless faucet

A hands-free system to deliver clean water through a touchless faucet design took first place at MechSE's 2014-2015 Innovation Trophy Competition. **Danielle Courtois**, **Timothy Jones** (shown here), and **Kevin Kienitz** brainstormed ways to control a faucet's temperature and pressure using a motion sensor. Moving forward, the team is interested in patenting, marketing, and implementing their product in residential kitchens, and then branching out to industrial kitchens and hospitals.

Biomedical

MechSE PhD candidate **Ritu Raman** has won the 2015 Illinois Innovation Prize, a campus-wide competition among student entrepreneurs. Raman uses 3D printing to manufacture biological building blocks that can harness the innate abilities of biological materials to sense, process, and respond to a variety of dynamic environmental signals in real time. Such building blocks can be used to design bio-integrated machines that can self-organize, self-heal, and self-replicate in response to a complex array of environmental cues.

Wheelchair lift

A Chicago-based startup—run by **Chris Delaney**, **Jake How**, and **Anando Naqui** (all BSME '12)—has developed a technology to make it much easier and cost-effective for wheelchair users to get up and down stairs in their homes without needing attendants. EscaWheel, Inc., which began as a 2012 senior design project in ME 470, has a long-range goal to mass-produce the final product and sell it for around the cost of the chairlift.

Robotic lawnmower

Mowing the lawn may soon change from inescapable chore to a favorite spectator sport. **Junho Yang**, a PhD candidate in MechSE, is working on "an omnidirectional-vision-based system to detect the containment status of a robotic lawn mower." The vision-based aspect is key, as there are currently robotic lawn mowers on the market, but owners need to stake and wire all lawn boundaries for these versions. John Deere is funding the project.

Hydraulic cycle

This year's student team (including **Iain Brearton**, left, and **Ian O'Leary**) performed very well in the national Parker Hannifin Chainless Challenge—taking second place overall and placing in the top three in nine other categories. The annual competition for fluid-power bicycles was held in Irvine, California, and stipulates that bikes must be chainless and human powered; use hydraulics, pneumatics, and electronics; and weigh less than 225 pounds.

High-performance car

Led by MechSE students, the Illinois Formula SAE team produced one of its best cars and top performances ever in 2015, placing 3rd out of 80 teams at the SAE organization's event in Lincoln, Nebraska. The Illini team outpaced all other Big Ten entries, including historical top competitors Michigan, Michigan State, Ohio State, and Wisconsin. The team was consistent across the different event categories, placing 3rd in Autocross, 19th in Skidpad, 11th in Acceleration, and 4th in Endurance.

MechSE Students

Oh, the places they'll go!

Every year, approximately 200 graduating seniors leave MechSE and head to industry or graduate programs across the country and around the world. While this snapshot is by no means comprehensive, it offers a look at the impressive places some of our 2015 grads have gone.

MechSE Student Honors 2014-15

MechSE Graduate Student Awards

David Hinde Memorial Award
Feini Zhang

Hassan Aref Memorial Award for Theoretical and Applied Mechanics
Nicolas Tobin

James O. Smith Memorial Award
Bruno Azeredo

Outstanding Teaching Assistant in Mechanical Engineering
Mayank Baranwal
Ziming Wang

Outstanding PhD Graduate in Mechanical Engineering
Anshuman Mishra

Stanley I. Weiss Outstanding Thesis Award
Hasib Uddin

MechSE Undergraduate Student Awards

A.G. Friederich Memorial Award
Alex Gruebele

ASME Junior Leadership Award
Carl Remler

Bei Tse & May Chao Award
Sanjit Dutta

Caterpillar Award
Michael Bastanipour

Clarence L. & Harriette Johnson Award
Paula Stocco

Fred B. Seely Award
Arik Avagyan

George W. Harper Award
Alex Allmandinger
Gregory Danielson
Michael Kabbes
Michael Lynch
Chris Nobre

GM/Philip W. Leistra Jr. Society of Automotive Engineers Award
Gail Butler

Helmut H. Korst Award
Robert Born
Boqi Li
Ryan Ruddell

Innovation Trophy Competition Award
Danielle Courtois
Timothy Jones
Kevin Kienitz

James W. Bayne Award for Outstanding Senior in Pi Tau Sigma
Samuel Zschack

James W. Bayne Outstanding Award for Outstanding Senior Design Project
Henry Fiorentini
Michael Georgen
Thomas Guttschow
Onur Hacioglu
Yan Han
Bryce Kirkpatrick
Andrew Margolis
Taylor Oltman
Yichao Sun
Kenneth Swartz

John C. & Elizabeth J. Chato Award in Bioengineering
YikTung Tracy Ling
Sasank Vemulapati

Kenneth J. Trigger Award
Mason Blake
Michael Holz
Nathan Zimmerer

Konzo/ASHRAE Engineers Award
Yirong Zhang

Leonard Fieman Student Research Award
Alex Kahn

Materials Processing Award
Bruno Abdelnour

O. A. Leutwiler Award
Athrey Nadhan

Patrick B. and Janet A. Flanagan ASME Senior Leadership Award
Danielle Tene

Pi Tau Sigma Sophomore Award
Allison Gibson

Student Outreach Award
Yan Han

Swanson Environmental Sustainability Award
Michelle Diaz

T. A. Peebles Award
Rohan Khanna

T & AM Merit Award
David Drewniak

College of Engineering Awards

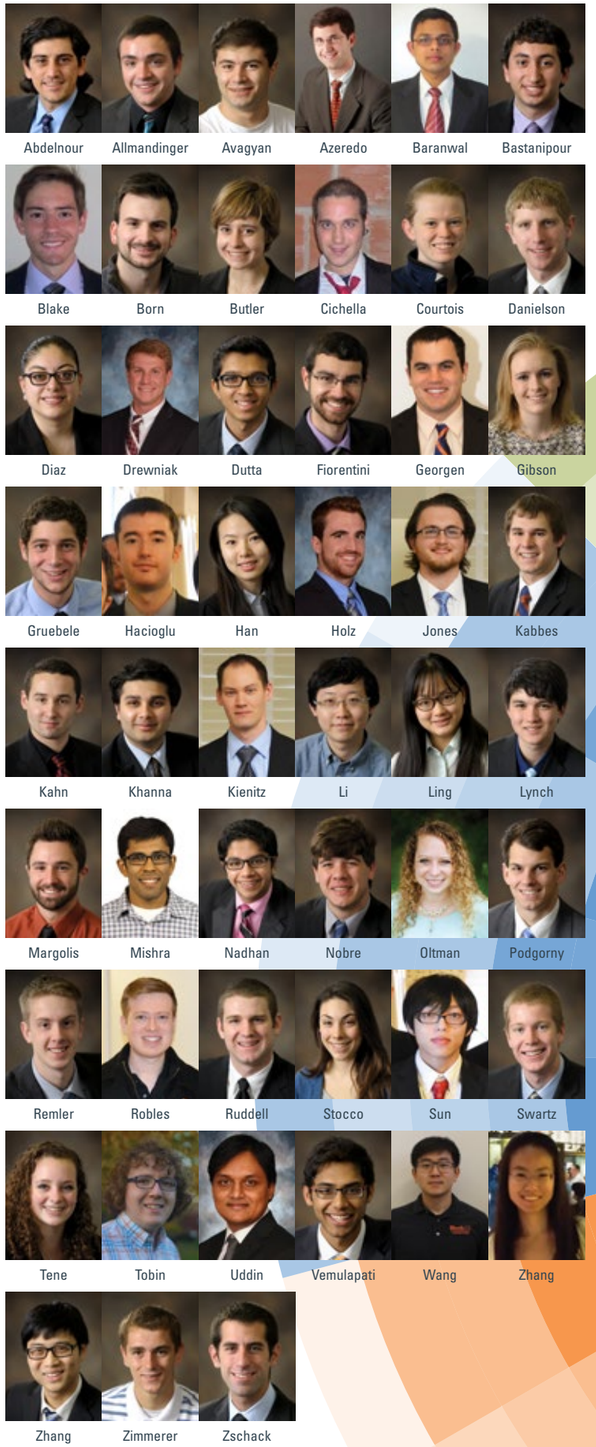
Knights of Saint Patrick
Ruben Robles

Stanley H. Pierce Student Award
Douglas Podgorny

Ross J. Martin Memorial Award
Venanzio Cichella

University Honors

Bronze Tablet
Bruno Abdelnour
Mason Blake
R. Davis Born
Alexander Gruebele
Boqi Li
Ryan Ruddell
Kenneth Swartz
Albert Xiao

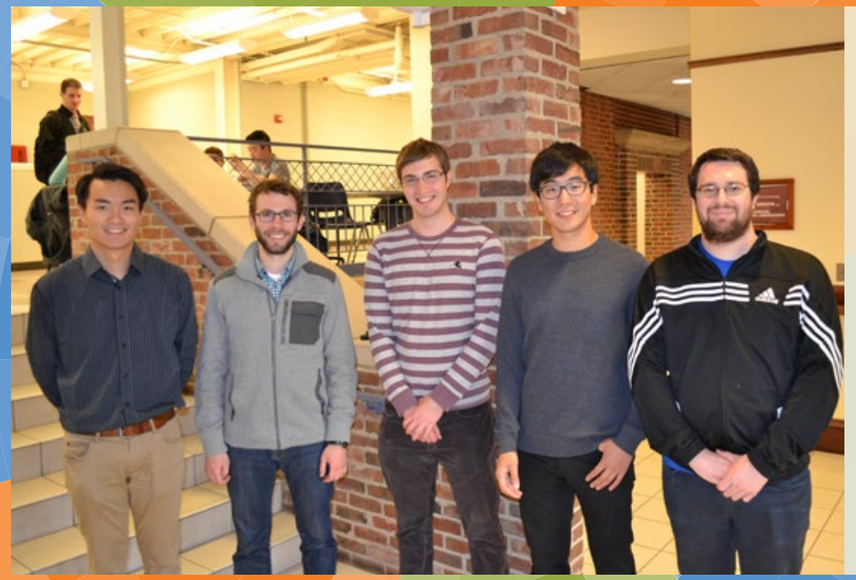


Senior 100

The Senior 100 Honorary is a program of the University of Illinois Alumni Association that recognizes notable seniors across campus for both their past achievement and future commitment to the university. The program honors what the students have accomplished and acknowledges the great impact they will have on the world at large after graduation. Only 100 seniors from the entire campus are chosen.

Back row: Andrew Horton, Ruben Robles, Alex Grubele, Mason Blake.

Front row: Jenny Lin, Davis Born, Michael Lynch.

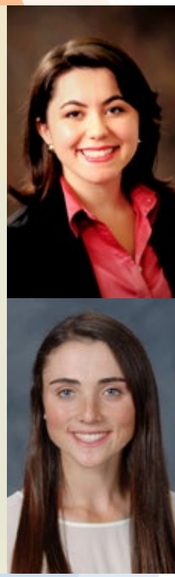


NSF winners

MechSE has seven graduate students who have received graduate research fellowships from the National Science Foundation.

Main photo: Dongguy Benjamin Sohn, Herschel C. Pangborn, Joshua A. Schiller, Anthony Fan, Keegan Moore.

Top right: Svjetlana Stekovic.
Bottom right: Ashley Armstrong.



THE CAMPAIGN TO

Transform MEB

Education.
Innovation.
Community.

A view of the transformed MEB from the corner of Green and Goodwin.

Since 1950, the Mechanical Engineering Building (MEB) has been the foundation and headquarters for one of the nation's top engineering departments. More than 20,000 students have become engineers here and then entered the world prepared to take it by storm. Now, buoyed by a cornerstone gift from alumnus **Sidney Lu**, we have the opportunity to transform MEB into an incredible, 21st-century facility that will inspire and empower current and future generations of MechSE students to be the best in the world.

"We have to give our students the space—physical and intellectual—to collaborate. We have to give them hands-on opportunities to solve real-world problems."
— Andreas Cangellaris
Dean of the College of Engineering

This historic project includes a five-story addition to the east of MEB, a single-story addition to the north, and 66,000 square feet of existing space reimagined, reengineered, and optimized for education, innovation, and community. More than ever before, MEB will be the place where successful careers are launched and the seeds of innovation are sown. It will be truly transformational.

Sidney Lu Center for Learning and Innovation

As leader of Foxconn Interconnect Technology, **Sidney Lu** (BSME '81) is an excellent example of the world-class success MechSE alumni can attain. He credits much of his achievement to his MechSE education and degree from Illinois. "I learned hard work here, and I learned how to learn."

In support of the campaign to transform MEB, Lu pledged a $12-million cornerstone gift to help fund the new east-wing addition—the largest part of the overall project—which has been named the Sidney Lu Center for Learning and Innovation.

Education.

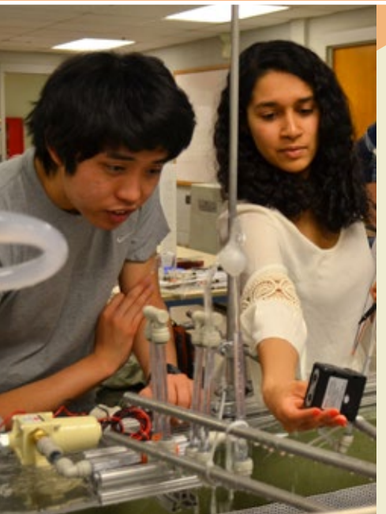
The world-class education our students receive is at the heart of the MechSE Department. Today, engineering education is being revolutionized with new ways of integrating instruction and technology. We teach advanced concepts for solving the world's grand challenges and assign hands-on design projects that reinforce classroom learning. Rooted in the fundamentals of engineering, our curriculum emphasizes teamwork, creativity, and the skills to thrive and grow in a technology-intensive world. The new facility's inspiring and innovative environment—featuring active-learning classrooms and a state-of-the-art complex of integrated, instructional, and project laboratories—will set a new standard for engineering departments everywhere.

During their time in the MechSE Department, students become fearless, confident, and independent learners who willingly take on intellectual challenges. They develop into highly effective collaborators who embrace team work; sophisticated and discriminating users of information and technology; and creative problem solvers. At the same time, they become generous teachers who share their knowledge, experiences, and perspectives with others.

"At Illinois, I learned through my courses and research, individual study, and interactions with others. The practice I received on presenting to groups has served me well in my career at Xerox, and the teamwork skills I learned through study groups and lab groups have proven to be invaluable. Having a space that encourages such interaction and enables collaborative efforts is essential and will definitely enhance students' experience and prepare them to thrive in their careers."

— Marina Tharayil
(BSME '99, MSME '01, PhD ME '05)
Manager, Business Process Modeling and Optimization Group at Xerox

A view of the transformed MEB from the corner of Green and Mathews.



Instructional Laboratory Complex

The new state-of-the-art complex will encompass the entire lower level of MEB and include lab space for many MechSE disciplines: fluid mechanics, heat transfer, manufacturing processes, mechatronics, metrology, motion control systems, robotics, and other specialty areas. Working in an open-architecture complex of instructional labs that share one massive space, students will better grasp how projects often cross boundaries and will find unique solutions to challenging engineering problems.

Active Learning Classrooms

Classrooms in the transformed MEB will enable an optimal learning environment—designed to utilize our faculty's advanced teaching methods and hands-on, project-based instruction. Movable desks and group seating centered around state-of-the-art technology support small group discussion and interactive, collaborative teamwork. Proven "blended learning" techniques of face-to-face instruction combined with online adaptive learning result in a more meaningful classroom experience. Our students are motivated to take ownership of their education—becoming engaged and critical thinkers with a true understanding of how to solve real-world engineering problems.

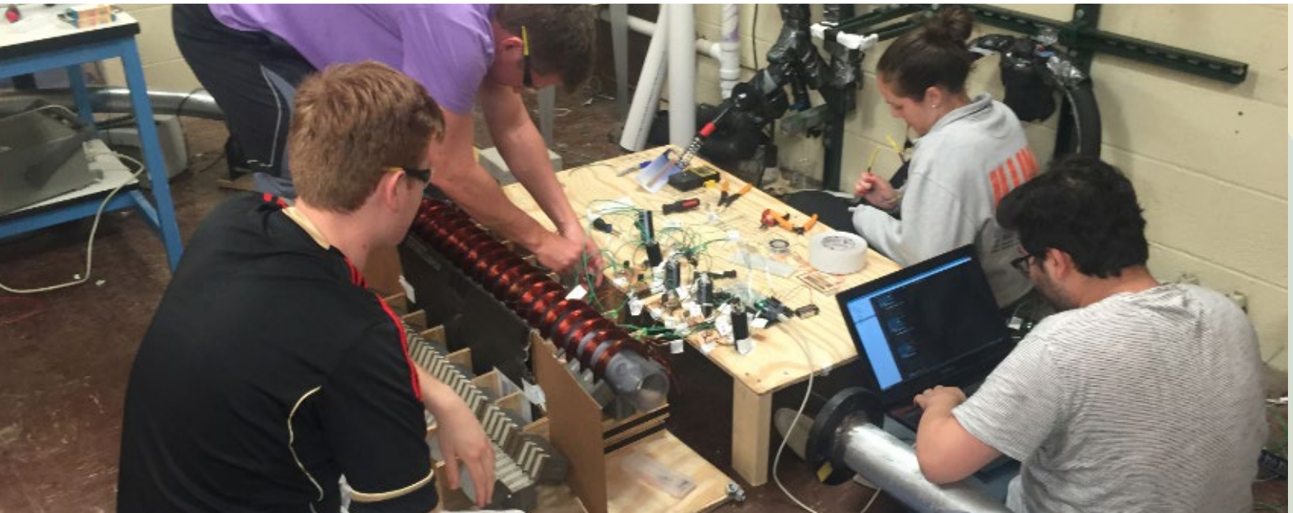
Innovation.

Simply put, MechSE students are leaders in innovation. They set records in international competitions. Their senior design projects are immediately implemented by sponsoring companies. They win campus-wide innovation contests, and they start successful businesses—often before graduation! The innovation-rich environment of the new MEB will equip our students for even greater success. This facility's 3,000-square-foot Senior Design Project Studio and 6,000-square-foot Innovation and Design Commons—a 24/7 "maker space"—will inspire creativity and foster teamwork, opening up a world of possibilities and new ideas. Our students will work, interact, learn, play, and grow in an environment optimized for true innovation.

"The new Innovation and Design Commons will offer MechSE students opportunities for communication and exchange of ideas. We'll learn the importance of teamwork as we collectively labor to meet both project deadlines and standards. Personally, I have gained practical experience in the present Innovation Studio, which I am certain will be beneficial towards becoming a control engineer."

— Obinna Onyemepu (BSME '16)

The transformed MEB's Innovation and Design Commons.



Senior Design team takes on Hyperloop challenge

In June 2015, well-known inventor and innovator Elon Musk announced his SpaceX company is sponsoring a competition to see who could design the perfect Hyperloop pod. The Hyperloop is a conceptual high-speed transportation system that incorporates reduced-pressure tubes in which pressurized capsules ride on an air cushion driven by linear induction motors and air compressors.

This announcement resulted in a flurry of media attention around the globe for the MechSE Department, where students already had made a working prototype in this new technology.

In recent semesters, Senior Design teams have tackled the challenge of designing a small-scale but functional prototype of a Hyperloop system. More students will continue to work on the project next year and continue to make improvements.

"Small steps is the way to go," said Associate Professor **Carlos Pantano-Rubino**, a MechSE faculty member and advisor to these teams. "That is how engineers learn to build complicated things. Nobody just learns to build complicated things the first time."

YouTube views of the students' six-second demonstration video surpassed 80,000 at press time. This year's team included **Nate Anderson**, **Andrew Horton**, **Rohan Khanna**, **Karen Lipa**, and **Ruben Robles**. They also collaborated with ECE students on the prototype's electrical components.

Musk's contest is aimed at students and will be hosted at the SpaceX headquarters in Hawthorne, California, in June 2016.

Community.

Providing students a space to make their "home away from home" has long been a departmental goal. The new facility will include a 3,000-square-foot, open-design student center and dedicated space for our student societies' projects, meetings, corporate events, and other interactions. These will be places to converse with peers and professors, work alone or in groups, grab lunch or a coffee, or just hang out between classes. They will be true "collaboration spaces" that spur interaction and strengthen the education and innovation already underway. Within the revitalized MEB, our future industry leaders, researchers, and entrepreneurs will build strong connections that continue long after graduation.

"My student experience really improved when I got involved in student societies as an undergrad, and we now encourage students to get involved much earlier. We want them to come in the door and feel a sense of community right away. Our student area in MEL is packed, especially late at night. There's a lot more group work than there's been before, and the projects the student societies engage in have really grown. With the new building project, we'll have all the students in one central area instead of spread out. This is going to have an incredible impact. Even more than now, the students will find their own niche, their own place, and a real sense of belonging."

— Emad Jassim
(BSME '00, MSME '01, PhDME '06)
Director of Undergraduate Programs in MechSE

The transformed MEB's student center.

My home away from home

Those who know me know I have always struggled with the answer to "Where are you from?" or "Where is home?" Four years ago, I left Beijing, China, to come to the University of Illinois in pursuit of a degree in mechanical engineering. I had no idea just how many incredible opportunities I would be given and the number of talented, passionate, and inspiring people I would meet.

One of the most notable things I felt at Illinois, and specifically at MechSE, was a strong sense of community. This was important to me, as I grew up moving every couple of years because of my dad's job. By the time I graduated high school, I had lived in five different countries across North America, South America, and Asia. I'm used to change and making new friends quickly, but I don't think it ever came as naturally as it did at Illinois. I know people with so many different cultures, backgrounds, and experiences. Everyone belongs, and everyone brings something new and important to the table.

Going to a top engineering program in the country (and the world!), there's the stereotype that students are cut-throat competitive and that everyone is fighting for the top of the curve. The reality is, I never once felt that way. Whether it's helping each other with tough homework problems, reviewing for upcoming exams together, or working on projects outside of class, collaboration is everywhere. The community of giving and taking results in something incredible: everyone benefits.

I can't even begin to imagine what the transformation of MEB will add—especially the student center. Student societies meeting in larger numbers to work on their projects. More opportunities for corporate after-hours and recruiting events. A place to test out and showcase projects to friends and classmates. Heck, even just more space to get together, socialize, and take breaks.

Getting involved and being an active part of the MechSE and College of Engineering communities through student organizations, leadership, and really just being present was truly the best decision I made in college.

Suddenly, looking at it now, the answer to that question, "Where is home?" becomes much more clear. Urbana-Champaign is my home, and I'm going to miss it like crazy.

— Chris Nobre (BSME '15),
Project Engineer, Amazon

MechSE professor to lead $18.5 million center for power optimization in mobile electronics

"There will definitely be opportunities for students to try their hand at spinning out these technologies into a product or a business."
— Andrew Alleyne

Heat is the enemy for people designing cars, construction machinery, aircraft, and mobile electronics. When their electrical systems do more work, they get hotter. When they get too hot, they operate inefficiently, fail, or even melt. Your cordless drill won't fire up. Bulldozer buckets don't lift. Planes are grounded. Electric cars sit on the side of the road.

A new, $18.5 million Engineering Research Center led by MechSE professor **Andrew Alleyne** is out to pack more power into less space for electrical systems. The center is funded by the National Science Foundation and will be headquartered at the University of Illinois at Urbana-Champaign.

Called P.O.E.T.S., the Power Optimization for Electro-Thermal Systems center will attack the thermal and electrical challenges surrounding mobile electronics and vehicle design as a single system. Partners from around the world will build new technologies like three-dimensional thermal circuitry for cooling, next-generation power converters, and algorithms for coordinating the technologies automatically. They will look at those technologies from the microchip level all the way up to an entire vehicle.

"We want to increase the total power density in vehicles by 10 to 100 times. That would translate into billions of liters of fuel saved and nearly double an electric car's range," said Alleyne, Ralph & Catherine Fisher Professor. "Today's electrical technologies are at their thermal limit. A systems approach is the only way we'll push beyond the current state of the art."

While the exact physical location on the Illinois campus has not yet been finalized, one thing is certain: MechSE students will benefit from P.O.E.T.S.

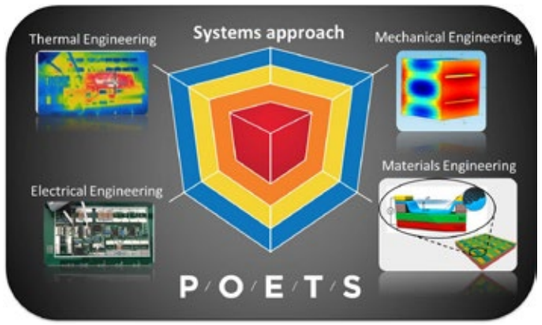
"Students will be very, very heavily involved," Alleyne said. "The goal is to have students from different departments co-located in a common, shared space. The whole goal is to break down some of the disciplinary silos that lead to constraints and barriers that can show up."

The undergrads, grad students, and post-docs who get involved may receive more than just the obvious educational benefits from the center. Alleyne envisions the possibility of student start-up businesses emerging, which he welcomes and will encourage.

"There will definitely be opportunities for students to try their hand at spinning out these technologies into a product or a business," he said.

More than a dozen companies across the United States will also take part, testing the ideas and hiring students trained through P.O.E.T.S. The center will also engage with school districts to transition the breakthrough interdisciplinary STEM concepts to K-12 classrooms and inspire young people to pursue careers in these fields.

"As part of the Caterpillar team, it's a privilege to work on electric drives as part of my day job and also serve on the Industrial Advisory Board for the P.O.E.T.S. project," said **Bryan Lammers**, a technical manager who also leads heavy equipment manufacturer Caterpillar's involvement with the program.



P.O.E.T.S. aims to openly and seamlessly combine the latest technologies from different engineering disciplines.

"This is an opportunity to help grow world-class engineers in our own backyard, and drive collective innovation through a valuable federal and academic partnership. We look forward to sharing industry knowledge with these great researchers to help explain how these technologies could be most useful."

The National Science Foundation began supporting Engineering Research Centers like P.O.E.T.S. in 1985, to create and sustain integrated interdisciplinary research environments that advance fundamental engineering knowledge, enable technology and engineered systems, and prepare U.S. engineering graduates for success in the global economy. Academe and industry are joined in partnership through the ERC to achieve these goals.

The P.O.E.T.S. ERC aims to pack more power into less space for electrical technologies on the move by integrating novel 3D cooling circuitry, power converters, and algorithms for smart power management. Their work will enable the manufacture of lighter, more compact and more efficient power electronic systems for electric vehicles, airplanes, construction equipment, handheld tools, and other mobile applications.

P.O.E.T.S. Partner Institutions

- Arkansas Power Electronics International
- Bosch
- Caterpillar
- Creative Thermal Solutions
- CU Aerospace
- Halliburton
- Howard University
- John Deere
- ON Semiconductor
- Parker Hannifin
- Rolls-Royce
- Royal Institute of Technology in Sweden
- Stanford University
- Texas Instruments
- Toyota
- United Technologies Research Center
- University of Arkansas
- University of Illinois at Urbana-Champaign
- University of Sao Paolo in Brazil

Professor Naira Hovakimyan (second from left) with her research team and U.S. Air Force Test Pilot personnel.

Breakthrough technology could lead to safer air travel

MechSE Professor, University Scholar, and Schaller Faculty Scholar, **Naira Hovakimyan**, and her research team (postdoc **Enric Xargay** and PhD students **Kasey Ackerman** and **Ronald Choe**) in the Advanced Controls Research Laboratory have developed a flight control system that was successfully tested for the first time on a manned aircraft—representing an important step toward the introduction of the technology into commercial aviation.

Predictable, reliable, repeatable, and safe: These four response criteria define a successful flight control system—and could set the stage for certification by the Federal Aviation Administration.

The flight control system is, perhaps, the soul of an aircraft—it consists of the necessary operating mechanisms to control its actions and direction in flight. The flight control systems on today's commercial aircraft have been tested and matured for decades and are considered very safe for the millions of passengers traveling on airplanes every day. But despite their safety, there is still great need for new technologies that could prevent more accidents.

In early March, students in the U.S. Air Force Test Pilot School flew Hovakimyan's L1 adaptive control technology on Calspan's variable stability Learjet at Edwards Air Force Base in California. The test team comprised two B-52 pilots, an F-16 pilot, two flight test engineers, and two safety pilots. Over three weeks and 10 sorties, the team performed a rigorous evaluation of the system within varying flight conditions. While in flight, the jet was injected with seven different failure configurations, including shifts in the center of gravity and changes in aerodynamic parameters.

"In all failure configurations, the L1 controller was able to recover aircraft performance to a point where pilots were comfortable flying the jet, with really minor adjustments to their standard piloting techniques. Remarkably, the evaluation showed that aircraft handling was quite consistent across failure configurations, a critical feature for flight safety," said Xargay.

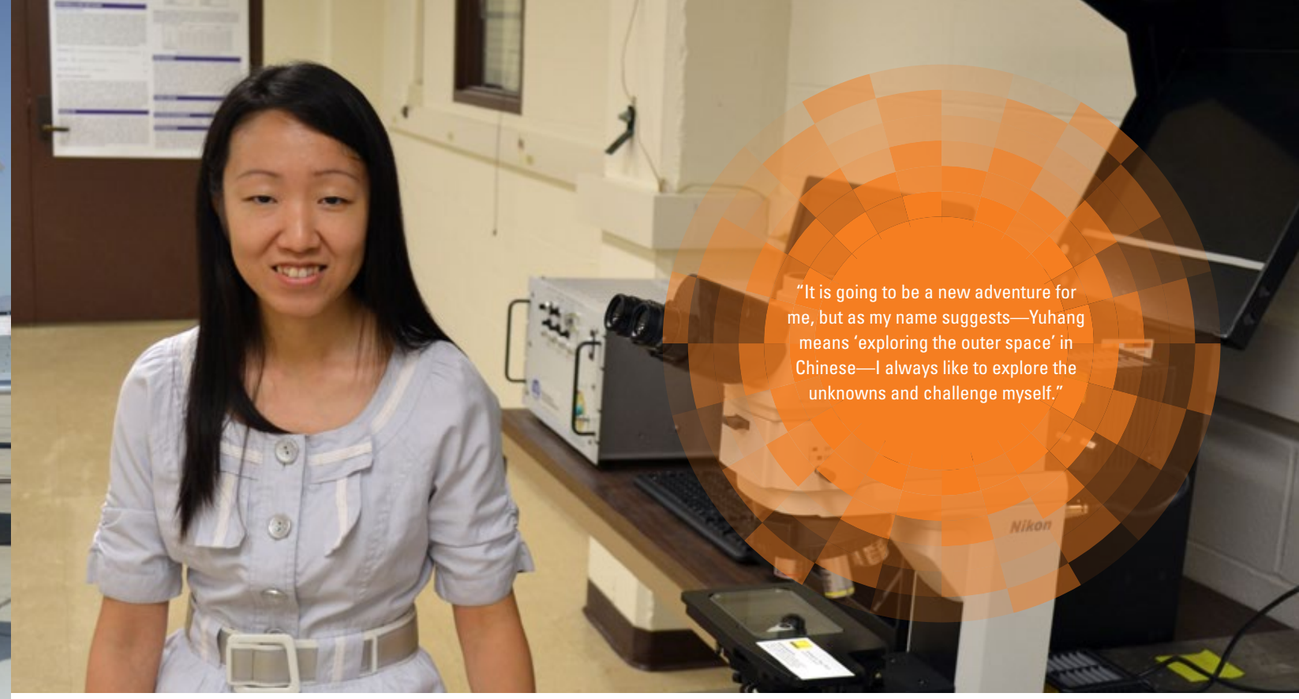
The results from these in-flight evaluations are consistent with previous tests by NASA using subscale research aircraft. As part of the AirSTAR project, NASA funded several research groups across the country to develop and test flight-control technologies on their variable-stability Generic Transport Model aircraft. Of the groups that qualified for flight testing, Hovakimyan's control system was the only one cleared by pilots for stall and post-stall flight conditions, and the only one able to provide a predictable and reliable response over the entire flight envelope.

All of these flight tests serve as in-flight validation of the underlying mathematical theory, which provides guaranteed, consistent, and uniform performance, regardless of the nature of the failure configuration. The implications for both airplane safety and new aircraft R&D are dramatic.

"We know how much uncertainty the L1 controller can handle before we leave the ground," said **Chris Cotting**, USAF TPS master instructor. "For this type of work, that's actually a really big deal. Also, with the L1 system, you don't need the extensive wind tunnel testing that all new planes undergo. If you can give it a couple of points along the way, it can sort everything out."

Hovakimyan's ultimate goal is to see the major airlines adopt this technology as a backup flight control system. "If anything goes wrong, this would kick in. If there's one switch that a pilot can turn on when the aircraft is in trouble, I want to see that happen."

Additionally, IntelinAir, a startup company developing next-generation UAS (unmanned aerial system) platforms, recently licensed the technology from Illinois for use in UASs marketed to farmers and the agriculture industry—a move that demonstrates the versatility of the technology in industries beyond aerospace and general aviation.



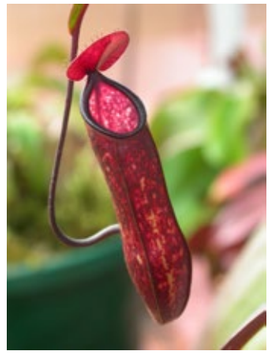
"It is going to be a new adventure for me, but as my name suggests—Yuhang means 'exploring the outer space' in Chinese—I always like to explore the unknowns and challenge myself."

Carnivorous plants inspire new professor's research

Everyone remembers Audrey II, the famous man-eating plant in the musical comedy horror film *The Little Shop of Horrors*. While carnivorous plants can't eat humans, it turns out they can make interesting subjects for the study of various mechanical and material phenomena.

New assistant professor **Yuhang Hu**, who started at MechSE in January, studies pitcher plants—carnivorous plants with modified leaves that form a deep, prey-trapping cavity—to analyze certain bio-inspired systems and soft materials. The phenomenon with these particular plants is that their surface becomes very slippery when wet, causing ants, for instance, to slide down inside and get digested. However, the pitcher plant's surface is slippery only occasionally. When dry, that same surface acts as a sort of adhesive, allowing insects to walk easily on it and access the nectar from the plant.

This varying surface property is what led to Hu's development of a new material system with optical properties and wettability that can be continuously tuned by mechanical stimuli.



"We wanted to know if we could make a surface like the pitcher plant that is both slippery and non-slippery, with active control. From my basic training in solid mechanics and from my previous research on poroelastic properties of hydrogel, which is also a type of solid-liquid composite soft material, I knew that if the material is stretched, it will change the pore pressure inside, causing the liquid to flow. The mechanical stimulus of stretching turned out to be the other half of the story," she said.

Based on this central idea, she and other researchers successfully developed a synthetic material that has continuously adjustable characteristics.

"Such a material is made of a liquid film supported by a nanoporous elastic substrate. As the substrate deforms, the liquid flows within the pores, causing the smooth and defect-free surface to roughen through a continuous range of topographies. We show that a graded mechanical stimulus can be directly translated into finely tuned, dynamic adjustments of optical transparency and wettability. In particular, we demonstrate simultaneous control of the film's transparency and its ability to continuously manipulate various low-surface-tension droplets from freesliding to pinned. This strategy should make possible the rational design of tunable, multifunctional adaptive materials for a broad range of applications," said Hu.

Hu also studies other biological materials or systems composed of soft solid and liquid, and the fundamental mechanics behind the nature systems that affect adaptability and efficiency. She develops robust mechanical testing techniques to characterize these delicate materials.

She said she sees a lot of potential in her work for future study in biology and bioengineering—on one hand, utilizing the bio-inspired material and device to tailor the morphology of cells and tissues, while, on the other hand, applying the mechanical testing technique for softer materials that she developed during her PhD work to characterize engineered biological materials.

Hu earned her bachelor's degree in engineering mechanics from Shanghai Jiao Tong University in China in 2005; a master's degree in civil and environmental engineering from Nanyang Technological University in Singapore in 2007; an MS in applied physics from Harvard in 2009; and a PhD in solid mechanics from Harvard in 2011. She completed her postdoctoral work in Harvard's biomimetic lab.

MechSE Faculty Updates

Andrew Alleyne won the Excellence in Graduate Student Mentoring Award, an honor that recognized the quality and depth of the impact of his mentoring on the department's graduate students, especially underrepresented minorities.

Gaurav Bahl discovered with his students the phenomenon of Brillouin Scattering Induced Transparency (BSIT). The results published in *Nature Physics* showed that BSIT can be used to slow down, speed up, and block light in an optical waveguide. Bahl was also selected as a recipient of the Young Investigator Award by the Air Force Office of Scientific Research for this research.

Leonardo Chamorro was appointed associate editor for the *Journal of Energy Engineering*, and new member of the editorial board of the journal Energies. He was invited to talk at the 'Whither Turbulence and Big Data In the 21st Century. Understanding and Harnessing Turbulence', held in France.

Elif Ertekin won the College of Engineering Dean's Award for Excellence in Research for her exceptional and highly interdisciplinary research accomplishments during the previous year.

Randy Ewoldt won the Rose Award for Teaching Excellence, an honor that recognizes instructors who excel at motivating freshmen and sophomore students in the College of Engineering. He was nominated for his innovative teaching methods and merit in instruction and course design and development.

Placid Ferreira was recognized and supported by the National Science Foundation for his work that uses lasers for transfer printing as a way of breaking the adhesion of tiny particles, a challenge prevalent in nanomanufacturing.

Bruce Flachsbart was honored with the Award for Excellence in Undergraduate Teaching. He was one of only three instructional staff across the entire campus to win this competitive award for his innovative approach to teaching and having an overall positive impact on student learning.

Sascha Hilgenfeldt was named a Willett Faculty Scholar by the College of Engineering. He was also honored with the Engineering Council Award for Excellence in Advising.

Naira Hovakimyan was named director of the new Intelligent Robotics Lab, an interdisciplinary collaboration of faculty from MechSE and other engineering departments, in the Coordinated Science Laboratory at Illinois. Research in the lab will aim to achieve breakthroughs in robotics and smart UAVs using motion-capture technology. Hovakimyan was honored with the Society of Women Engineers Achievement Award, the organization's highest honor, as well as the Engineering Council Award for Excellence in Advising in the College of Engineering.

Predrag Hrnjak was named an ASME Fellow, the society's highest membership grade of distinction.

Elizabeth Hsiao-Wecksler was honored with the Engineering Council Award for Excellence in Advising.

Yuhang Hu and a team of researchers developed a new, dynamic mechanism that can control the flow of materials through micropores, using fluid to regulate their opening and closing. The article, published in Nature, was based on Hu's research while a postdoc at Harvard University.

Emad Jassim was honored with the Engineering Council Award for Excellence in Advising.

Mariana Kersh was an invited speaker at the ASME Global Congress on NanoEngineering for Medicine and Biology, and at Deakin University's School of Exercise and Nutrition Sciences Seminar Series in Melbourne, Australia.

Seok Kim was awarded the ASME Chao and Trigger Young Manufacturing Engineer Award, which recognizes a manufacturing researcher under 40 with potential for significant fundamental contributions to the science and technology of manufacturing processes. Kim also won the Young Investigator Grant from the Korean-American Scientists and Engineers Association. Additionally, he was honored with the Engineering Council Award for Excellence in Advising.

William King was named to Crain's Chicago Business's 2015 "Tech 50" list, reflecting the magazine's "people you should know if you care about Chicago tech." He was an invited speaker on the topic of advanced manufacturing at the National Academy of Engineering "Frontiers of Engineering" workshop in June 2015. King was also named to ChicagoNEXT, a council of business and technology leaders focused on new venture formation and rapid expansion of science, innovation, and technology-driven entrepreneurship in the Chicago area.

Nenad Miljkovic, with researchers at MIT, published an article in *NanoLetters* demonstrating graphene as a promising hydrophobic surface coating on condensers during heat transfer in applications ranging from anti-friction, de-icing, mold resistance, and others.

SungWoo Nam developed a new approach to forming 3D shapes from flat 2D sheets of graphene, which could allow for graphene-MEMS hybrid devices and flexible electronics, and this work was published in *NanoLetters*. Additionally, he was honored with the Engineering Council Award for Excellence in Advising. Nam's research on a novel single-step process to achieve 3D texturing of graphene and graphite was also published in *NanoLetters*.

Martin Ostoja-Starzewski became Associate Editor of *Mechanics Research Communications*. In February he gave an invited seminar on "Continuum mechanics beyond the second law of thermodynamics" at the University of California, San Diego. In May his paper "Scaling and bounds in thermal conductivity of planar Gaussian correlated microstructures" co-authored by **Sohan Kale**, **Ankit Saharan**, and **Seid Koric**, was selected as Editors' Choice in the *Journal of Applied Physics*.

Huseyin Sehitoglu started a new journal, *Shape Memory and Superelasticity*, focused exclusively on shape memory alloys and the developments, innovative manufacturing, and novel use of these materials. Sehitoglu is also editor-in-chief of the new publication, which launched under ASM. Additionally, Sehitoglu's former students will host a mini-symposium in his honor, titled "Multi-faceted Research in Materials and Mechanics," at the 2016 Plasticity Conference.

Mariana Silva was honored with the Engineering Council Award for Excellence in Advising.

Kyle Smith's article "Design of Bi-Tortuous, Anisotropic Graphite Anodes for Fast Ion-Transport in Li-Ion Batteries" was published in the Journal of The Electrochemical Society.

Kelly Stephani was accepted into the Air Force Office of Scientific Research's Summer Faculty Fellowship Program. She and her team of graduate students spent 12 weeks at the Wright-Patterson Air Force Base, where they developed methods for computing non-equilibrium flows, indicated by strong, abrupt changes in velocity, temperature, and other characteristics over a short distance.

Scott Stewart was named an ASME Fellow, the society's highest membership grade of distinction.

Daniel Tortorelli was honored with the Engineering Council Award for Excellence in Advising.

Kimani Toussaint's article "Plasmonic nanoantennas: from nanotweezers to plasmonic photography" was published as the cover story in the June 2015 issue of *Optics and Photonics News*. Toussaint was also part of a team of researchers that received funding from the Carver Trust to build a first-of-its-kind opto-mechanical microscope. The device will be capable of obtaining optical, mechanical, and chemical information from a biological specimen. Additionally, Toussaint demonstrated the first-ever recording of optically encoded audio onto a nonmagnetic plasmonic nanostructure, indicating potential for an array of new uses for analog data storage. He also won the College of Engineering Dean's Award for Excellence in Research for his exceptional and highly interdisciplinary research accomplishments over the previous five years.

Amy Wagoner Johnson was the recipient of a Chair of Excellence from the NanoSciences Foundation, Grenoble, France. The Chair is a 3-year position, the first of which she spent in Grenoble on sabbatical doing research on hydroxyapatite and cell-material interactions in the Laboratoire des matériaux et du génie physique (LMGP) in collaboration with Professor Catherine Picart. During this time she was a Midi@Minatec speaker—a forum for disseminating research to the broader Grenoble scientific community, was a plenary speaker at the French-American Workshop, and presented her research as an "invited expert" at a focused workshop on Micro and Nano Systems for Biology—Additive Manufacturing and Biomedical Applications organized by the French technology watchgroup OMNT (Observatoire des Micro et NanoTechnologies).

MechSE announces new Master of Engineering degree program

A new graduate degree program—Master of Engineering in Mechanical Engineering (M.Eng.ME)—launched with its first class of students in Fall 2015.

Designed to be completed in 12 months, this industry-oriented professional degree program provides in-depth technical knowledge relevant to a wide selection of mechanical engineering career interests, including biomechanics, controls and dynamics, fluids and thermal sciences, nanomechanics and nanomanufacturing, solids and materials, mechanics and computation, energy systems, and many others.

"For students who want to enter industry with the best possible preparation, with a graduate degree from a top school like Illinois, to enhance their chances of getting their dream job, this is an incredible option," said Department Head **Anthony Jacobi**. "They're investing just one year here that will pay off for their entire career. We're very excited."

Today, with the increasing breadth and depth within the engineering profession, additional preparation and professional skills development are required. This is why the College of Engineering has planned the new Master of Engineering degree programs in several disciplines—as a natural extension of the College's efforts to train the engineers of the future.

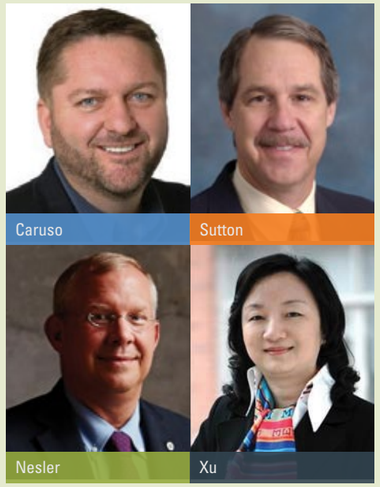
"The new degree programs address a growing industry demand for engineers who possess a broad mix of hard science and math tools along with a variety of professional skills—communications, teamwork, and a 'big-picture' understanding of project management," stated **Bill Buttlar**, associate dean of graduate and online engineering programs. "Students have also begun to realize the value and necessity of a professional master's degree as preparation for a successful career leading innovation in industry. In fact, a master's degree may soon be a requirement for obtaining Professional Engineer certification."

Master of Engineering degrees are designed to be non-thesis, professionally oriented programs that

combine in-depth technical expertise and professional skills development beyond what can be covered in a traditional bachelor's degree.

The M.Eng.ME program consists of a full course load of classes in the fall and spring semesters, followed by an optional capstone project in the summer. All classes take place in Urbana-Champaign.

MechSE Distinguished Alumni



The department recognized four distinguished alumni at its annual awards banquet on April 17, 2015. Each recipient shared their thoughts on how their Illinois education helped shape their personal and professional lives, and offered career advice to the MechSE students who were in attendance.

Dan Caruso (BSME '86),
Cofounder, Chairman & CEO, Zayo Group

"As an engineering student, I learned what it was like to work around very smart, talented, hard-working people, both fellow students and faculty, and what it takes to be successful and to be able to contribute in that environment. That foundation has lasted with me throughout my career. I've learned that the intersection between technology and business, which I view as entrepreneurship, does so much in creating opportunities for individuals and for society in general. It's the key to prosperity. So when you look forward at what's next for you in your careers, reflect on how you can work with others who don't have technical backgrounds but who bring to the table other types of creativity around business or liberal arts, and together how you can create the next generation of companies and ideas that will change society in ways we can't imagine today."

Clay Nesler (BSME '82, MSME '83),
Vice President of Corporate Sustainability, Johnson Controls

"Being a student in mechanical engineering is great preparation for professional life or academic life, or whatever direction you want to go. The skills you learn in engineering—problem-solving, systems orientation, data-driven analytics, working in teams—those are absolutely crucial in anything you do. Right now we're working on the world's great challenges—perhaps the greatest challenges we've ever faced—and we have to bring innovation technology and the power of markets and business to solve these problems. So innovation and the things we do in engineering are critically important."

Michael Sutton (PhD TAM '81),
Carolina Distinguished Professor, University of South Carolina

"Because of the opportunity I had to be educated here and at other institutions, this is beyond my wildest expectations. Much of what I've accomplished has been due in large part to my education in the TAM Department, now part of MechSE. The professors I had there made a big difference in my life. They provided me with the ability to think outside the box and do things that I really didn't think were possible."

Xuemin (Lisa) Xu (PhD ME '91),
Professor, Vice President, Acting Dean of Biomedical Engineering, and Director of the Med-X Research Institute—all at Shanghai Jiao Tong University

"The education I received here has transformed me and transformed my view of the whole world. As the world is becoming smaller and smaller, striving for excellence and working hard are the most important things. Additionally, Illinois' strength is the multicultural environment that this campus embraces. You students are very fortunate to be here, to get your education here, which will make a future for you. As an alumna I would do anything I could to help students to know that Illinois is the best in the world."

College of Engineering Alumni Award for Distinguished Service

This award is conferred upon exceptional alumni and recognizes them for professional distinction through outstanding leadership, contributions to the field of engineering, creativity, and entrepreneurship; as well as service to society, the professional community, and to the department, college, or university.

Sidney Lu is a world leader in technology. Based in Taiwan, Lu serves as the first chairman and CEO of Foxconn Interconnect Technology, which provides joint-design, joint-development, manufacturing, assembly, and after-sales services to computer, communication, and consumer electronics leaders.

Lawrence Ziemba is executive vice president of refining for Phillips 66 and has spent 35 years in the oil and gas industry. Before assuming his current role in 2012, Ziemba worked for ConocoPhillips as president of global refining. He first joined Phillips Petroleum in 2001 after its acquisition of Tosco.

Sidney Lu
BSME '81
Chairman & CEO
Foxconn Interconnect Technology
Taiwan

Lawrence Ziemba
BSME '77
Executive Vice President
Phillips 66
Houston, TX

News from MechSE's Alumni Board

At the spring Alumni Board meeting, outgoing board president **Eric Brown** (BSME '98, MSTAM '01, PhDTAM '03) handed over his duties to incoming president **Thomas Donovan** (BSME '82). **Marina Tharayil** (MSME '01, PhDME '05) took over the position of vice president. Donovan and Tharayil look forward to working closely with the MechSE Department as it navigates through the exciting challenges that are quickly upcoming, including the fundraising efforts for the Campaign to Transform MEB.

Alumni News

Eric Wetzel (PhDME '99) is leading the researchers at the Army Research Lab in investigating a way to use straps containing shear thickening fluid (like a cornstarch and water mixture) to reduce the likelihood of football players suffering concussions. The National Football League, Under Armour, and GE awarded the team $500,000 to research the technology as part of their Head Health Challenge II. Wetzel, the technical area manager for Materials for Soldier Protection, said the findings can also be applied to reduce concussions among soldiers on the battlefield or in training. By working with football players, he now has the benefit of a real-world laboratory to study concussions.

Magdi Azer (MSME '89, PhDME '96) has joined the University of Illinois Applied Research Institute (ARI) as Associate Director for Manufacturing Science. Improving and advancing the state of manufacturing science is a top national and Illinois priority. ARI is contributing to that vision with the launch of a strategic focus in manufacturing science. This program will advance R&D in digital manufacturing, intelligent machining processes, smart factory applications, and defense systems. Azer is an industry veteran with decades of technical and business management experience, expanding on a professional career that has largely been spent with General Electric.

Tony Califano (BSME '14) has received his selection for Officer Training School in the United States Air Force for the specialty of General Engineering Officer. This specialty gives him the opportunity to locate nearly anywhere in the world. "I had decided to work toward joining the U.S. Air Force as an officer in June of 2014, a month after graduating," he said. "However, I had to take a few months to meet the fitness standards. Many months and negative 50 pounds later, I was ready to begin my application. I have had many people help and encourage me on this road, and I have turned both my career and my health around."

Marcus Crotts (MSME '56) has been recognized by North Carolina State University with a lifetime achievement award. He has distinguished himself as an outstanding mechanical engineer in private practice and as a dedicated supporter of engineering as a profession. He is a partner of Crotts & Saunders Engineering, Inc., of Winston-Salem, a consulting firm recognized throughout the country and abroad for its impact on manufacturing processes through improved basic design methodologies in the machine tool and manufacturing industries.

Sean Hopkins (BSME '11) is a reliability engineer at the design and manufacturing company Dyson. Based in his hometown of Chicago, he oversees the quality and reliability of the entire product line, from heaters to fans to hand dryers to vacuums. "I volunteer with the James Dyson Foundation, giving talks and workshops to encourage students from the Chicago area who aspire to be engineers," he said in an interview for the *New York Times* in May 2015. "In college I rarely met minority engineers from Chicago, so I'm also showing minority students that this is a viable career."

Outstanding Young Alumni

In 2015, MechSE established the Outstanding Young Alumni award to recognize recent graduates who have gotten off to a great start in industry, academia, and/or entrepreneurship. There were nine standout alumni who received the award this year.

Kira Barton
MSME 2006, PhD ME 2010
Assistant Professor
University of Michigan
Ann Arbor, MI

Scott Daigle
BSME 2009, MSME 2011
Co-Founder & CEO
IntelliWheels, Inc.
Champaign, IL

Diana Dascalescu
MSME 2008
Mechanical Product Engineer
Ricardo, Inc.
Burr Ridge, IL

Morgan Hawker
MS TAM 2005
Project Engineer
Chemical & Industrial Engineering, Inc.
Louisville, KY

Andrew Honegger
BSME 2003, MSME 2005
Vice President & Owner
Microlution, Inc.
Chicago, IL

Thomas Korder
BSME 2005
Brewmaster
Penrose Brewing Company
Geneva, IL

Ricardo Mejia-Alvarez
MS TAM 2010, PhD TAM 2010
Scientist
Los Alamos National Laboratory
Los Alamos, NM

Benjamin Newell
BSME 2002, MBA 2008
President
Newell Instruments
Urbana, IL

Andrew Phillip
MSME 2005
Founder & President
Microlution, Inc.
Chicago, IL

Help us Transform MEB today!

This is the department's largest undertaking ever, with an estimated cost of $37 million. Once it is completed, MechSE's education, innovation, and community will bolster the department's place among the nation's elite engineering programs for decades to come.

And the campaign has already begun in a big way: we have secured $10 million from the U of I and an inspiring $12 million pledge from alumnus Sidney Lu! This is an incredible start, but $15 million is still needed to complete the project.

We are asking you, our alumni and friends, to partner with us in reaching this goal.

THE CAMPAIGN TO
Transform MEB
Education. Innovation. Community.

- To get involved, call 217-333-4109 or email mechse-advancement@illinois.edu
- To give online or find out more about the project, visit: transformMEB.mechse.illinois.edu

Message from the Advancement Office:

Join Us in Transforming MEB

Dear Alumni & Friends,

When we visit with our outstanding alumni across the nation, many people comment on how much campus has changed since they were students. From the high-rise apartment buildings popping up on Green Street to the newly renovated (and air-conditioned!) Ikenberry Commons Residence Halls, change is nearly constant in Champaign-Urbana. Many of our alumni have also correctly noted that there has been one exception to this flurry of change: Mechanical Engineering Building (MEB). While alumni share that it is nostalgic to walk through the halls of MEB when they are visiting, it is evident that they realize the significance of renovating this facility.

As you have read throughout this magazine, now is the time to transform MEB. This historic project is the department's largest endeavor to date. The Campaign to Transform MEB will allow our faculty members to utilize creative teaching methods in active learning classrooms and state-of-the art teaching laboratories where students will learn from real-world, hands-on activities. The new MEB will be a hub for innovation; students will have the chance to learn, create, collaborate, design, and make, all within one space. Lifelong connections and memories will be made as students meet in the new open-design student center to grab a coffee, study for a midterm, or simply take a break to socialize between classes. The new MEB will be a "home" for our students, a home that they will return to as proud alumni.

This important transformation of MEB cannot happen without the generosity of our alumni and friends, like you. We ask that you consider partnering with us by supporting the Campaign to Transform MEB. Making a gift to this project is easy; visit **transformMEB.mechse.illinois.edu**, click the "Give now" button, and select the first option under "Featured Opportunities": The Campaign to Transform MEB. Every gift matters. Every gift is cherished. Every gift helps us build our new home.

If you would like to learn more about how to support this essential project, please feel free to contact us. Thank you in advance for your consideration to join us in transforming MEB!

Go Illini! Bob Betsy Meg

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Give a Gift

Giving a gift to MechSE online is simple and secure. Just go to **mechse.illinois.edu/giving**.

Keep in Touch

Keep up to date with the MechSE Department! Just go to **mechse.illinois.edu/contact** to sign up with your current contact information or email us at **mechse-advancement@illinois.edu**.

Attention Entrepreneurs!

MechSE wants to hear from all of our alumni who have started their own businesses. Please contact Bob Coverdill at **mechse-advancement@illinois.edu**, and provide a short description of your company. We will share this information in a future publication.

If you have a smart phone, you can access these pages by scanning the accompanying QR code.

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An incredibly generous gift from alumnus Sidney Lu has changed MechSE's future–
look inside to read about it and how you can get involved!

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