

# MechSE



## Did you know?

Mechanical Engineering Laboratory just turned 113 years old!





You're invited to join the MechSE Department for the  
**Transform MEB Groundbreaking Ceremony**  
 Friday, October 12, 2018 at 2:00 p.m.  
 (Homecoming weekend!)

1206 W. Green Street, Urbana  
 Corner of Green and Goodwin

Find out more and RSVP at:  
[go.mechse.illinois.edu/groundbreaking](http://go.mechse.illinois.edu/groundbreaking)

## From the Department Head



We begin a new academic calendar every August, but this year feels a little different from the typical year for MechSE. It is the beginning of an especially important time for us.

Our Transform MEB project, which includes a 25,000-square-foot addition and the redesign of the existing Mechanical Engineering Building, will hit an especially meaningful milestone on October 12 when we hold an official groundbreaking ceremony. It will be a day of celebration for everyone who knows how much this state-of-the-art facility means for our students and their future. Please join us if you can.

After the groundbreaking, the next major step in Transform MEB will be in January 2019, when faculty and staff offices move from MEB to a temporary home at the Computing Applications Building. When our spring semester classes end in early May, construction on the project will be underway—another milestone to celebrate.

We have news on topics beyond buildings and schedules! Starting on page 6, we share 32 short facts about MechSE in a feature simply called, “Did You Know?” I hope you have fun reading it, and that you come away with a few new ‘nuggets’ about our historic department.

I hate to spoil any of the short facts before you read them, but it is noteworthy that this year marks the 30th anniversary of the Air Conditioning and Refrigeration Center (ACRC). Professors **Clark Bullard**, **Pega Hrnjak**, and I—in one combination or another—have been the directors of ACRC for its entire history. Recognizing my own bias, I can honestly say that ACRC is one of the best examples of industry-academia collaboration found anywhere in the world. Marking 30 years of purposeful innovation makes us extremely proud.

This year also marks the start of our pre-medicine undergraduate track, through which MechSE students can become qualified for medical school, while concurrently preparing for an engineering career. Professor **Amy Wagoner Johnson** has been named MechSE’s first pre-med advisor, and we are fortunate to have such a well-qualified faculty member for this vital post.

So much of what we do is made possible by the generosity of our alumni, corporate partners, and other friends of the department. Whether it is time, talent, or treasure that you provide us, we are deeply grateful to you for sharing our belief that MechSE students go on to make the world a better place.

Best regards,

Anthony Jacobi  
 Department Head  
 Richard W. Kritzer Distinguished Professor

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# MechSE

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### ON THE COVER

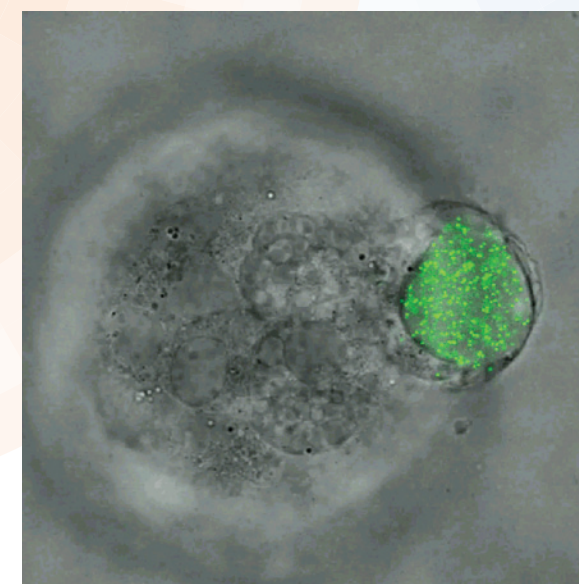
Mechanical Engineering Laboratory (at the time known as the Mechanical Engineering Building) in an undated photo from the early 1900s.



Join our social networks—  
 just go to [mechse.illinois.edu](http://mechse.illinois.edu)!

## Senior Design projects educate children at the Orpheum

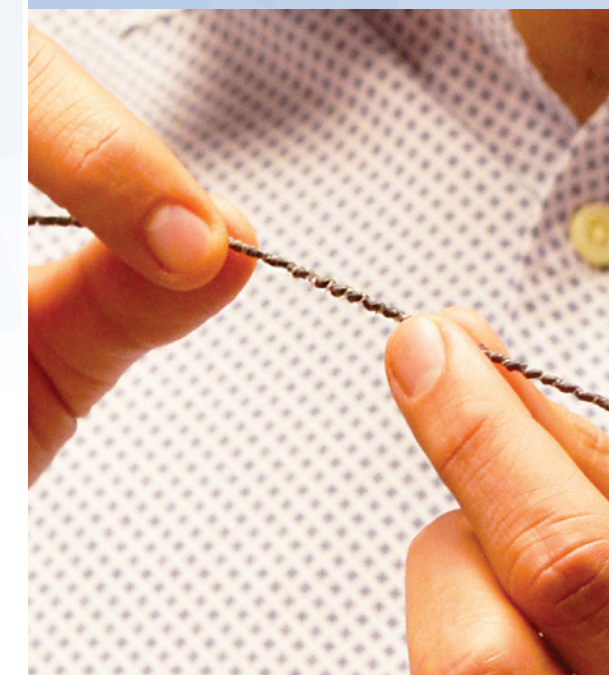
Two MechSE Senior Capstone Design teams celebrated the unveiling of their semester-long projects—two new interactive exhibits at the Orpheum Children’s Science Museum in Champaign. The astronomy-themed “Asteroid Mine” and “Orphy’s Escape to Space” are part of the museum’s new Busey Astronomy Kids Corner. The exhibits were first-of-their-kind projects for MechSE, in which the two teams of five undergraduates were given full autonomy to conceive, design, and build the exhibits. They collaborated with two undergraduate graphic design students from the School of Art + Design at Illinois, and were assisted by staff and volunteers at the Orpheum as well as their faculty advisors, Professors **Sameh Tawfick** and **Aimy Wissa**.



## Wang captures essence of cancer in photo

An incredible image captured by MechSE professor **Ning Wang** was featured as the Biomedical Picture of the Day (BPoD) by the BPoD biomedical science website. A major focus of Wang’s research program is the mechanics of cancer cells. From BPoD: “Here’s the moment a skin cancer cell grabs a tiny

gel ball packed with fluorescent nanoparticles, squeezing it tightly with a membrane ‘hand.’ This microscopic game of catch has been set up to measure the physical forces generated by cells growing in plastic dishes in the lab as they jostle for space against each other. Knowing more about the physical properties of individual cancer cells provides useful insights as to how they might behave as a tumor grows and spreads.”



## Tawfick creates super-strong artificial muscles

MechSE assistant professor **Sameh Tawfick** is leading research that has designed artificial muscles capable of lifting up to 12,600 times their own weight, according to a study published in *Smart Material and Structures*. Made from carbon fiber-reinforced siloxane rubber and containing a coiled geometry, these muscles can support up to 60 MPa of mechanical stress, providing tensile strokes higher than 25% and specific work of up to 758 J/kg. This amount is 18 times more than the specific work natural muscles are capable of producing. On the Reddit/science social media channel, these findings received an incredible 25,000 up-votes, and people linked through to the MechSE article so voraciously that several College of Engineering websites crashed and were down for hours.



## Sridhar takes Bloom Energy public

Wall Street seemingly could not get enough of Bloom Energy Corp., with shares rising more than 60% after an initial public offering that chief executive and founder **K.R. Sridhar** (PhDME ’90) credited to his company’s ability to explain its purpose. Investors “understood very clearly what the size of the market is, they understood what the opportunity is,” Sridhar said. Bloom Energy makes solid oxide fuel cells that are used in stationary power-generation servers as small as half the size of a typical shipping container. The servers, placed at client locations, convert natural gas or biogas into electricity through electrochemical reactions that result in lower emissions than traditional energy generation. (*MarketWatch. Photo by Bloomberg.*)



## Dunn, Park earn NSF CAREER Awards

Two MechSE assistant professors have received Faculty Early Career Development Program (CAREER) Awards from the National Science Foundation. **Alison Dunn** won the prestigious NSF award for her research on hydrogel interfacial slip. The award will provide her with a five-year grant dedicated to research in designing hydrogels that will perform in a sliding interface—specifically, gels that would interface with biological tissues. **Hae-Won Park**’s work involves the design and optimization of trajectory in dynamic, legged robots. Based on emulating the motion of bipedal or quadrupedal beings, designing movements of legged robots requires the difficult task of configuring different components to efficiently reach a destination.

## Lee teams with ARL to take historic X-rays

MechSE associate professor **Tonghun Lee** joined forces with the U.S. Army Research Laboratory’s Center for Unmanned Aircraft Systems Propulsion to make an historic first with an experiment in a gas turbine combustor using X-rays. Scientists said the data will help advance gas turbine engine designs for higher power density and efficiency. “This is the strongest X-ray source in the world,” Lee said. He and his graduate students, along with partners from the ARL Center for UAS Propulsion, set up shop in the U.S. Department of Energy’s Advanced Photon Source at Argonne National Laboratory, resulting in a unique experiment. Lee said their experiment mimicked what happens inside a typical Army helicopter gas turbine engine.





1

Selim Hobart Peabody, department head from 1878 to 1881, also served as regent of the University and **successfully lobbied to change the school's name from Illinois Industrial University to the University of Illinois.** And during his tenure, every engineering student learned physics from Professor Peabody.

UNIVERSITY

of ILLINOIS

# Did you know? 32 Fun facts about MechSE

2

Until the early 1960s, the main bay in the Mechanical Engineering Laboratory (MEL) **held a steam engine developed in 1871** by Professor **S. W. Robinson** and his students. Records indicate the engine “supplied power to the first shop in which instruction in the mechanic arts was given in the United States.”



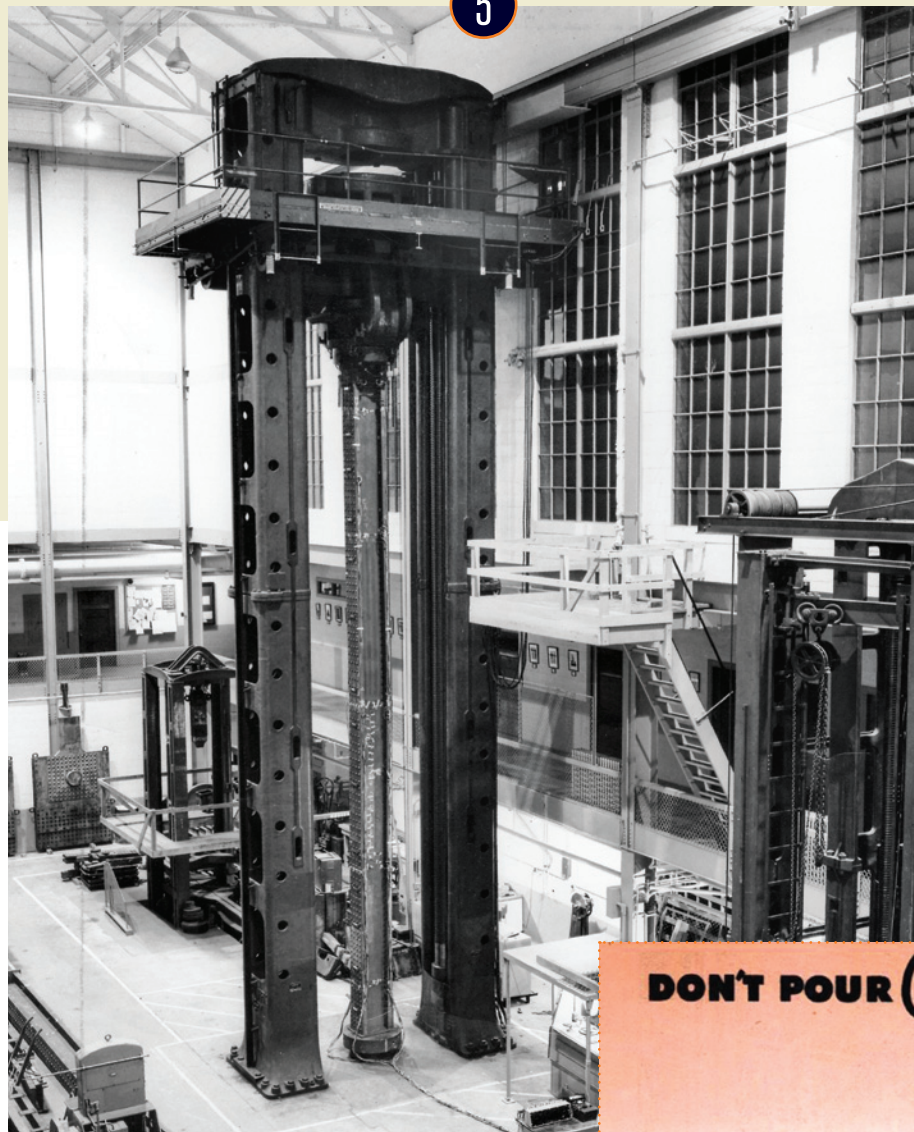
4

Celebrating its 30th anniversary this year, the Air Conditioning and Refrigeration Center (ACRC) was established in 1988 by the National Science Foundation (NSF) as an industry-university cooperative research center. It is now **powered by more than 100 researchers**, including about a dozen faculty and their students from MechSE, and **funded by 30 industry partners.**

3

Professor **Helmut Korst** developed **base pressure theory**, which recognized that separated flows are inherently elliptical in nature and which illuminated the effects of separated flows and drag on rockets, missiles, and airplanes.

5



Assembled in 1929 in Talbot Laboratory, where it still stands, the two-story tall Southwark-Emery Universal Testing Machine can load up to **3 million pounds in tension or compression** and can measure the applied force within one tenth of one percent. The massive machine is often used to do testing for companies, such as tensile testing steel bridge components.

6

The **Dolan-Corten theory** was named for Professors **Thomas J. Dolan** and **Herbert T. Corten** and has become widely referenced and used, accounting for a sequence effect that depends on the most recently recorded maximum stress that occurs during fatigue loading.

## DON'T POUR Coal UP THE CHIMNEY



The University of Illinois has found how to “stretch” coal further and heat homes better

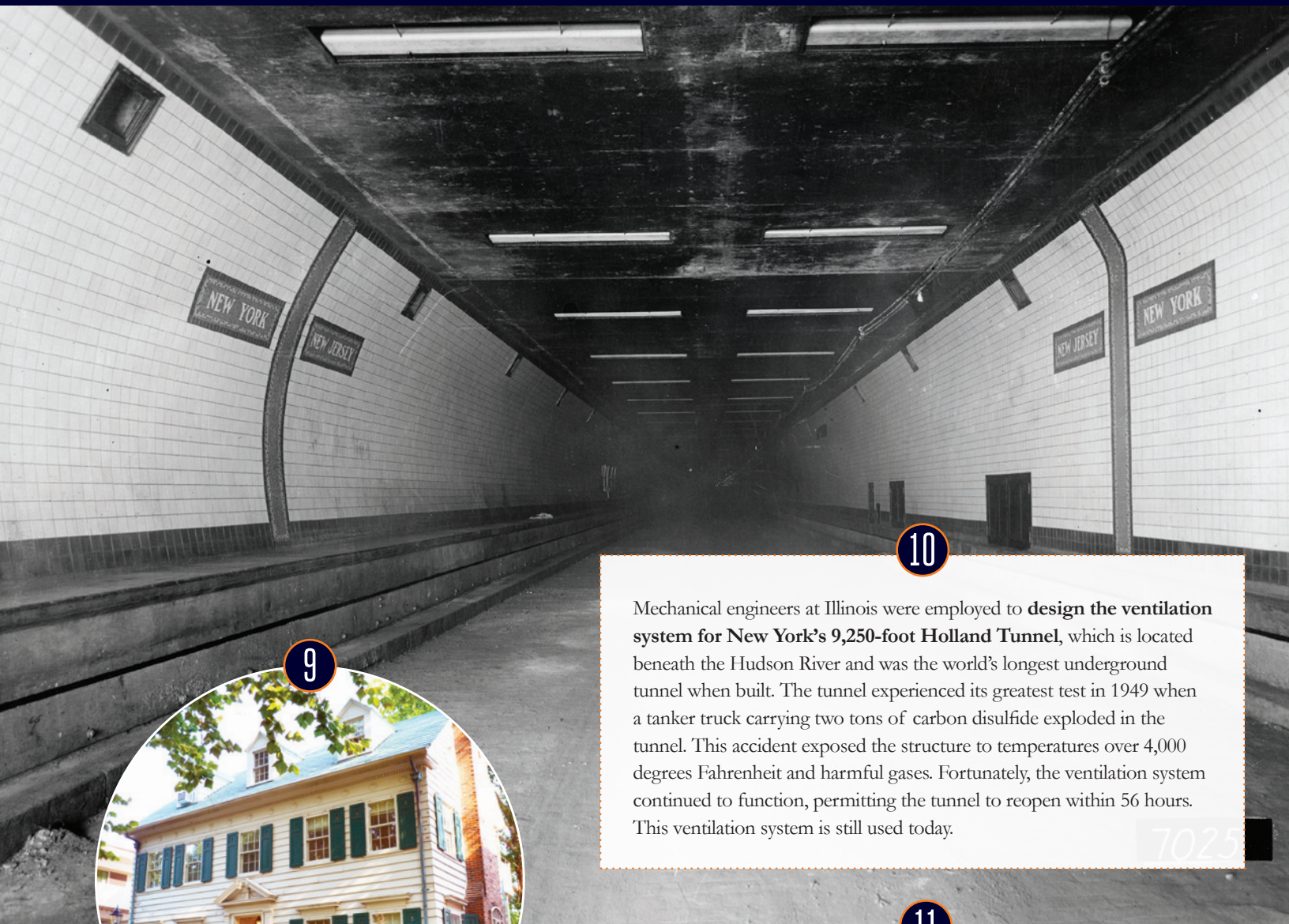
8

Professors **Julian Fellows**, **Alonzo Kratz**, and **Seichi Konzo** created a **breakthrough in home heating with the Illinois smokeless furnace**, which was capable of burning any soft coal without smoke, providing even heat, and saving as much as 30 percent of the fuel pile. Built around a downdraft coking principle and overcoming what had been a vexing soft coal smoke problem, their invention was featured on the front page of the *New York Times* and in a five-page article in *Popular Mechanics*, which included the above rendering.

7



The mission of the International Institute for Carbon-Neutral Energy Research (I<sup>2</sup>CNER) is to contribute to the advancement of **low carbon emission and cost-effective energy systems**, and improvement of energy efficiency. I<sup>2</sup>CNER's research efforts are underpinning impactful energy technologies that address the energy needs of Japan and the world. The I<sup>2</sup>CNER project is highly unique because it is co-hosted by Kyushu University in Japan and the University of Illinois at Urbana-Champaign with an additional 24 international partnering institutions worldwide, including MIT, UC Berkeley, ETH Zurich, Imperial College London, and the University of Göttingen.



Truly dedicated to his research, Professor and Department Head **Seichi Konzo** lived for two years in one of the earliest air-conditioned houses in North America at 1108 West Stoughton, Urbana. In his memoirs, he remembers his time in the house on Stoughton fondly, especially the summer of 1936 “when Urbana had 21 days over 100 degrees Fahrenheit.”

9

10

Mechanical engineers at Illinois were employed to **design the ventilation system for New York’s 9,250-foot Holland Tunnel**, which is located beneath the Hudson River and was the world’s longest underground tunnel when built. The tunnel experienced its greatest test in 1949 when a tanker truck carrying two tons of carbon disulfide exploded in the tunnel. This accident exposed the structure to temperatures over 4,000 degrees Fahrenheit and harmful gases. Fortunately, the ventilation system continued to function, permitting the tunnel to reopen within 56 hours. This ventilation system is still used today.

11

According to university archives, the department was **home to the first thermo-mechanical fatigue lab** outside of industry capable of conducting experiments on a variety of metals, alloys, and composites.

12

Professor and Department Head **Hassan Aref** introduced **chaotic advection**, a state-of-the-art concept derived from nonlinear dynamics widely used as an approach to investigate transport and mixing problems in fluid flows.



14

The **first engineering experiment station in the United States**, dedicated to investigating real-world engineering problems, was founded by mechanical engineering professor **Lester Paige Breckenridge** in 1905.

15

### XPACC

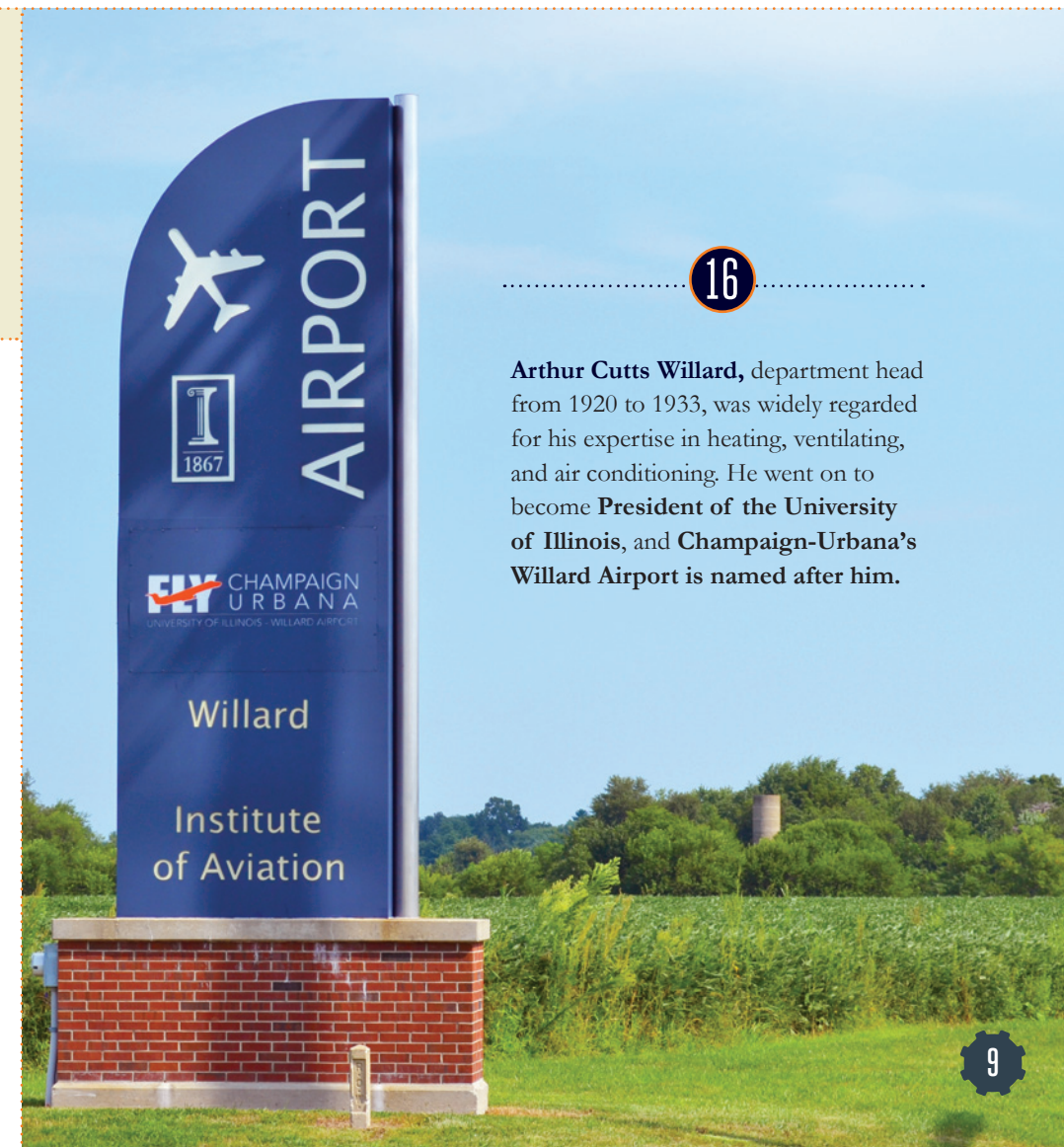
The Center for Exascale Simulation of Plasma-Coupled Combustion (XPACC) is using physics-based predictive sciences and massive-scale numerical simulation to **advance a new mode of managing combustion**. It aims to make breakthroughs in this emerging field at the basic science level. Funded by the National Nuclear Security Administration, part of the U.S. Department of Energy, the center is one of three Multidisciplinary Simulation Centers funded through NNSA’s Predictive Science Academic Alliance Program II.

13

Every day, more and more talented women are fueling the field of engineering with a wide array of research and innovations that impact society. For most of them, their path truly starts during their undergraduate years, and we are pleased to report **positive growth in the number of women** in our mechanical engineering and engineering mechanics programs. In 2010, about 10% of our undergraduate students were women, but now it’s nearly 20%.

16

**Arthur Cutts Willard**, department head from 1920 to 1933, was widely regarded for his expertise in heating, ventilating, and air conditioning. He went on to become **President of the University of Illinois**, and **Champaign-Urbana’s Willard Airport** is named after him.





17

MechSE has two large-scale flow diagnostic facilities that allow cutting-edge fundamental and applied research. MechSE's Eiffel-type, open loop wind tunnel has exceptionally low turbulence levels and is equipped with state-of-the-art instrumentations for point, planar, and volumetric flow measurements at high-temporal resolution. The department's refractive index matching flume is **one of the largest facilities of its kind in the world** and allows for unobstructed optics in setups with customized acrylic material.

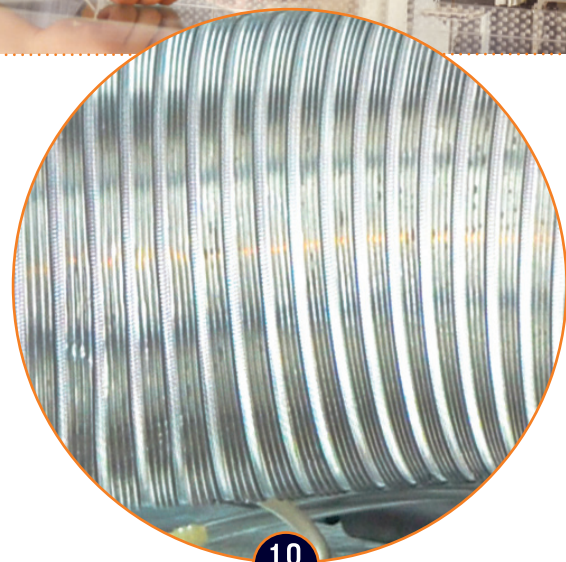


21

Several MechSE professors are part of the inaugural faculty for the new Carle Illinois College of Medicine, which welcomes its first class in Fall 2018. Called **the world's first engineering-based college of medicine**, it will leverage advanced technology to train physician-innovators who will deliver better and more accessible care to patients worldwide.

22

The department's research in residential heating and cooling produced **firsts in perimeter heating and heat pumps**.

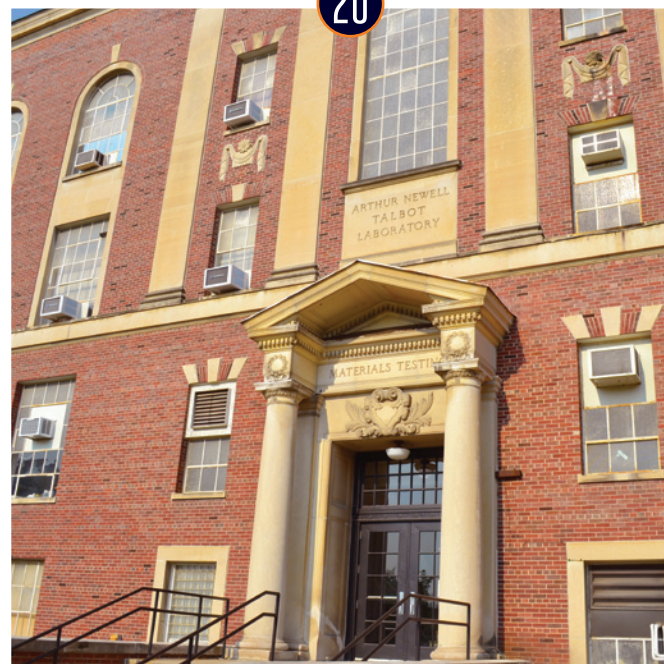


18

The **first standards for rating furnace efficiencies and heating capacities** was established by the department for the National Warm Air Heating and Ventilating Association.

19

Professor **Ronald Adrian** developed **Particle Imaging Velocimetry (PIV)**, a powerful flow diagnostic tool.



20

The **first scientific study of stresses in railroad tracks**, conducted by Professor **Arthur Newell Talbot**, is considered one of the most significant contributions to the scientific knowledge of railroads ever made. In 1938, the Materials Testing Laboratory was renamed the **Arthur Newell Talbot Laboratory**. It sits prominently on the west side of the Bardeen Quad and is still in use today.

23



The **first chapter of national honorary fraternity Pi Tau Sigma** was founded by Illinois students assisted by mechanical engineering professor **Charles Russ Richards**, department head from 1911 to 1920. In 1944, his great influence resulted in ASME creating the **Charles Russ Richards Memorial Award**, which is still awarded annually today.



24

The booming Research Park at the University of Illinois is now **home to more than 110 companies** employing more than 2,000 people and 650 interns. Many MechSE faculty, students, and alumni have contributed to the park's growth, launching or joining start-ups and taking advantage of this incredibly fertile environment for innovation and entrepreneurship.

25

Once the Transform MEB project is completed, the Mechanical Engineering Building will have the **longest building frontage of any building on historic Green Street**, spanning a full block from Goodwin Avenue to Mathews Avenue.



26

The MechSE Department is proud to have its own **state-of-the-art cleanroom, the Micro-Nano Mechanical Systems (MNMS) Laboratory**. This valuable and extremely well-run lab was built in 1998, with a second phase added in 2005. The lab supports research and instruction in the general area of micro- and nano-electro-mechanical systems, and nano-chemical-electrical-mechanical-manufacturing systems.

27

Professor **Shao Lee Soo** was a leader in developing the field of **multiphase fluid dynamics**.

28

Professor **JoDean Morrow** introduced the **strain approach to fatigue**, and his efforts helped establish the first servo-hydraulic fatigue-testing facility in Talbot Laboratory, which has since become one of the most prestigious research laboratories in the country for materials testing.



29

Starting in Fall 2018, **MechSE students can follow a pre-med track** consisting of a prescribed sequence of traditional MechSE courses and newly recommended courses to qualify for medical school. It will allow MechSE students an opportunity to stay within the established curriculum, but also have a tailored program to help them go into medicine if they choose.



30

The **Mechanical Engineering Building** was the second new building on the Illinois engineering campus dedicated after World War II. Built at a cost of \$2 million, the building included 32 classrooms, 21 labs, and 44 offices.

31

Much of the **pioneering work on the theory of heat transfer in metal cutting** was done by Professors **Kenneth Trigger** and **Bei Tse Chao**.



32

The Center for Power Optimization for Electro-Thermal Systems (POETS) is funded by an initial \$18.5 million investment by the National Science Foundation, with additional support from many industrial partners, and **focuses on power optimization in mobile electrified systems**. With heat being the enemy for people designing cars, construction machinery, and aircraft, the mission of POETS is to pack more power into less space for electrical systems. Headquartered at Illinois, but with an international footprint, the center attacks the thermal and electrical challenges surrounding mobile electronics and vehicle design as a single system, striving to increase the total power density in vehicles by 10 to 100 times.



## Pi Tau Sigma wins double recognition

The University of Illinois chapter of Pi Tau Sigma has been awarded the Outstanding Performance Award and Outstanding Service Award at the fraternity's national convention.

Pi Tau Sigma, the mechanical engineering honor society, was founded at Illinois in 1915 with a mission to create better engineers through commitment to academic excellence and dedication to service. Of the 180 international chapters, the Illinois chapter is one of the largest and most active. Research Professor and Professor Emeritus **Pratap Vanka** currently serves as their faculty advisor.

PTS has a tightly knit group of students due to its numerous projects, service opportunities, meetings, and social events.

The society participates in Engineering Open House each year with four projects—an original open-ended project, an original design project, a siege weapon project, and an entry in the Midwestern Robotics Design Competition. Philanthropically, the society works with Booker T. Washington Elementary School for a six-week educational outreach program in which the members of PTS introduce school children to fun,

science-based projects, such as 3D printing challenges and gum drop towers.

The society also holds fundraisers each semester, with proceeds going to nonprofit organizations.

Professionally, the society holds general meetings, hosting companies that can present information regarding their work to the members. The companies are then welcome to view a portfolio the society compiles featuring resumes of members in the society, and contact them regarding employment opportunities.



## Rube Goldberg team places second at national tournament

Continuing their streak of success, MechSE's Rube Goldberg Society placed second in the 2018 national Rube Goldberg Machine Contest.

Held at the Museum of Science and Industry in Chicago, the task at this year's competition was to pour a bowl of cereal.

"Our machine could use as many steps as we wanted, but you get more points for more steps. Our team had about 75 steps," said team member **Angela Wiscons** (BSME '18).

Rube Goldberg, of course, refers to an over-the-top complicated invention created to perform a simple operation. The Rube Goldberg method challenges traditional solutions to problems, and forces students to think unconventionally and innovatively.

The Illinois team's machine had a pirate ship theme and incorporated mechanisms such as weighted pulleys, saltwater circuits, and mini marble tracks, to name a few.

## EOH 2018

The MechSE Department's impressive displays and interactive activities led to winning the Spirit of Illini Award at the 2018 Engineering Open House. The two-day event featured exhibits, hands-on experiments for all age groups, and plenty of demonstrations by our car teams.





## Small and large robots "walk" on the Quad



ME 370 finals.



ME 598 finals.

MechSE kept the Bardeen Quad hopping with activity in May 2018, with both undergraduate and graduate students putting their design skills on full display.

For the ME 370 final project, students formed teams and built all-terrain "walkers," in a nod to the giant mechanical war machines featured in the film *Star Wars: The Empire Strikes Back*. The students' robots were small and light, and needed to be able to rapidly negotiate the Quad's thick grass.

In ME 598, students from the Master of Engineering in Mechanical Engineering program also teamed up to build walkers—but they were each big enough to carry one of the team members! The participants were excited with this rare opportunity to gain hands-on design experience in a professional degree program.

## L1 system's Air Force flight another step toward commercialization

MechSE PhD students **Javier Puig-Navarro** and **Kasey Ackerman** received a first-hand look at aviation history earlier this year. The L1 adaptive control system, developed by MechSE professor **Naira Hovakimyan**, entered an unprecedented third round of flight tests, and her students Puig-Navarro and Ackerman headed to Edwards Air Force Base in California to help with the implementation.

Hovakimyan and her research team have been developing L1 adaptive control theory since 2005 for the design of robust adaptive control architectures for safety-critical systems. The goal of the pioneering L1 system is to maintain aircraft performance and maneuverability even in the presence of severe failures—ultimately increasing aircraft safety, resilience to critical failures, and ease of operation for human pilots, as well as autopilots, in extreme conditions.

In 2015, the team began testing at Edwards with flight tests that were completed successfully for the first time on a manned aircraft, a Learjet 25 equipped with a variable stability system. In 2016, tests were successfully performed on a VISTA-F16, a fighter aircraft with faster and more challenging dynamics.

This third round of testing pushes the L1 technology ever closer towards commercialization.

"We've proven that L1 works mathematically and we're showing that it also works in application," said Puig-Navarro. "Its biggest contribution to society and the world of engineering is ensuring that time-critical systems like those in aircraft have performance and robustness guarantees."

L1 has the potential to revolutionize aircraft safety by greatly diminishing the possibility of pilot error during high-workload maneuvers. The technology has been transitioned into various products across different industries, including Raymarine's Evolution autopilot, among others.



Javier Puig-Navarro and Kasey Ackerman.



Hovakimyan's L1 adaptive control system has now undergone three rounds of testing on manned aircraft at Edwards Air Force Base.



The Nuclear Regulatory Commission has selected **Natasha Childs** (BSME '99) as resident inspector at the Sequoyah Nuclear Plant near Soddy-Daisy, Tennessee. The two-unit plant is operated by the Tennessee Valley Authority. Childs joined the NRC in October 2008 as a project engineer in the Resident Inspector Development Program in the NRC's Region II office in Atlanta.



Graham Healthcare Group, a subsidiary of Graham Holdings Company, named **Justin DeWitte** (BSME '96, MSME '98) as chief executive officer of Graham Healthcare Group Hospice. DeWitte previously served as chief operating officer of Graham Healthcare Group Hospice, overseeing the day-to-day operations of Celtic Hospice and Residential Hospice, as well as president of Graham Health Services.



**Steve Langer** (BSME '86, MSME '88) has been hired by Modine Manufacturing Company as its new vice president, information technology. "Steve brings to Modine a broad, global experience in the information technology discipline," said Mick Lucareli, vice president and CFO. Modine, with fiscal 2017 revenues of \$1.5 billion, specializes in thermal management systems and components.



**Randal Lewis** (BSME '88) was named president of a new consumer products group at Spectrum Brands Holdings, Inc. Lewis had been president of pet, home, and garden at Spectrum Brands, a position he had held since 2014. Previously, he had been senior vice president and general manager of home and garden since January 2011, where he led the restructuring of the business.



**John Marshall** (BSME '95) was named president and CEO for Earthway Products Incorporated. Marshall arrived at Earthway with experience in operations, product development, strategic business development, sales, and customer support from the agriculture, control systems, and commercial vehicle industries. He has most recently held senior level positions in the areas of sales, marketing, operations, engineering, and customer support for Chore-Time Brock, Spartan Motors, and Case New Holland.



**Vishal Nandigana** (MSME '11, PhDME '16) was awarded the Bharat Guarav Award for his academic excellence throughout his undergraduate and graduate studies. Now an assistant professor at the Indian Institute of Technology, Madras, Nandigana began his collegiate education at the College of Engineering in Guindy, earning a degree in engineering, before coming to Illinois.



VaaS International Holdings (VaaS), a global leader in image recognition, data, and analytical technology, hired **Nagendra Palle** (PhDME '93) as chief operating officer. In this role, Dr. Palle is responsible for overseeing daily operations at VaaS. He will implement key strategies and goals while establishing and promoting the policies that "support VaaS as the preeminent provider of image analytics services."



**Ron Schmidt** (BSME '82), VP of technology development at Elgin Sweeper, has spearheaded an engineering breakthrough in the street sweeper industry—one engine that powers all functions. Elgin Sweeper's Crosswind, now hitting the marketplace, has taken a vehicle that forever has required two engines—one to run the truck and the other to run the sweeping apparatus—and consolidated it into a single

engine. The Crosswind now gets better diesel fuel mileage and runs quieter with less vibration, resulting in decreased maintenance.



**Kevin Wise** (BSME '80, MSME '82, PhDME '87) was elected this year to the prestigious National Academy of Engineering (NAE) for application of optimal, robust, and adaptive control to aircraft and advanced weapon systems. Election to the NAE is among the highest professional distinctions accorded to an engineer. Membership honors those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature" and to "the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education."

## In Memoriam



**Pat Calabrese** (BSME '49), born in Chicago, passed away February 17, 2018, at the age of 90. He received the MechSE Distinguished Alumni Award in 2001. In 1999, he and his wife, Bette, established the Pat and Bette Calabrese Fellowship to provide support to graduate students enrolled in the department. At that time, he was president and COO of Grieve Corporation, a manufacturer of industrial ovens and furnaces.



**Jack Levy** (MSTAM '54), who received a Distinguished Alumni Award from MechSE in 2013, passed away on October 27, 2017. In recent years, Professor Levy was engaged in engineering consulting, having completed a career at the UK Engineering Council and City University, London, where he had become a professor emeritus.

## MechSE Outstanding Young Alumni



Dr. **Andrew Hamilton** and **Kathryn Svoboda** received MechSE's Outstanding Young Alumni Award for 2018. This honor is given to alumni of the department who have achieved great things early in their careers.

Hamilton received his MS and PhD in theoretical and applied mechanics, graduating in 2011. Throughout his education, Hamilton studied biomaterials. At Illinois, he researched the manufacturing of bio-inspired synthetic vascular systems and their application to self-healing in structural polymers. In his post-doctoral research at Aalborg University in Denmark, Hamilton investigated the mechanical impact of nano-scale reinforcement on cellular polymers for use in composite sandwich panels. He entered academia first by lecturing for the School of Mechanical and Aerospace Engineering at Queens University in Belfast and is now an associate professor for engineering and the environment at the University of Southampton. There, he is continuing his research on the mechanical properties and capabilities of biological material systems; specifically, he is working on bio-inspired materials, cellular and porous materials, sandwich structures, self-healing materials, and biomaterials.

Svoboda earned her BS in mechanical engineering from Illinois in 2011. While here, she was an active member of Pi Tau Sigma, an Engineering Learning Assistant (ELA), and served as captain of the Baja SAE team. She had internships in special projects at Oceaneering and in engine systems at Electro-Motive Diesel. After graduation, Svoboda worked as a testing engineer for Microlution, a Chicago-based and University of Illinois-bred business specializing in high-performance CNC micro-machining centers. Now she has returned to electro-motive diesel as an engine development engineer, where she improves the reliability and performance of 2- and 4-stroke engines up to 4.5MW for marine, power generation, and locomotive applications. In her off hours, Svoboda is the head referee for Illinois' FIRST Tech Challenge, leading referees at more than a dozen high school robotics competitions and managing the entire Illinois referee contingent.

## MechSE Distinguished Alumnus



**Phillip W. Thiessen**, a Senior Fellow for Raytheon Integrated Defense Systems (IDS), received the 2018 MechSE Distinguished Alumni Award. This honor is given to alumni from MechSE who have established themselves in their chosen career paths and uphold the professionalism for which the department is known.

"I owe everything to the education that I received here at Illinois," Thiessen said.

Thiessen has worked at Raytheon for the last 49 years, primarily as a managing design engineer, but also filling roles as a section manager, department manager, and director for mechanical engineering design and analysis organizations. With a focus on large-scale radar and communication systems, Thiessen has directly contributed to, been integrally involved in, or provided oversight for numerous shipboard and land-based radars and radar communication programs. He has worked on projects that include SPS-49, NSSMS, TDWR, RAMP, SBX, SMART-T, and Iridium.

More recently, Thiessen has spread his influence in the company by providing project engineering leadership on a variety of programs and developing new business pursuits. In the last few years, he has focused on developing business in various sensor markets related to defense and air traffic control.

## College of Engineering Alumni Award



**Bill Jackson** (BSME '82, MSME '83) was honored with the College of Engineering Award for Distinguished Service in April 2018. The college recognizes recipients 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.

Jackson was recognized for outstanding achievements in business, for distinguished service to the broader community via corporate leadership, and for commitment and service to the University of Illinois at Urbana-Champaign.



## The Dantzigs give back to support student research in biological concentrations

"We see the intersection of engineering and biological research providing opportunities to improve people's lives directly."

—Jon Dantzig

some of that back, to enable future generations of students to be able to attend graduate school and to develop their careers."

Recipients of the fund will have a research focus in biomechanics, biomaterials, or bioengineering. Dantzig is interested in supporting these areas because his career in engineering and his wife's career in life sciences both had the goal of improving quality of life.

"We see the intersection of engineering and biological research providing opportunities to improve people's lives directly," Dantzig said.

Dantzig became a professor emeritus in 2008 after teaching at Illinois for 28 years.

"The highlight of my career at Illinois was that I was able to work with so many great people—the high caliber of students at both the undergraduate and graduate levels, and outstanding colleagues both at Illinois, and in the international community," he said.

Retired professor **Jon** and his wife **Dr. Anne Dantzig** have established the Jon and Anne Dantzig Graduate Scholarship Fund. The fund will support MechSE graduate students interested in biological concentrations.

"My wife, Anne, and I were able to have fulfilling careers because of our graduate education," Dantzig said. "We see this scholarship fund as an opportunity to give

## Many ways for alumni, corporations to interact with MechSE

The MechSE Department is thriving, and we always welcome engagement from our alumni, corporate friends, and other supporters of our mission.

You've probably heard about our largest current initiative, the Campaign to Transform Mechanical Engineering Building (MEB). As we get closer to breaking ground on this historic project, many opportunities for support are still available to help bring this incredible facility to life for our students.

If you are interested in impacting students' ability to join MechSE, Engineering Visionary Scholarships are a great way to provide significant, flexible scholarships to our students. Through the end of 2019, The Grainger Foundation will give a full dollar-for-dollar match for scholarship donations, making your gift go even further.

For corporations, partnering with MechSE is a proven-effective way to reach and recruit our students for internships, co-ops, and full-time positions, as well as work together on research and capstone design projects.

Please contact us anytime! We are always happy to help enhance your connection to the MechSE Department, our renowned faculty, and our incredible students.



**Betsy Rodriguez**  
Assistant Director of Advancement  
217-333-9713



**Alec Verone**  
Assistant Director of Corporate and Alumni Relations  
217-265-5251



**Kendra Wolf**  
Associate Director of Advancement  
217-300-7297



## Sharp making an impact through humanitarian engineering

Kendra Sharp works closely with student teams (left) and end users (above) in her humanitarian engineering efforts.

Alumna **Kendra Sharp** (PhDTAM '01) has a passion for humanitarian engineering that has impacted people around the world. A professor of mechanical engineering at Oregon State University, Sharp founded and now directs OSU's humanitarian engineering program. She was named the Richard and Gretchen Evans Professor in Humanitarian Engineering in 2015.

"The best part about my academic position is having the flexibility to direct my own learning and professional growth, to get involved with new networks of people, and take advantage of really interesting opportunities as part of my job," Sharp said.

With an extensive background in experimental fluid mechanics, Sharp has focused her research on international development and sustainable water and energy systems, including small-scale approaches to generating hydroelectric power. Called "micro hydropower," these systems use energy from smaller, natural waterways. Sharp began her efforts to implement or improve micro hydropower systems in 2010 in Pakistan, where half the population has little or no access to power. This led to collaborations with Pakistan's National University of Science and Technology—and her work has evolved from there.

She has participated in instructional and organization teams for three consecutive International Development Design summits,

hosted by the International Development Innovation Network. The annual summit offers workshops on various aspects of humanitarian engineering, from teaching about aspects of the design process to hands-on skills like welding and basic woodwork.

Each year since 2015, Sharp has traveled to Chennai, India; Lahore, Pakistan; and Si Saket, Thailand. At each summit, she teaches design sessions focused on developing a strategic approach to solving problems in the field. She also leads various skill-building workshops such as metalworking and using hand tools.

"Field engineering practice often forces us to be a bit more creative about solving equipment or research problems on the fly and with limited resources," she said.

Her work has also earned her prestigious recognition from the American Society of Mechanical Engineers. She recently won ASME's Edwin F. Church Medal, awarded annually to an individual who has made a significant contribution toward increasing the value, importance, and attractiveness of mechanical engineering education.

"I was very excited to see that a professional engineering society is recognizing humanitarian engineering, since it's often not what we think of as traditional engineering," she said.



**Andrew Alleyne** was named the 2018 recipient of the Control Engineering Practice Award from the American Automatic Control Council (AACC). He was invited to join the Board on Army Research and Development at the National Academy of Sciences. He also was selected as Vice Chair for Science & Technology (2018-2019) for the U.S. Air Force Scientific Advisory Board.



**Gaurav Bahl** led researchers in demonstrating the existence of a new phase of matter called a quadrupole topological insulator, which was originally predicted by theoretical physicists in 2017. The team's work on QTI's are the first experimental findings to validate their theory. The researchers reported their findings in the journal *Nature*, and their work was also featured on the popular website Gizmodo.



**Leonardo Chamorro's** group and collaborators from Purdue and TTU demonstrated an effective way to control separated flows under adverse pressure gradient using a bio-inspired coating. It was published in the Proceedings of the National Academy of Sciences of the United States of America.



**Geir Dullerud** was named a 2018 Outstanding Advisor by Engineering Council, recognizing him as one of the top 10 percent of advisors throughout the College of Engineering.



**Elif Ertekin** co-directed a unique outreach program—the IRISE Engineering Entrepreneurship Scholars Program. The approximately 30 scholars who participated in the program during the spring semester were challenged with designing solutions that met a variety of problems faced by Illini wheelchair basketball athletes and other wheelchair users.



**Placid Ferreira** was featured by *Manufacturing Engineering*, discussing the MechSE Department's prolific history as a leader in taking on manufacturing challenges, along with his team's current research.



**Paul Fischer** received an \$800,000 Department of Energy grant to give engineers designing nuclear reactors a more accurate, less expensive means of testing the efficiency of the fluid flow that is key to reactor operation.



**Naira Hovakimyan** gave a keynote address, "CPS in the World: 21st Century Challenges," at the NSF's 2018 Cyber-Physical Systems Week: *A Visioning Workshop for International Networks to Advance CPS Research, Development, and Education Worldwide*. She was organizer and general co-chair of the International Conference in Nonlinear Problems in Aviation and Aerospace. She is also leading an NSF study to see if drones and existing ride-sharing vehicles can provide synergetic delivery service in urban areas.



**Elizabeth Hsiao-Wecksler** was recognized by the university's Gender Equity Council as one of 150 women from the past or present who have contributed to the University of Illinois through their research, teaching, service, advocacy, and more. The recognition is titled, "150 for 150: Celebrating the Accomplishments of Women."



**Anthony Jacobi** is a co-principal investigator of a project titled "Ultra-Compact and Efficient Heat Exchanger for Solar Desalination with Unprecedented Scaling Resistance," which will receive \$1.6 million in funding from the Department of Energy.



**Harley Johnson** was one of only seven members from the Urbana-Champaign campus named to the 2017-18 University of Illinois President's Executive Leadership Program (PELP), for which he represented all campus faculty. He was appointed as the first Faculty Fellow in the Office of the Vice Chancellor for Research (OVCR), where he will bring the perspective of a research-active faculty member to the operations of the OVCR, and to help build infrastructure to support large-scale, interdisciplinary faculty research. Johnson also has been appointed as chair of the first College of Engineering Advisory Committee on Diversity and Inclusion.



**Shiv Kapoor** was featured by *Manufacturing Engineering*, discussing the MechSE Department's prolific history as a leader in taking on manufacturing challenges, along with his team's current research.



**Mariana Kersh** was awarded a grant from the National Basketball Association, in partnership with General Electric, to study how the tibia bone is loaded during different basketball maneuvers and determine how muscle fatigue might influence fracture risk.



**William King** was co-leader of a project to develop a new technology for switching heat flows 'on' or 'off.' The findings were published in the article, "Millimeter-scale liquid metal droplet thermal switch," which appeared in *Applied Physics Letters*. Also, the 2018 sale of Anasys Instruments Corp. marked the end of its long collaboration with King, who helped start the company in 2004 and since then had collaborated on many projects in its development of equipment for materials characterization, including nanoscale infrared spectroscopy and thermal measurements.



**Seid Koric** was a keynote speaker at the International Supercomputing Conference in Frankfurt, Germany.



**Leon Liebenberg** founded a new Strategic Instructional Innovation Program (SIIP), titled *Play-in-Learning: Cognition, Emotion, and Playful Pedagogy*. Nine faculty from across campus are participating in this multidisciplinary initiative, which enjoys support from the Academy for Excellence in Engineering Education.



Professor Emerita **Judith Liebman** was recognized by the university's Gender Equity Council as one of 150 women from the past or present who have contributed to the University of Illinois through their research, teaching, service, advocacy, and more. The recognition is titled, "150 for 150: Celebrating the Accomplishments of Women." Liebman was only

the second female faculty member to earn tenure in the College of Engineering—and the first to earn tenure in MechSE (then the Mechanical and Industrial Engineering Department).



**Moshe Matalon** delivered a short course on *Combustion Theory* at the 2018 summer school of the Tsinghua-Princeton Combustion Institute (Beijing, China). The nearly 400 attendees included select graduate students, postdocs, and faculty from universities across China.



**Kathryn Matlack** was awarded a summer faculty fellowship with the Air Force Research Laboratory, to develop 3D-printed magneto-active materials for vibration mitigation.



**Prashant Mehta** received NSF funding for his project, "Theory and Algorithms for Feedback Particle Filter," to develop optimal control formulations using optimal transportation theory and mean-field games formalisms.



**Nenad Miljkovic** was named the 2018 recipient of the competitive ASME/Pi Tau Sigma Gold Medal, based on his highly innovative and impactful work in nanoscale phase change

heat transfer, and enabling the use of scalable nano-engineered coatings to industrial sectors not previously utilizing nanotechnology. He was co-leader of a project to develop a new technology for switching heat flows 'on' or 'off.' These findings were published in the article, "Millimeter-scale liquid metal droplet thermal switch," which appeared in *Applied Physics Letters*. He also was the recipient of the ASME International Conference on Nanochannels, Microchannels, and Minichannels Outstanding Early Career Award.



**SungWoo Nam** was selected for a highly competitive Defense University Research Instrumentation Program (DURIP) award from the Air Force Office of Scientific Research (AFOSR) for the proposed project, "Nanoscale Infrared Spectroscopy and Imaging: Enabling Nanoscale Plasmonic/Optical Interrogation of Corrugated Two-dimensional

Materials." Nam published "Mechanically Reconfigurable Architected Graphene for Tunable Plasmonic Resonances" in *Light: Science & Applications*. He also has received a 2018 Campus Distinguished Promotion Award.



**Martin Ostoja-Starzewski** was the 2018 recipient of the Worcester Reed Warner Medal from ASME for his book, "Microstructural Randomness and Scaling in Mechanics of Materials."



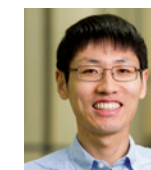
**Taher Saif** was named the 2018 recipient of the Warner T. Koiter Medal from ASME. He is the first winner of this award from Illinois.



**Srinivasa Salapaka** gave a plenary lecture at the International Conference in Nonlinear Problems in Aviation and Aerospace, held at American University of Armenia (AUA), in Yerevan, Armenia.



**Huseyin Sehitoğlu** was one of seven eminent people to receive a 2018 honorary doctorate from the Aalto University schools of technology in Finland. He also received a new AFOSR grant, "Scientific Understanding of Interfaces," and a new joint NSF grant, "Towards Nanomanufacturing of Materials with Coherent Interfaces."



**Chenhui Shao** was named to SME's 2018 class of 30 Under 30 honorees, a program that recognizes individuals who exemplify extraordinary promise in manufacturing.



**Sanjiv Sinha** was named a 2018 Outstanding Advisor by Engineering Council, recognizing him as one of the top 10 percent of advisors throughout the College of Engineering.



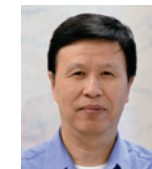
**Kyle Smith** was honored by the International Society of Electrochemistry with the 2018 ISE-Elsevier Prize for Applied Electrochemistry. Smith's award win was based on his group's high-level work on the mathematical modeling of battery-based desalination devices, lithium-ion batteries, and flow batteries.



**Alexander Vakakis** has been named a Donald Biggar Willett Professor of Engineering. This new appointment is the result of his exceptional research, teaching, and service.



**Amy Wagoner Johnson** will lead MechSE's pre-med undergraduate track by serving as the inaugural Pre-med Advisor.



**Ning Wang** has developed a new technique that uses tiny elastic balls filled with fluorescent nanoparticles to expand the understanding of the mechanical forces that exist between cells. His findings demonstrate the quantification of 3D forces within cells and may unlock some of the mysteries related to embryonic development and cancer stem cells, i.e., tumor-repopulating cells. (See image on page 5.)



**Xiaofei Wang** is a co-principal investigator of a project titled "Ultra-Compact and Efficient Heat Exchanger for Solar Desalination with Unprecedented Scaling Resistance," which will receive \$1.6 million in funding from the Department of Energy.



**Aimy Wissa** has received a Young Investigator award from the Air Force Office of Scientific Research (an AFOSR YIP award) to further her aerodynamic testing and structural modeling that was first focused on a single covert feather, and will now use modeling to create a full wing system equipped with covert feathers in both chord and span directions. She was also awarded a summer faculty fellowship with the Air Force Research Laboratory, to further improve unmanned aerial vehicle design.

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Mechanical Science & Engineering

COLLEGE OF ENGINEERING

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Launched!



First-year MechSE students bond from Day 1! All freshmen and transfer students were invited to the College of Engineering's Launch! event on the Bardeen Quad on Saturday, August 25.