TEXAS ENGINEER

2018

THE MAGAZINE OF THE COCKRELL SCHOOL OF ENGINEERING AT THE UNIVERSITY OF TEXAS AT AUSTIN

Co-founded a program that provides early-stage funding and guidance for student startups

Launched a long-distance ride-sharing app that has already completed over 1,000 rides

Engineered a temporary prosthetic hand for a car accident survivor

Coaches fellow students on how to use state-of-the-art equipment to bring their ideas to life

THE NEW GENERATION

How the Motivations and Values of Gen Z Are Driving Big Changes in Engineering Education

PAGE 12

TEXAS ENGINEERS GO GREEN

This year marked the Cockrell School's first-ever study abroad Maymester course on the island of Ireland. A group of 14 adventurous students spent four weeks in the Irish capital, where they not only completed ME 302: Engineering Design and Graphics at the University College Dublin but also packed in as many cultural tours and field trips as possible.

Students learned about Ireland's unique sports — Gaelic football, hurling and handball — and visited the country's largest stadium, Croke Park, which seats over 80,000 people. They also visited Howth Castle, where "Gulliver's Travels" author Jonathan Swift was a frequent visitor, and traveled to Belfast for a day, where they stopped by the Titanic Belfast museum located on the site of the former shipyard where the famous ocean liner was built.

It might be difficult for the students to agree on the best highlight during their trip, but one thing is certain — they all want to go back.

"It was a fantastic trip for our young engineers, and the learning experience was truly invaluable," said Billy Wood, senior lecturer in the Department of Mechanical Engineering and the course's instructor. "Dublin has etched a place in the hearts of all of us. Every student has vowed to return."

PHOTO: COURTESY OF BILLY WOOD

DID YOU KNOW?

There are three times as many Texas Engineering students studying abroad today as there were 10 years ago.

OUR WORLD IS CHANGING. IT'S TIME TO CHANGE WITH IT.

Across the nation, a new generation of engineering students has arrived on college campuses ready to change the world. Today's young adults are ambitious and socially conscious, self-motivated and eager for mentorship, and entrepreneurial-minded with a laser focus on solving society's biggest problems. All of these qualities—along with so many others that have come to define our youth—are important to understand because, as educators, we can provide a learning experience that embraces their virtues rather than defies them.

It's time to think critically about what our engineering students need in order to be successful in a future where new technology is being introduced every day. It's time to get more of our engineering students into labs and design studios. It's time to challenge our students and support them if they stumble. It's time for a new era in engineering education, and UT is leading this charge.

This issue of *Texas Engineer* magazine illustrates our efforts in this area while celebrating the tremendous successes, stories, and discoveries that continue to strengthen our position as one of the world's best engineering schools. I hope you enjoy it.

Hook 'Em Horns!

Sharon L. Wood, *Dean*
Cockrell Family Chair in Engineering #14
Jack and Beverly Randall Dean's Chair for Excellence in Engineering

The University of Texas at Austin
Cockrell School of Engineering

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Seated, left to right: freshman Janna Roberts, senior Mark Jennings, junior Irene Lee, sophomore Tanuj Girish

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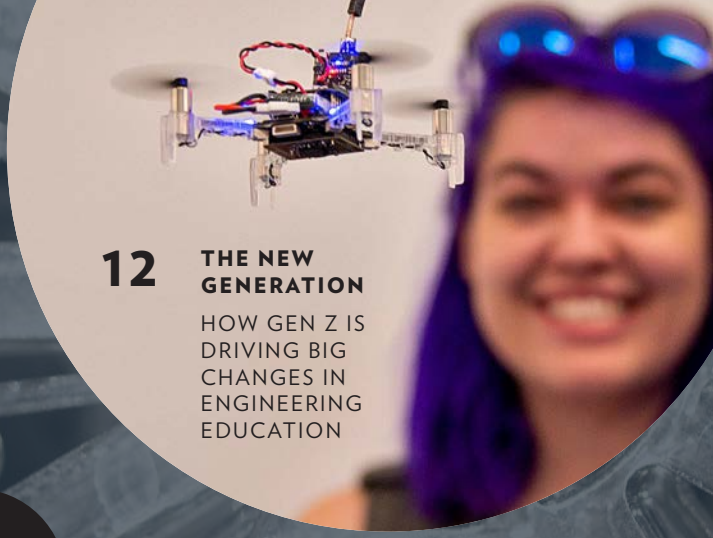
2018



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REX TILLERSON

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THIS YEAR SO FAR

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SOCIETY FOR COLLEGE AND UNIVERSITY PLANNING/AIA-CAE, EXCELLENCE IN ARCHITECTURE FOR A NEW BUILDING, HONOR AWARD

CHICAGO ATHENAEUM, AMERICAN ARCHITECTURE AWARD

ENGINEERING NEWS RECORD TEXAS & LOUISIANA, BEST PROJECT, HIGHER EDUCATION/RESEARCH

NATIONAL COUNCIL OF STRUCTURAL ENGINEERING ASSOCIATIONS, EXCELLENCE IN STRUCTURAL ENGINEERING AWARD

RESEARCH FROM PROFESSOR **JOSH APTE** FINDS THAT AIR POLLUTION REDUCES GLOBAL LIFE EXPECTANCY BY MORE THAN ONE YEAR

2 NEW ACADEMIC OFFERINGS INTRODUCED FOR COCKRELL SCHOOL UNDERGRADUATES:

- **MINOR IN MATERIALS SCIENCE & ENGINEERING**
- **HUMANITARIAN ENGINEERING CERTIFICATE**

6 FACULTY MEMBERS ELECTED TO NATIONAL, INTERNATIONAL ORGANIZATIONS:

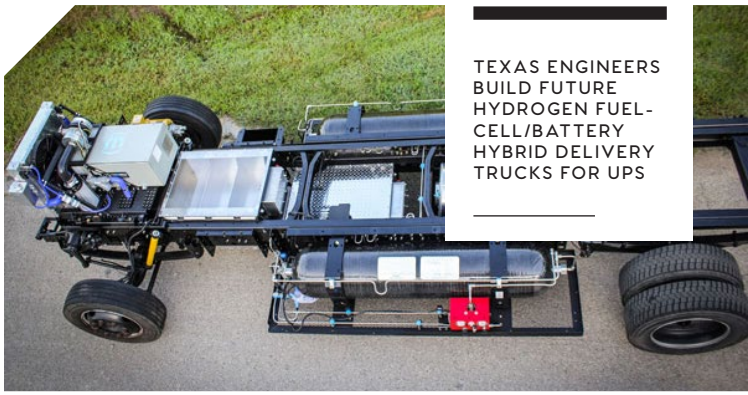
TOM TRUSKETT
FELLOW OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SHELLY SAKIYAMA-ELBERT & ROBERT W. HEATH JR.
FELLOWS OF THE NATIONAL ACADEMY OF INVENTORS

HAL ALPER & ADELA BEN-YAKAR
FELLOWS OF THE AMERICAN INSTITUTE FOR MEDICAL & BIOLOGICAL ENGINEERING

NICHOLAS PEPPAS
FOREIGN MEMBER OF THE CHINESE ACADEMY OF ENGINEERING

RENOVATIONS BEGIN ON HOME FOR AEROSPACE ENGINEERING & ENGINEERING MECHANICS DEPARTMENT



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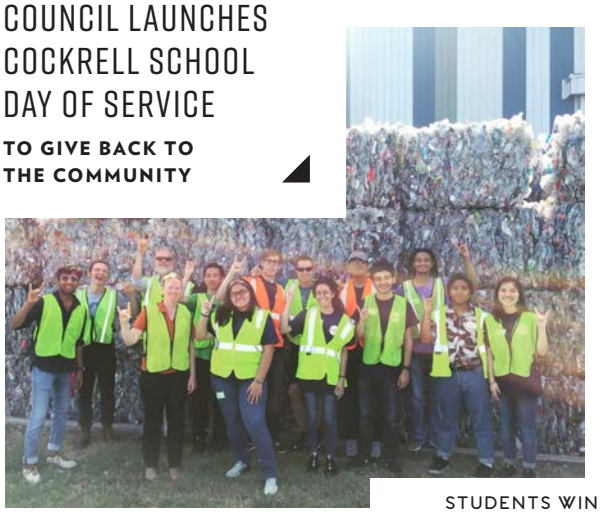
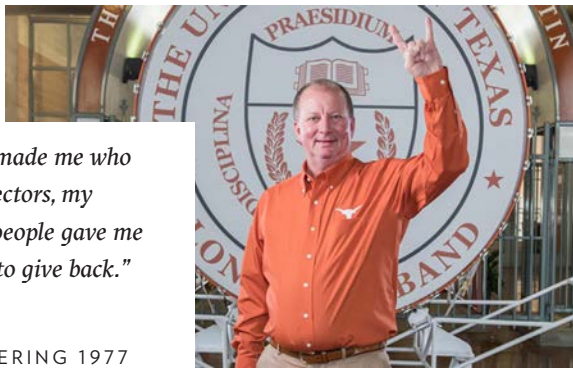
TO GIVE BACK TO THE COMMUNITY





"I want to give to the people who made me who I am — my mentors, my band directors, my professors in engineering. These people gave me everything, and now, I just want to give back."

—RICK CHURCH,
B.S. MECHANICAL ENGINEERING 1977

ALUMNUS RICK CHURCH GIVES

$7,000,000
TO **COCKRELL SCHOOL**

+ $12,000,000
TO **LONGHORN BAND**

STUDENTS WIN $10,000+ FOR THEIR COMPANY, **SUN CO.**, WHICH DEVELOPS DEVICES TO HELP SOLAR PANELS MOVE WITH THE MOVEMENT OF THE SUN

GE Reports | INNOVATION | PERSPECTIVES | PERFORMANCE

THE VANGUARD

The 5 Coolest Things On Earth This Week

PROFESSOR NANSHU LU INVENTS ARTIFICIAL RETINA

TO RESTORE SIGHT TO THE VISION-IMPAIRED

cockrellschool
Nellis Air Force Base, Nevada

cockrellschool #TexasEngineering alumna and Brigadier General Jeannie Leavitt gave Oscar-winning actress @brielarson some pointers for her role in Marvel Studios' #CaptainMarvel in their recent visit to Nellis Air Force Base in Nevada!

4 NEWLY FUNDED TEXAS ENGINEERING RESEARCH INITIATIVES

TO SOLVE REAL-WORLD CHALLENGES

$10,750,000
CENTER FOR MATERIALS FOR WATER AND ENERGY SYSTEMS TO IMPROVE WATER PURIFICATION
U.S. DEPARTMENT OF ENERGY

$7,500,000
TO DEVELOP ARTIFICIAL INTELLIGENCE FOR UNMANNED AERIAL VEHICLES
U.S. DEPARTMENT OF DEFENSE

$5,000,000
TO FORTIFY INDIA'S INDIGENOUS ENERGY CAPABILITIES
INDIA'S OIL AND NATURAL GAS CORPORATION

$3,000,000
TO DEVELOP OPTICAL MICROSCOPY TECHNOLOGIES TO MAP THE BRAIN IN A WHOLE NEW WAY
NATIONAL INSTITUTES OF HEALTH

3 PROFESSORS ELECTED TO NATIONAL ACADEMY OF ENGINEERING

BRIAN KORGEL, MUKUL SHARMA AND CHUN HUH

GRADUATE STUDENT ANGELA WAGNER,

WHOSE RESEARCH FOCUSES ON DEVELOPING BIOPOLYMERS FOR CANCER THERAPY,
REPRESENTS TEXAS IN PRESTIGIOUS LINDAU NOBEL LAUREATE MEETING

DEAN SHARON WOOD

RECEIVES THE 2018 OUTSTANDING PROJECTS AND LEADERS AWARD FOR EDUCATION
FROM THE
AMERICAN SOCIETY OF CIVIL ENGINEERS

LUIS SENTIS

ASSOCIATE PROFESSOR, DEPARTMENT OF AEROSPACE ENGINEERING AND ENGINEERING MECHANICS

BALANCING

WHEN WALKING IN A CROWDED PLACE, chances are you aren't thinking about how to avoid bumping into the person next to you. Our bodies and minds are designed to apply numerous complex skills that, when combined, allow us to execute seemingly simple motions and keep our bodies upright and under control. Now, thanks to Luis Sentis and the amazing work happening in his Human Centered Robotics Laboratory, the same type of balance and "natural" control may soon be experienced by robots.

Sentis, an associate professor in the Department of Aerospace Engineering and Engineering Mechanics, has demonstrated a novel approach to human-like balance in biped robots that can be used in everything from emergency response to defense to entertainment. By translating a key human physical dynamic skill — maintaining whole-body balance — into a mathematical equation, the team was able to use the numerical formula to program their robot Mercury. Because Mercury doesn't have jointed feet, the researchers looked at hiking for the most appropriate comparison. They calculated the margin of error necessary for a hiker to lose one's balance and fall when hillwalking to be a simple figure — 2 centimeters.

"Essentially, we developed a technique to teach autonomous robots how to maintain balance even when they are hit unexpectedly or when a force is applied without warning," Sentis said. "This is a valuable skill we as humans use when navigating through large crowds."

Human-body-like movement is far harder to achieve for a robot without ankle control than for one equipped with actuated, or jointed, feet. But once mastered, it's also the reason why Mercury could become a proficient hiker. To do so, the UT Austin team used an efficient whole-body controller developed by integrating contact-consistent rotators (or torques) that can effectively send and receive data to essentially tell the robot what move to make next in response to a collision. They also applied a mathematical technique — often used in 3D animation to achieve realistic-looking movements from animated characters — known as inverse kinematics, along with low-level motor position controllers.

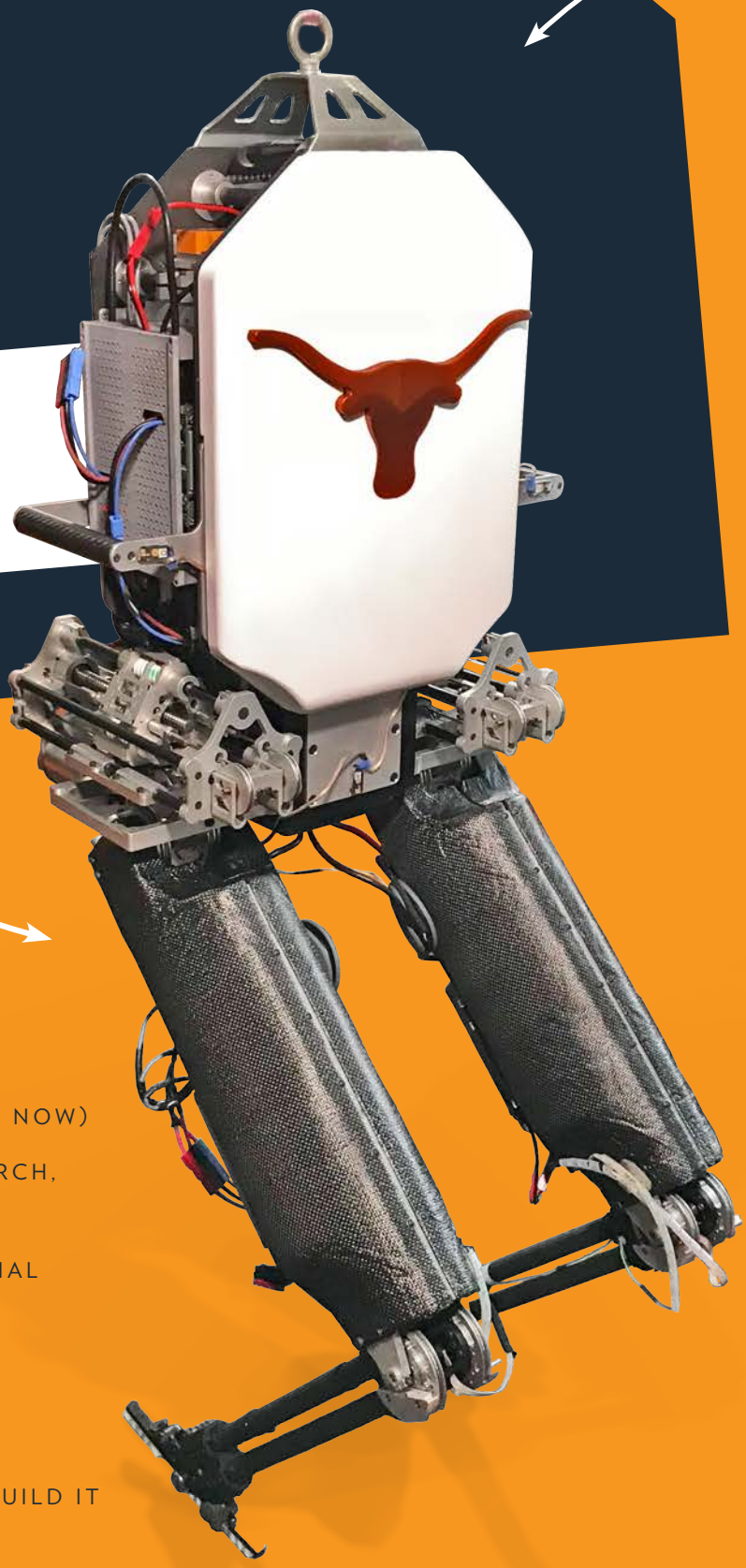
Like all the robots developed in Sentis' lab, the biped is anthropomorphic — designed to mimic the movement and characteristics of humans.

"We choose to mimic human movement and physical form in our lab because I believe autonomous systems designed to be similar to humans gives the technology greater familiarity," Sentis said. "This, in turn, will make us more comfortable with robotic behavior, and the more we can relate, the easier it will be to recognize just how much potential autonomous systems have to enhance our lives."

BOTS

DID YOU KNOW?

Mercury was disassembled and re-assembled 100 times during the span of the research.



ABOUT MERCURY

HEIGHT: 4′6″

WEIGHT: 35 LBS.

AGE: 6 YEARS (FROM INITIAL CONCEPT TO NOW)

COST: $650,000 (TOTAL SPENT ON RESEARCH, DESIGN AND DEVELOPMENT TO DATE)

WHAT'S INSIDE: 1 CPU, 1 TACTICAL INERTIAL MEASUREMENT UNIT, 6 SERIES ELASTIC ACTUATORS, 6 MOTOR AMPLIFIERS, 7 MICROCONTROLLERS

STUDENT INVOLVEMENT:
4 COCKRELL SCHOOL STUDENTS HELPED BUILD IT

INSPIRED BY NATURE

5 QUESTIONS WITH ENGINEERING STUDENT SAVANNA SMITH ⟶

After moving from Hawaii to South Texas as a teenager, Savanna Smith experienced culture shock in a variety of forms. The most immediate differences in food and colloquialisms were expected but she found the difference in how locals interacted with the environment surprising. These contrasts were the foundation for Smith's interest in the give-and-take relationship we have with our environment. Now, Smith is a civil engineering senior in the Cockrell School with a particular interest in biomimicry, or how to solve problems by emulating nature's patterns and processes. We sat down with Smith to learn more about the increasingly popular field of biomimicry and why UT Austin is the ideal place to carve out your own niche.

How did you know you wanted to be a civil engineer?

I enjoyed math a lot in school, but I also wanted to make a positive impact on society and use my education to help people and communities. I was initially drawn to civil engineering after watching a documentary on water desalination, which led me to learn more about water treatment. Civil engineering is a discipline that inspires me and provides what I am looking for in a career.

What is biomimicry and why does it interest you?

Biomimicry is a way to solve problems by looking to nature for their solutions, and civil engineering is a perfect field to incorporate biomimicry research. It is important because nature already has solutions for many of the issues that we face, such as wastewater treatment and pollution. Nature's solution to wastewater pollution is a wetland. By constructing our own, human-made wetlands, we can design them to maximize the appropriate processes for the water needs of the area. Personally, I am most interested in biomimicry for its applications to wastewater treatment but there are so many more applications.

How would you say your overall experience has been (so far) as a student at UT?

I chose to attend UT because of the world-class caliber of the civil engineering program, the amazing location and the affordable tuition. A degree in civil engineering from the Cockrell School carries a lot of weight. It's a globally recognized program that produces fantastic engineers.

Once I was here, I took full advantage of the opportunities that are available for all engineering students. I joined Engineers for a Sustainable World, a project-based student organization that allows us to "get our hands dirty," apply what we've learned in class and work on sustainable engineering problems. It's a great community and joining has really helped my success at UT. I've also been fortunate to have found great mentors within the program. I was an undergraduate researcher working with a graduate student who just completed his Ph.D. The experience taught me about what it actually means to solve problems — that it's more than just answering one question, it's about the larger scope and also the seemingly insignificant details.

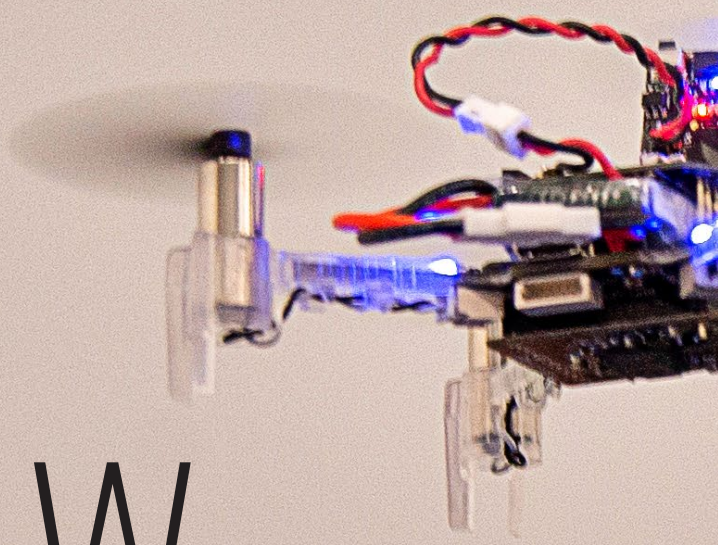
What types of internships, research opportunities or other experiences have you had that incorporate your interest in biomimicry?

My internship this summer at Los Alamos National Laboratory allowed me to contribute to finding creative water solutions for new infrastructure being developed. This was exciting because I got to recommend biomimetic options for water treatment in addition to the more traditional techniques. The mycofiltration project through Engineers for a Sustainable World is another way that I've explored biomimicry applications. In it, our student-led project is incorporating mycofiltration into rain gardens and aiming to improve the water quality of rainwater runoff.

What are your plans after graduation?

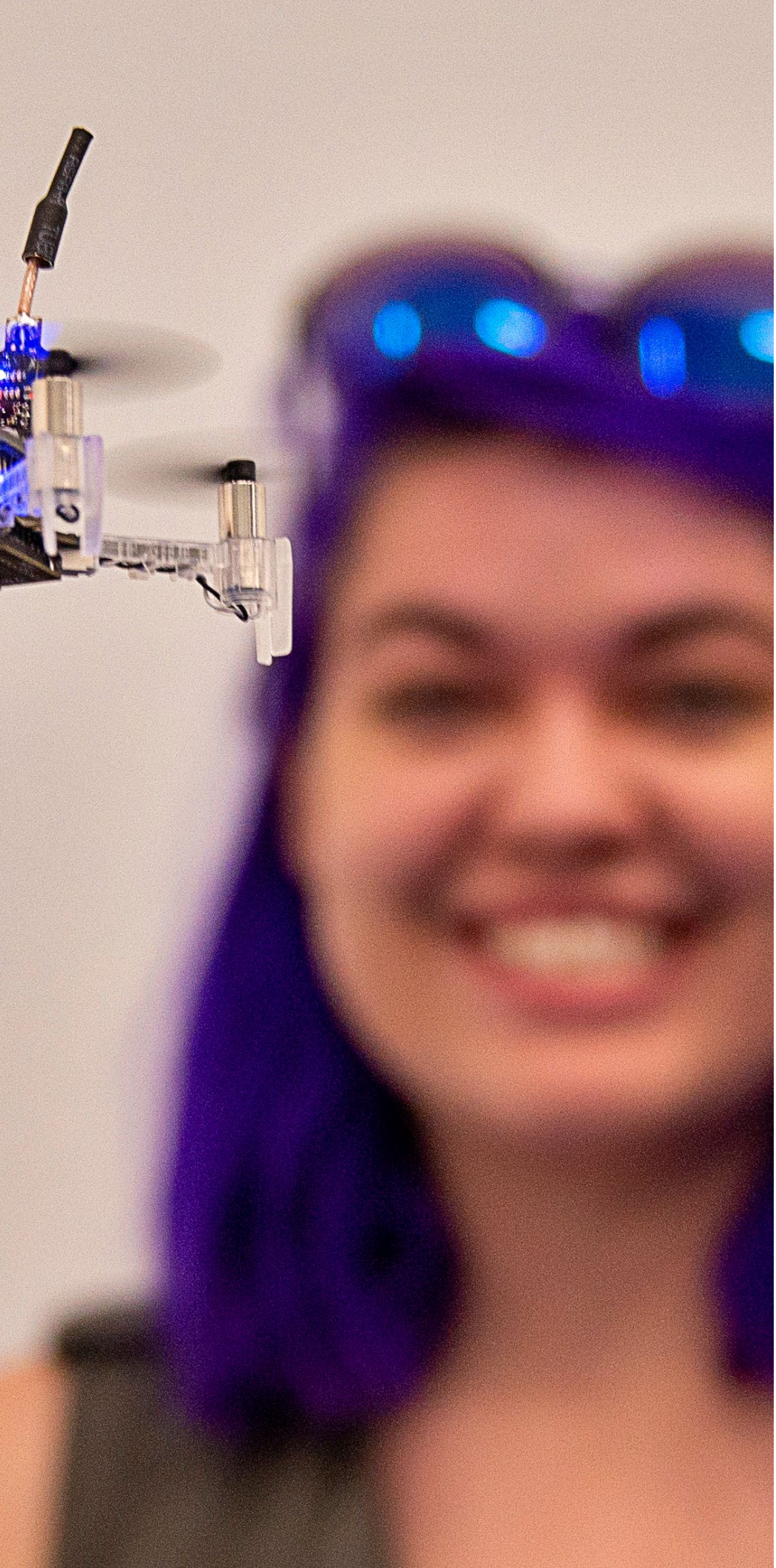
One of the most valuable discoveries I've made as a student at UT is that I really enjoy research. So, I plan to apply to graduate school. My dream job would involve solving challenging engineering problems with creative, sustainable solutions and would give me the chance to work with underserved communities to bring basic amenities, like clean water or sanitary wastewater treatment, to people in need.

This interview is part of an ongoing "5 Questions" series, where we ask Texas Engineers about their lives and research. ⟶ TO READ MORE, VISIT **MEDIUM.COM/@COCKRELLSCHOOL**



THE NEW GENERATION

Mission-driven. Entrepreneurial. Tech-savvy. Open-minded. Optimistic. These are the defining traits of Generation Z, a demographic born between the mid-1990s and mid-2000s. As these digital natives of an increasingly global society reach college age, engineering educators are working to answer a decidedly complex question: How do we deliver an educational experience that unlocks the unique potential of Gen Z?



More so than any other generation, Gen Z students are eager to get out of the classroom and learn in the real world. And perhaps above all, they feel that their careers should have a true purpose—that they should be engaged in a collaborative effort to make the world a better place.

"For today's students, it's not enough to learn theories without also learning how to apply them in the real world," said Maura Borrego, professor of mechanical engineering and STEM education and director of the university's Center for Engineering Education. "They crave authentic project experiences and don't trust textbooks to prepare them for the future."

The traditional curriculum of years past is ill-equipped to provide the experiential, tech-driven education that Gen Z craves. Along with other top institutions around the world, the Cockrell School of Engineering is encouraging students to solve problems right away.

"Historically, students have had to wait until senior year to work on meaningful research," said Scott Evans, director of Texas Inventionworks—a new program in the Cockrell School that provides an infrastructure for hands-on projects. "The sooner they see themselves as engineers, the sooner they will have the confidence to overcome complex challenges."

Texas Inventionworks is one of many new student-focused initiatives located in the Engineering Education and Research Center (EERC). With its state-of-the-art labs and awe-inspiring design, the EERC provides a central home for Texas Engineers, and prospective students are taking notice. As visual learners who frequently play out their lives on social media, today's students are more likely than ever to base their college decision around the attractiveness and potential of a school's facilities. For them, seeing truly is believing.

PLAN II AND MECHANICAL ENGINEERING STUDENT KATHERINE ALLEN CO-FOUNDED GENESIS, A PROGRAM THAT PROVIDES STUDENT STARTUPS WITH MENTORS AND EARLY-STAGE FUNDING.

"Our facilities should reflect our priorities and aspirations for engineering education," said Sharon L. Wood, dean of the Cockrell School. "When students visit our engineering campus, we want them to see researchers and young engineers from many fields working together to change the world."

Only by breaking down the discipline-specific silos that have long defined the engineering educational experience will educators adequately prepare students for careers of the future, which are increasingly interdisciplinary.

"For today's graduates to succeed, they must be seasoned problem solvers who can work effectively with people from all backgrounds and areas of expertise," said Tony Go, a chief engineer at ExxonMobil Chemical Company with years of experience in student recruitment.

When analyzing how the defining characteristics of Gen Z could be applied to create a new kind of engineering education, four key building blocks emerge: entrepreneurship, global experiences, big ideas and doing good. By incorporating these components into the Texas Engineering student experience—and by providing opportunities for students to immerse themselves in them—the Cockrell School will establish an innovative vision for the future of engineering education.

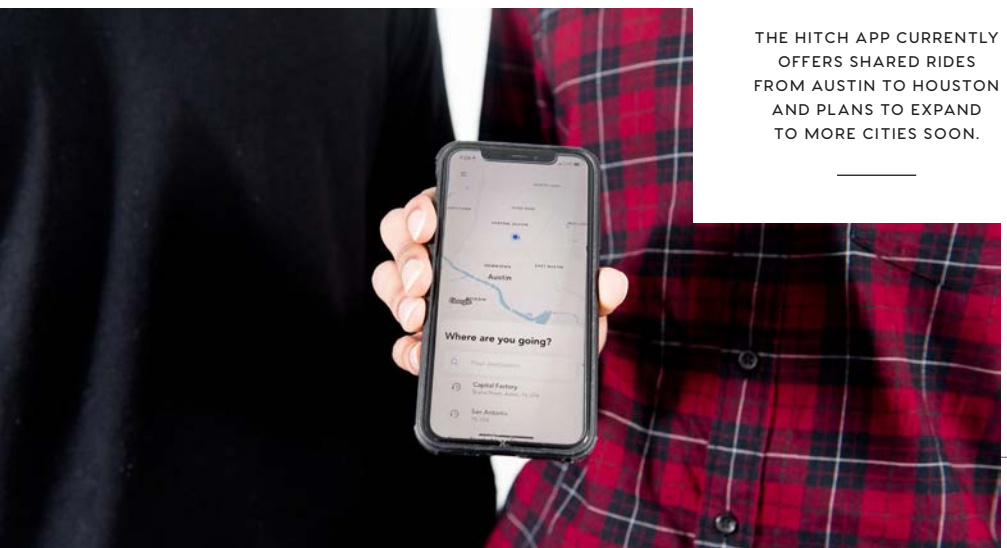
THE SPIRIT OF ENTREPRENEURSHIP

Studies have shown that this career-minded generation still recognizes the value of a college degree, as long as their educational experience enables them to begin pursuing career goals right away. To accommodate these ambitions, the Cockrell School has prioritized entrepreneurial training for students, providing resources for innovation, mentoring and commercialization.

After conducting a study that revealed a significant lack of funding for student startups at UT Austin, an enterprising group of alumni and student leaders received support from Texas Engineering to form Genesis, a program that provides students with early-stage funding and mentors them as they build their companies.

"We discovered that many student entrepreneurs were tinkering away on projects in their dorms and waiting for an opportunity to take the next step," said Plan II and mechanical engineering student Katherine Allen, who co-founded Genesis along with mechanical engineering alumnus Jacob Cordova, electrical and computer engineering alumnus Clarke Rahrig and chemical engineering student Jeff Auster. "Genesis

BUSINESS STUDENT KUSH SINGH AND ELECTRICAL AND COMPUTER ENGINEERING STUDENT TANUJ GIRISH CO-FOUNDED HITCH, A LONG-DISTANCE RIDE-SHARING COMPANY.



THE HITCH APP CURRENTLY OFFERS SHARED RIDES FROM AUSTIN TO HOUSTON AND PLANS TO EXPAND TO MORE CITIES SOON.

invites these students to bring their ideas out into the world."

One of the most remarkable Genesis success stories so far has been a company called Hitch. Co-founded by business student Kush Singh and electrical and computer engineering student Tanuj Girish — both of whom completed their freshman year last May — Hitch was born on the long, uncomfortable bus rides between their respective homes in Houston and Dallas.

Convinced that there must be a better way to travel, Singh and Girish believed that the ride-share option popularized by Uber and Lyft shouldn't be confined within the borders of a city. Through a proprietary app that pairs drivers with riders located along the driver's route, Hitch offers inexpensive long-distance ride-sharing from Austin to Houston, with plans to expand to more cities soon.

The company has even attracted some of Austin's most influential entrepreneurs to join the team as advisers, reflecting the ultimate intent of Genesis — to provide the early funds that enable a young company to get off the ground and attract top investors who will take them to the next level.

"To a typical investor, the funding we received from Genesis may not seem substantial, but it was exactly what we needed," Singh said. "The Genesis funding allowed us to complete hundreds of rides and learn more about our model, putting us in a position where we could bring proven metrics to larger venture capital firms."

THE EXPERIENCE OF GLOBAL CULTURES

Gen Z only knows a world where the internet exists and instant connections can be made among people in any country, at any time. It is our first truly global generation,

> *"In some cases, a lack of international experience may be the only obstacle that blocks an engineer's path to the top of the corporate ladder. Our goal is to develop leaders who will be ready to step into that position."*
>
> —HELENA WILKINS-VERSALOVIC
> DIRECTOR OF INTERNATIONAL ENGINEERING EDUCATION

comprised of advocates for diversity who take an active interest in other cultures. As a result, today's students are typically seen as more tolerant and inclusive than previous generations and are often better prepared to communicate and collaborate with peers from many different backgrounds.

So, Cockrell School educators are providing unique opportunities for students to broaden their worldview while also experiencing the rigors of a world-class engineering curriculum.

Through the International Engineering Education study abroad program, the school is helping students immerse themselves in other cultures, offering courses ranging from short-term programs to yearlong exchange trips.

"By becoming foreigners themselves, students begin to recognize the diversity around them back home and the value that diversity has on their own experiences," said Helena Wilkins-Versalovic, director of International Engineering Education. "This is their first step toward becoming inclusive leaders capable of navigating global industries."

Over the past 10 years, participation in the Cockrell School's study abroad programs has more than tripled. Engineering is now the most common major among Fortune 500 CEOs, and, as corporations race to develop the latest innovations in a competitive global marketplace, they will continue looking to engineers to lead the way.

"In some cases, a lack of international experience may be the only obstacle that blocks an engineer's path to the top of the corporate ladder," Wilkins-Versalovic said. "Our goal is to develop leaders who will be ready to step into that position."

After participating in a Maymester in Croatia that included trips to geological formations and tours of gas exploration facilities in the Adriatic Sea, recent graduate Jessica Vieira parlayed her experience into a job at Schlumberger, the world's largest oilfield services company, and she now works in France.

"Studying abroad introduced me to what a career in the oil and gas industry actually looks like," Vieira said. "During my time in Croatia, I learned about a variety of enhanced oil recovery techniques, networked with Croatian students and engineers to develop my communication skills and visited a gas rig to gain new perspective on what would ultimately be my first job after graduation. The program absolutely kickstarted my career."

By tapping into this generation's capacity for inclusiveness and global understanding, study abroad experiences will help students like Vieira accelerate their personal growth and become the leaders our society will depend upon in the decades to come.

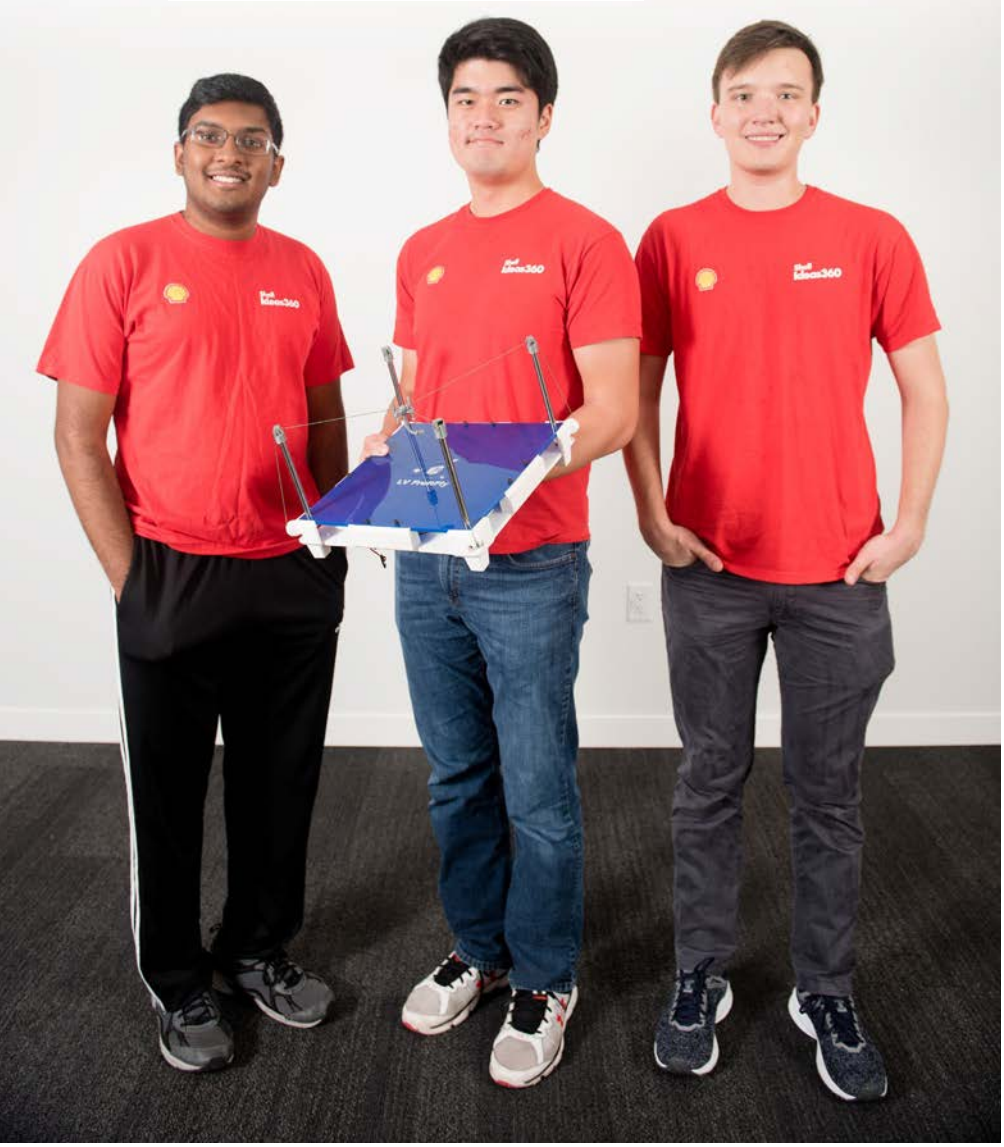
THE COURAGE TO FAIL AND PURSUE BOLD IDEAS

For Gen Z students, no problem is too difficult, and all problems are worthy of solutions. It is well documented that Gen Z is a cause-driven generation—students are willing to experiment, fail and try again in their efforts to make the world a better place. Through the numerous partnerships it has with industry and the cutting-edge project spaces it now boasts, the Cockrell School is integrating real-world research and projects into the student experience, preparing young engineers for successful careers while empowering them to make an immediate impact on campus.

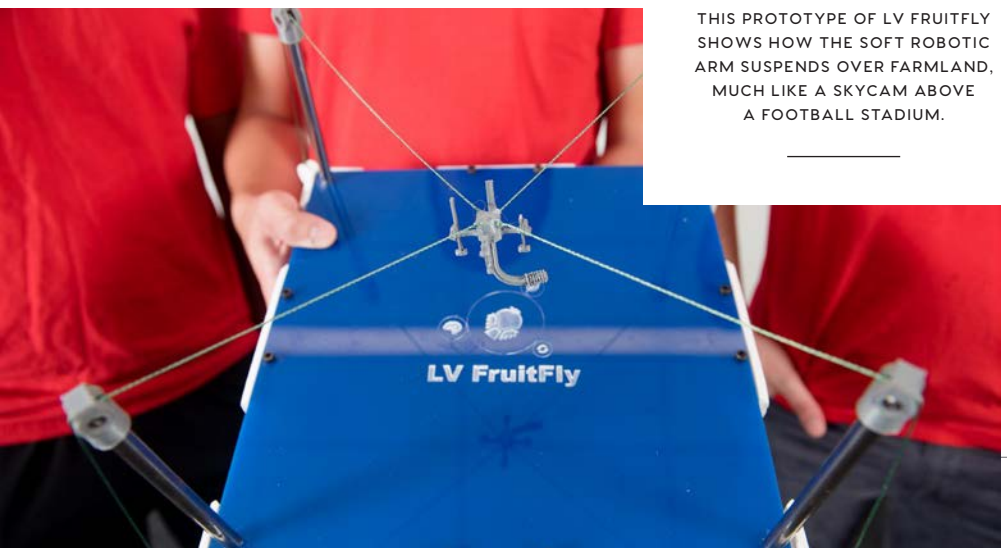
When Unique Electric Solutions (UES), a New York-based firm focused on the electrification of commercial vehicles, approached Bob Hebner, director of UT's Center for Electromechanics (CEM), to collaborate on a revolutionary zero-emission system for UPS delivery trucks, both parties saw an amazing opportunity to get students involved right away. This is the type of leading research that they will be applying in their future careers. UES began working with six undergraduate students to convert a UPS diesel van into a fuel-cell/battery hybrid, and one of these students, Austin Mabrey, is now employed full time as an engineer at UES.

"Seeing the real-world relevance of my education beyond the classroom was crucial to both my development as a student and my transition into life as a working engineer," Mabrey said. "This project gave me a greater appreciation for the theories I learned about in school, and I continue to be inspired every day by my fellow students and researchers at CEM."

Faced with the difficult task of devising a zero-emission system that doesn't make the vehicles heavier or reduce their cargo capacities, these young engineers rose to the occasion, taking risks and bouncing back from failures until they arrived at a solution. If future iterations of the vans are successful, this core team of



BIOCHEMISTRY STUDENT ARJUN MENTA, MECHANICAL ENGINEERING STUDENT UKSANG YOO AND CHEMICAL ENGINEERING STUDENT LOGAN HAGEMAN INVENTED A SOLUTION TO ENCOURAGE SUSTAINABLE FARMING: A SUSPENDED AND AUTOMATED ROBOTIC ARM CALLED LV FRUITFLY.



THIS PROTOTYPE OF LV FRUITFLY SHOWS HOW THE SOFT ROBOTIC ARM SUSPENDS OVER FARMLAND, MUCH LIKE A SKYCAM ABOVE A FOOTBALL STADIUM.

UT students will be hired to design and operate a fabrication facility in New York.

Gen Z students also recognize that bold ideas can strike at any moment. When engineering students Uksang Yoo and Logan Hageman joined biochemistry student Arjun Menta to tackle issues related to food production — specifically, how to avoid a future where fruits and vegetables are no longer available to a majority of the global population — they got their inspiration from the Texas Longhorns.

While attending a UT football game, Yoo watched the stadium's Skycam glide across the field, dipping to capture close-ups before pulling away for wide shots, and he suddenly envisioned another potential application for this smooth-moving, cable-suspended technology.

What started as an outside-of-the-box idea eventually blossomed into LV Fruitfly, an autonomous robotic arm suspended by cables that uses artificial intelligence and soft robotics to determine when fruit is ripe and then pick the fruit without damaging it. Because the arm is airborne, there is no need to leave walkways between fruit trees, allowing more trees to be planted, an increase in food production and a reduction in water waste.

The project was named a Top 5 Finalist in the international Shell Ideas360 competition, and the team is now developing the next version of LV Fruitfly and evaluating its potential for funding.

"Many students have great ideas, but few try to take those ideas to the next level," Menta said. "You don't need to have all the answers early on to develop an idea. With a diverse team — and a little courage — you can accomplish anything."

THE MORAL IMPERATIVE TO DO GOOD

When you combine Gen Z's entrepreneurial and often fearless spirit with their empathetic worldview, you get students who are determined to help those in need. Students of Gen Z are driven by more than self-realization and self-fulfillment; they want their professional work to change lives and transform communities. In many ways, UT Austin's motto — "What starts here changes the world" — is more relevant and accurate than ever before.

In May 2017, Texas State University student Maddie Garbarz suffered an accident that resulted in the loss of her left hand. Faced with the monthslong process of acquiring a prosthetic replacement, Garbarz began to explore temporary options. After learning more about the Cockrell School's work with rehabilitation robotics, she reached out to associate professor Ashish Deshpande's ReNeu Robotics Lab for a solution.

Two undergraduate members of the lab, Taylor Johnson and Mark Jennings, jumped at the opportunity. Through e-NABLE, a volunteer network that creates free, open-source downloadable files for 3D-printed devices, they found a file for a prosthetic hand that they could adapt to Garbarz's measurements.

The design included cables that stretched from the elbow over thermoformed 3D-printed plastic to the fingertips, resulting in a prosthetic that allowed Garbarz to open and close her hand by straightening or bending her arm. Though she only used it for a short time, the temporary solution provided by this team of Texas Engineers had a transformative impact on Garbarz's daily life.

"The arm helped me perform routine tasks like opening water bottles, holding a curling iron and even stabilizing pots and pans while cooking," Garbarz said. "Living with one hand is doable, but — thanks to Taylor and Mark — this prosthetic made things so much easier."

Remarkably, Johnson and Jennings completed this project on their own, with their own money. For them, Garbarz' request wasn't just another assignment — it was an opportunity to utilize the theories they have learned in the classroom to help someone in need.

"At first, it was intimidating to think that a real person would be relying on a device that we made," Johnson said. "But then I realized that this is the reason I chose to major in engineering in the first place — to build things that will help people and maybe even change the world."

MECHANICAL ENGINEERING STUDENT MARK JENNINGS AND BIOMEDICAL ENGINEERING STUDENT TAYLOR JOHNSON 3D PRINTED A PROSTHETIC HAND FOR CAR ACCIDENT SURVIVOR MADDIE GARBARZ.

THE STUDENTS' NEW PROSTHETIC TOOK TWO WEEKS TO DESIGN, PRINT AND ASSEMBLE.

DRIVERLESS CARS? THAT'S SO YESTERDAY.

UBER IS BETTING THAT ONE DAY — however soon or far away that is — we all will be ride-sharing in the skies. So much so that the company recently enlisted UT engineers and a team from the Army Research Labs (ARL) on a major R&D project aimed at launching the world's first flying taxi.

Led by Jayant Sirohi, an associate professor in the Department of Aerospace Engineering and Engineering Mechanics, the new research agreement is in place to help Uber accomplish two bold but visionary goals: introduce prototype flying taxis by 2020 and make the ride-sharing-by-air network available for public use by 2023. The initiative, called Uber Elevate, seeks to build next-generation technology and an infrastructure for on-demand airborne ride-hailing services within dense urban areas.

Sirohi and his team in the Cockrell School will focus on creating one of the first usable stacked co-rotating rotors, or propellers, for vertical take-off and landing, a novel flying technology in which two rotor systems are stacked on top of each other with both rotating in the same direction. Preliminary testing of this concept has shown the potential for this technology to be quieter than traditional paired rotor approaches while simultaneously improving overall performance for a flying craft.

"UT is uniquely positioned to advance this new technology, and Uber has recognized that," said Sirohi, who is one of the nation's leading experts in UAVs, vertical-lift aircraft and fixed- and rotary-wing aeroelasticity. "In addition to the technical expertise we bring, we also have a rig to test new rotor configurations right here on campus."

Uber has named two metroplexes — Dallas-Fort Worth and Los Angeles — as the first Uber Elevate test cities where the network will be set up. Both currently suffer from major traffic congestion, especially during rush hour. The drive from DFW International Airport to the nearby city of Frisco, a distance of under 25 miles, could take up to an hour during rush hour. In an air taxi, it would take less than 10 minutes.

"Uber's urban air mobility concept aims to revolutionize transportation through the introduction of these air taxis," Sirohi said. "Many of the same technologies used by Uber on the ground can be used in the sky. This, however, offers a new dimension to the ride-sharing experience."

An official launch of the collaboration took place on the Forty Acres in August, with leaders from Uber, ARL and UT all in attendance.

ONE OF A KIND

One million terajoules—that's how much energy humankind uses each day. The Palo Verde Nuclear Generating Station in Arizona, one of the largest power stations in the world, would need to multiply its daily output 3,000 times just to keep pace with that average. To say we consume a lot of energy would be an understatement, and our global population and corresponding demand for energy will only continue to rise.

DESIGN RENDERING OF NEW ENERGY ENGINEERING BUILDING, VIEWED FROM THE SOUTHEAST.

To meet this extraordinary demand, we will need to cultivate a multidisciplinary approach to research and development and generate new ideas, and there is no better place for this than UT Austin—the energy university. As the nexus of energy research and education on campus, the Cockrell School can play the role of leader and matchmaker. By building a truly world-class energy engineering facility, Texas Engineering is positioned like no other to bring faculty, students, industry partners and policy experts together in ways never before imagined—to find solutions to energy challenges we don't yet know exist.

Marking the second major construction project in the Cockrell School's master facilities plan, the Energy Engineering Building (EEB) will join the recently opened Engineering Education and Research Center (EERC) as state-of-the-art spaces built not just for one specific engineering department, but for all. Whereas the EERC serves as the school's new home for hands-on student projects and groundbreaking research in a variety of fields, the EEB will represent a strategic investment in two of UT's greatest strengths—its location in the nation's premier energy state and its remarkable community of faculty and students working in energy.

"We envisioned the EERC as a building that would revolutionize education and research for the Cockrell School, and I believe it is doing that," said Alex O'Briant, associate principal at Ennead Architects—the firm behind the EERC and EEB designs. "We think the EEB can accomplish the same objective for UT's energy community. We are excited to see how this facility will amplify the university's expertise in an area where it's already seen as a global leader."

Representing 9 percent of the United States' gross domestic product—second only to health care—energy plays an influential role in our economy as well as our daily lives. This is particularly true in Texas, which not only accounts for over 35 percent of the nation's crude oil production but also produces more wind power, natural gas and lignite coal than any other state. Unsurprisingly, the energy industry continues to be one of the top employers and generators of wealth in Texas.

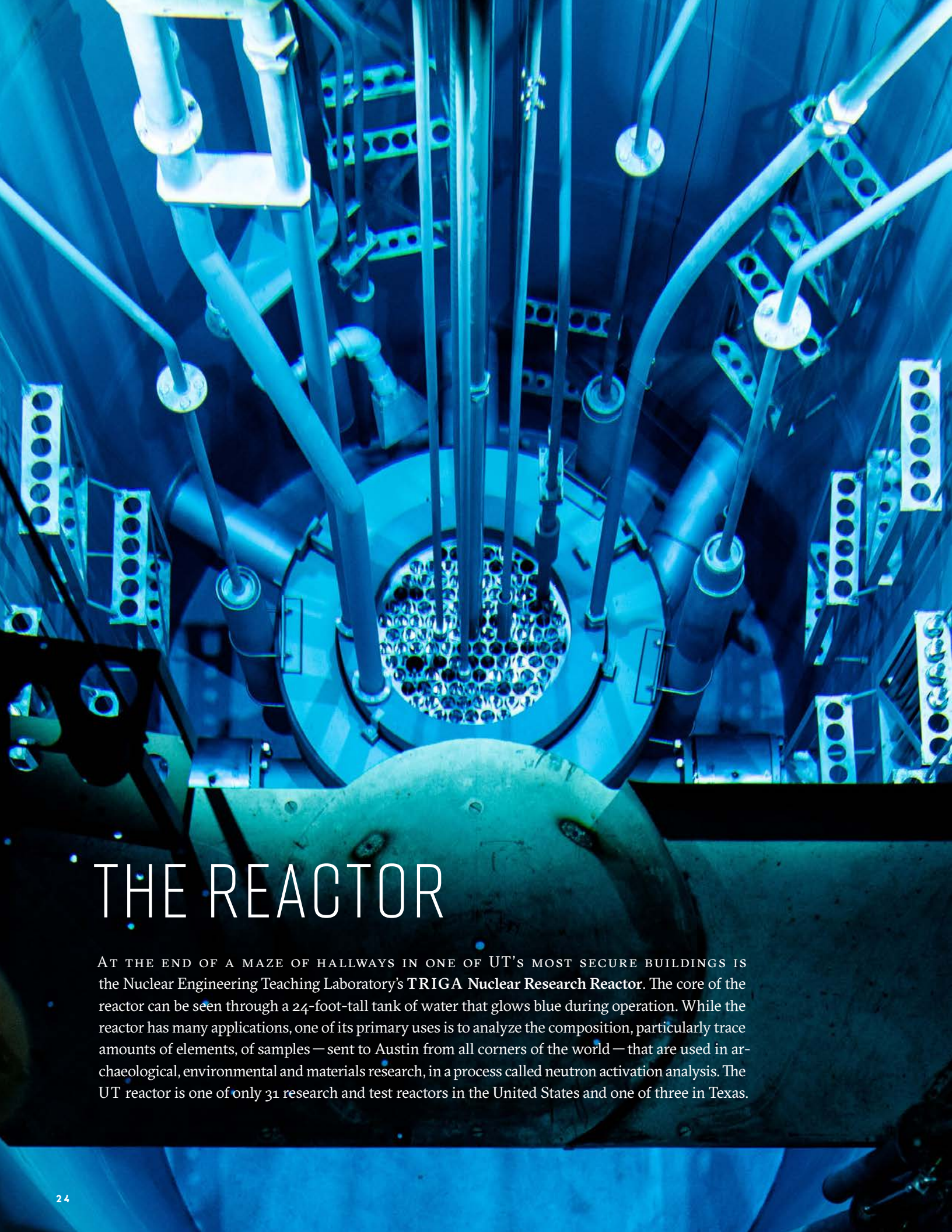
UT has capitalized on this geographical strength, attracting a strong community of researchers working in all areas of energy. These researchers have, in turn, attracted the best and brightest students hoping to benefit from the upward mobility offered by the energy industry. Thanks to average starting salaries like the $81,600 earned by UT Austin's petroleum engineering undergraduates, motivated young engineers are making their dream careers a reality.

The EEB will provide a centralized hub for energy on the Forty Acres, with flexible classrooms, labs and cutting-edge research spaces. A vast improvement over the current crowded and outdated facilities, the new building will give students, faculty members, researchers and energy experts a modern facility and valuable resources to accelerate energy innovation. Additionally, by attracting outside experts from other institutions and industry partners to develop breakthrough technologies, the EEB will help strengthen the school's reputation and enhance its capacity to solve the energy challenges of the future.

"We live in an increasingly global society, and the challenges surrounding energy are best addressed by bringing top experts together—regardless of their department," said Sharon L. Wood, dean of the Cockrell School. "With the EEB, we will offer a dedicated space where these experts can collaborate on groundbreaking research and ultimately change the world. As a multidisciplinary building dedicated to one of the most important issues facing the nation and the world, the EEB represents a one-of-a-kind facility for UT."

OUR HIDDEN GEM

Just 10 miles up the road from UT's main campus sits the university's other campus — one dedicated primarily to research with nearly 500 acres and over 25 major labs and centers. The J.J. Pickle Research Campus (PRC), known to many but still somehow steeped in mystery, began as a magnesium processing plant during World War II before being purchased by the university in 1949. After decades of site development and several changes to its name, the PRC now serves as one of the nation's leading research hubs, where engineering innovations come to life and world-changing discovery happens at a grand scale. Join us for a visual tour of four of the campus' biggest — and seemingly most hidden — locations.



THE REACTOR

At the end of a maze of hallways in one of UT's most secure buildings is the Nuclear Engineering Teaching Laboratory's **TRIGA Nuclear Research Reactor**. The core of the reactor can be seen through a 24-foot-tall tank of water that glows blue during operation. While the reactor has many applications, one of its primary uses is to analyze the composition, particularly trace amounts of elements, of samples — sent to Austin from all corners of the world — that are used in archaeological, environmental and materials research, in a process called neutron activation analysis. The UT reactor is one of only 31 research and test reactors in the United States and one of three in Texas.

THE MEGASTRUCTURE

In the massive **Ferguson Structural Engineering Lab (FSEL)**, researchers and students from the Cockrell School study the response of structures under extreme loads due to earthquakes, wind, fire and blast with the goal of improving civil infrastructure and advancing modern society. The lab—a 45,000-square-foot, hanger-like facility the length of a football field—allows for ultra-large-scale behavioral studies of real-life structures such as bridges, buildings, nuclear power plants and others. With a community of some of the nation's leading structural engineers, and with advanced simulation tools to complement their unique large-scale experimental capabilities, FSEL continues to be a world-class destination for top-tier structural engineering research.

THE SUPER POWER

A soft hum, an assortment of blinking lights, miles of cables and row upon row of whirring fans combine to create **Stampede2**—UT's flagship supercomputer and one of the largest at any university around the world. With a processing power of 18 petaflops, meaning it is processing 18×10^{15} operations in one second, Stampede2 is essentially as powerful as 100,000 desktop computers combined. Housed in the Texas Advanced Computing Center, Stampede2 makes large-scale research possible, serving thousands of researchers and students across the nation in areas ranging from health care to climate to energy. Thanks to Stampede2, the intense number-crunching and simulating that once took years now takes only hours or days.

THE SIMULATOR

If you're visiting the **James R. Fair Process Science and Technology Center** for the first time, you might just think you've stepped off a university campus and into a corporate industrial chemical plant. As a large-scale testing ground and simulation platform supported by giants like ExxonMobil, Phillips 66, Emerson Automation Solutions, Shell and Eastman, the facility is operated by the Separations Research Program and facilitates cutting-edge experiments on new separations technologies and methods. Technologies are being developed in collaboration with the industry partners to enhance distillation capabilities of fluid mixtures by improving mass transfer and hydrodynamics, which can then lead to decreased energy consumption and lower capital costs. The researchers and students working in the center are investigating distillation, process optimization and control, liquid-liquid extraction, oil/water separations, complex fluid behavior and many other areas of separations technology. When it comes to the sheer size and grandeur of university research, it doesn't get much better than this.

UNSUNG HEROES

We already know that Texas Engineering faculty and students are changing the world, but behind the scenes, staff and administrators are the ones keeping things running smoothly. From alumni outreach to student life programming, staff members dedicate themselves to improving and advancing the Cockrell School. Read about two of our many "unsung heroes," and find out what inspires them to build a better Texas Engineering experience for the next generation.

HORTENSIA PEOPLES

TITLE: DEPARTMENT MANAGER, CAEE

YEARS AT UT AUSTIN: 34

In the Department of Civil, Architectural and Environmental Engineering (CAEE), over 1,200 students, 60 faculty members and 22 staff members strive to work together to make the world a better place. As one of the biggest and best civil engineering departments in the U.S., CAEE is constantly evolving and often confronting new challenges. But for longtime department manager Hortensia Peoples, that's what creates opportunity.

Peoples oversees the daily organizational and financial operations of department programs and resources, and she serves as the primary administrative contact for all CAEE faculty, staff and students. A talented strategist and savvy problem solver, she inspires by example and lives by her professional mantra, "the students come first."

Most importantly for Peoples, it's all about helping others and promoting a supportive community. Her caring is genuine and she is quick to share a smile or laugh, which makes people feel they belong, like they are part of a family.

"You have to be approachable, a good listener and a good communicator — no matter what role you serve in the organization or what problem you're trying to solve," she said. "I don't believe in failure, so I'm looking for solutions *everywhere*. It is my job to be a creative thinker and open doors for people in the department to have success. I have been so proud to be in a position to help so many."

> *"I try to help people realize that there is always more than one way to get something done or meet a challenge. Creativity is so important when facing obstacles."*
>
> —HORTENSIA PEOPLES

"Every successful student elicits a positive memory, but it is especially gratifying to see alumni working in industry come back to campus to meet with and recruit current students. It really shows that they loved their experiences in Texas Engineering."

—FRANCIS AN

FRANCIS AN

TITLE: CO-OP PROGRAM COORDINATOR

YEARS AT UT AUSTIN: 5

Every year, roughly 150 Texas Engineering students participate in a Cockrell School co-op program—a yearlong industry-immersive experience that puts students on company teams to prepare them for the future. And every year, Francis An makes sure each of them has the best and most rewarding experience possible.

With a degree in psychology from UT Austin and a passion for behavioral counseling, it's fitting that An is dedicated to students' career development. When he's not coordinating the logistics and planning of his students' co-op programs, he serves as a general career counselor, helping students polish their resumes and refine their interviewing skills.

"We really have amazing students," An said. "They're focused on what they want to do in the future and already have a vision—that part makes my job easy. What makes it rewarding is working with them through the process and seeing their education and training manifest into a career that they have a real passion for."

There is a no-appointment-necessary, walk-in policy for students seeking guidance in the Engineering Career Assistance Center. As a result, An sometimes meets with up to 20 students in a day. He customizes each session for the student but always gives one piece of advice: "Make the most of your time in college—get involved, become a leader, do something beyond the classroom. Many things can be part of your resume."

FROM BOSTON TO AUSTIN

As aerospace engineer Karen Willcox departs MIT to become the new director of UT's Institute for Computational Engineering and Sciences (ICES), she inherits a world-renowned organization that has grown into one of the STEM gems on the Forty Acres. We sat down with her to learn more about her vision for the future and what truly sets ICES apart.

You've spent your entire career (up to this point) at MIT, but you're a Longhorn now! What has been your impression of Austin as you've prepared for life in Texas?

There are actually many things about Austin that feel similar to Boston. Both have a vibrant urban area with a diverse population and a real sense of excitement about what's happening in the city. But there is obviously a huge difference between the European feel underlying Boston and the Texan feel of Austin. We are absolutely loving the straight, fast-flowing roads and the breakfast tacos, although we are looking forward to some cooler weather!

What interested you most in making the move to UT?

ICES is simply a remarkable place with exceptional people. There is no question that this institute is a world leader. Under Tinsley Oden, ICES has had an enormous impact on the scholarly field of computational science, engineering and mathematics, but also on the many disciplines that have been revolutionized by computation. Also, when I visited UT last year, I was inspired by the vision that President Fenves and Provost McInnis have for this university. There is so much to be excited about here—from the Dell Medical School to UT's leadership in supercomputing to opportunities to work with Austin's tech sector—all while having the chance to be a part of a world-class engineering school.

What do you see as your key priorities as you settle into your role?

One of my most pressing priorities is to maintain and strengthen our partnerships. For example, we already enjoy a strong partnership with UT's Texas Advanced Computing Center, home of the fastest supercomputer at any U.S. university, but I also want to build more collaborations where we have strategic opportunities, like with the Dell Medical School for computational medicine.

In addition, we want to look at how the ICES portfolio in both research and education evolves in the future. We will maintain a firm focus on computational science, engineering and math, which is and always will be the hallmark of ICES, but at the same time consider emerging areas like data science and machine learning. I am also excited about the potential for ICES' increased role in educating undergraduate students across campus. We will not be offering a major, but the multidisciplinary nature of our organization presents a unique opportunity for students to get more involved.

And a third major priority will be strengthening the diversity of the ICES community. The intellectual diversity of having mathematicians, engineers, scientists and geoscientists together is what makes us so rich. Increased diversity in gender and race, and in perspective and socioeconomic status and background, will similarly contribute to making us even stronger.

What is the biggest opportunity for ICES as it begins the next chapter in its history? What is its biggest challenge?

ICES has so many exciting opportunities; it's hard to single out one. I believe an enhanced role in the UT undergraduate education, in whatever form that ultimately takes, is among our biggest opportunities. ICES, in partnership with various colleges, schools and departments across campus, is well positioned to help develop the well-rounded but technically grounded leaders of tomorrow.

Our biggest challenge may be determining what our scope should be moving forward. We have to be careful not to expand in so many different directions that our core strengths become diluted. But, again, this is where our partnerships will play a critical role.

How important is cross-campus collaboration, especially with the Cockrell School, to ICES' mission and potential for the future?

ICES already has very strong relationships across UT, enabled in large part by the direct connections through ICES faculty. The intellectual diversity of ICES' faculty and students is one of the things that makes our institute such a vibrant place. With computation playing such a critical role in practically all disciplines across engineering, I'm particularly excited to strengthen our collaborations across the Cockrell School. There is so much quality and breadth on this campus. Opportunities for collaboration are everywhere.

How can the work of ICES impact society and quality of life in the future? And, more locally, how can the institute's work impact the state of Texas and its citizens?

Computational science is impacting society and quality of life in incredible ways, and ICES research is at the forefront. For example, Cockrell School professor Tom Hughes is leading the way in computational medicine with modeling that is transforming the way that heart disease is diagnosed and treated. And professor Clint Dawson works to model and forecast storm surges, providing valuable information to Texas and its cities in events like Hurricane Harvey. These are just two examples. I can give many more!

In one sentence, what makes ICES extraordinary?

ICES is one of the very few places where disciplinary barriers have truly been broken down — where engineers, scientists, mathematicians, physicians and computers come together to tackle some of the most critical problems facing our society.

> *"There is so much quality and breadth on this campus. Opportunities for collaboration are everywhere."*
>
> —KAREN WILLCOX
> DIRECTOR OF ICES

A STORM SURGE OF OPTIMISM

Though Often Devastating, Hurricanes Can Also Provide Invaluable Data and Experience That Can Save Lives in the Future

One year after Hurricane Harvey dumped 60 inches of rain on Houston and Southeast Texas and shook the Lone Star State to its core, some coastal towns may never be the same again. In terms of scale and impact, it was truly a storm like no other. And through it all—even well after it was gone—Texas Engineers were there searching for solutions.

Because of UT's unique breadth of research quality, and because of its location and the array of different landscapes and climates across the state of Texas, the university has become a recognized leader in research efforts that analyze weather patterns and prepare cities and emergency response units in situations like we saw in Houston.

Clint Dawson, professor in the Department of Aerospace Engineering and Engineering Mechanics and the head of UT's Computational Hydraulics Group, developed storm surge prediction models (storm surge is typically the part of a major storm that does the most damage) that were integral to estimating the catastrophic potential of Harvey. In addition, researchers in the Center for Space Research deployed their satellite imaging technology to paint a clearer picture of what was happening, while David Maidment, recently retired professor in the Department of Civil, Architectural and Environmental Engineering and one of the world's go-to experts for surface water information systems, was a key adviser to response units on the ground.

And underpinning everything was the Texas Advanced Computing Center (TACC), home to several of the world's most powerful supercomputers, which allowed researchers to collect, store and analyze massive amounts of storm data quickly, revealing the extreme scale and behavioral pattern of the hurricane.

Today—after assessing the aftermath and working to help victims put their communities back together—UT engineers and scientists are focusing on the question most critical for Houston's future: How can we be better prepared for the next Harvey-like storm?

They believe the answer lies in the data.

"David Maidment approached us at TACC to help develop the first-ever tools for modeling conditions on the ground during a storm—in real time," explains Niall Gaffney, director of data intensive computing at TACC. "He thought that if we could combine all available data on local topography with observed and predictive weather models for the storm in both short and long terms, his team could gauge where and how high the water could be."

While the idea was certainly useful (in some cases it accelerated the reaction times of first responders), there wasn't quite adequate topographical data to provide the detail needed to aid emergency rescue operations at the level they were hoping for

during Harvey. But the exercise was not in vain. With each major hurricane that arises on the Gulf Coast, new lessons are always presenting themselves. Compiling and analyzing data to develop efficient, effective and universally applicable response protocol is only made possible through experience.

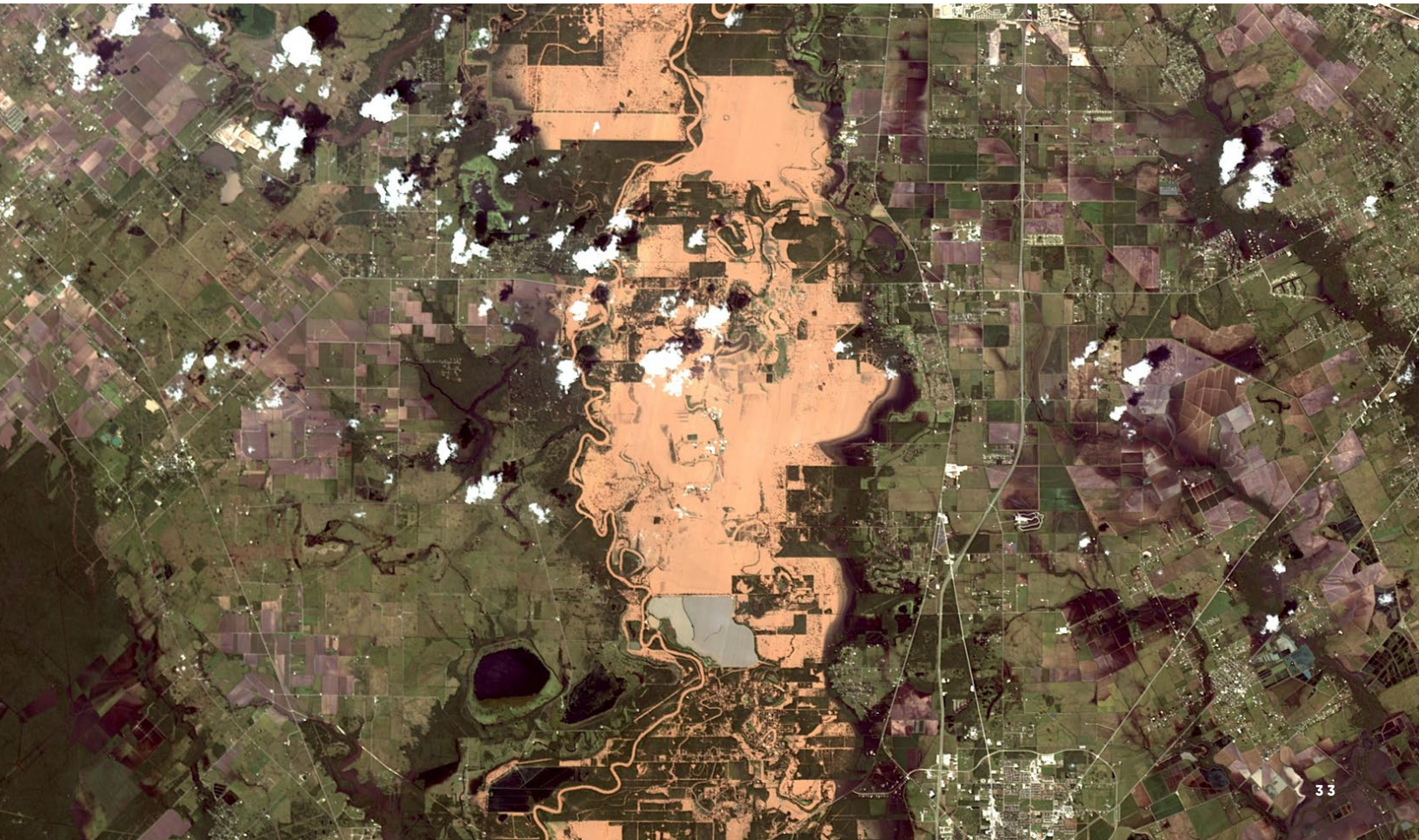
"Now, over 180,000 square miles of the state of Texas are currently being mapped in unprecedented detail," Maidment said. "That's a major component of accurate flood mapping for the future. If we can effectively follow the motion of the water more precisely, it is a huge step forward."

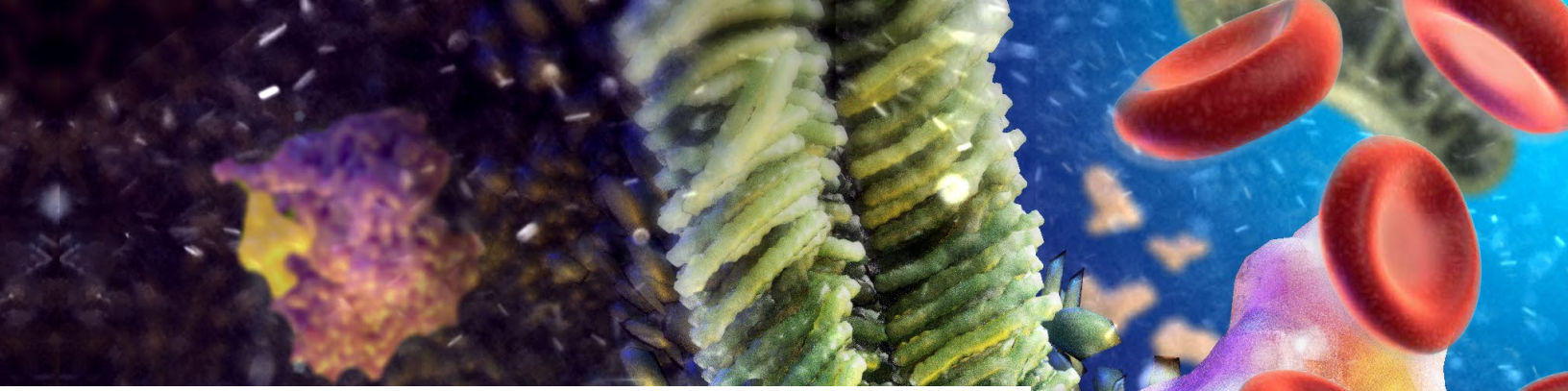
Back in 2005, Bob Gilbert, professor and chair of the Department of Civil, Architectural and Environmental Engineering, was part of an expert team that reviewed and assessed all forensic analysis gathered by the federal government after Hurricane Katrina. When compared to Harvey, which killed 80 people, destroyed an estimated 300,000 vehicles and damaged over 200,000 homes, Katrina was an even bigger disaster. But it also provided crucial information that would end up helping responders during Harvey.

"The majority of the 1,800 people who lost their lives during Katrina were over 65 years of age," Gilbert said. "These victims were of all races and socio-economic backgrounds. It didn't matter which neighborhood they lived in, and it wasn't about being rich or poor. Realizing this, it was clear that Harvey's emergency response teams needed to prioritize elderly populations during their operations, which made a big difference."

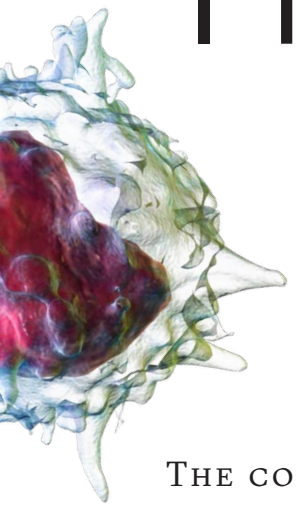
The scale of Hurricanes Katrina and Harvey were extraordinary, and the hardships that victims have endured since have been nothing short of devastating. But as we've seen time and again after natural disasters, these experiences have a way of bringing out the best in people.

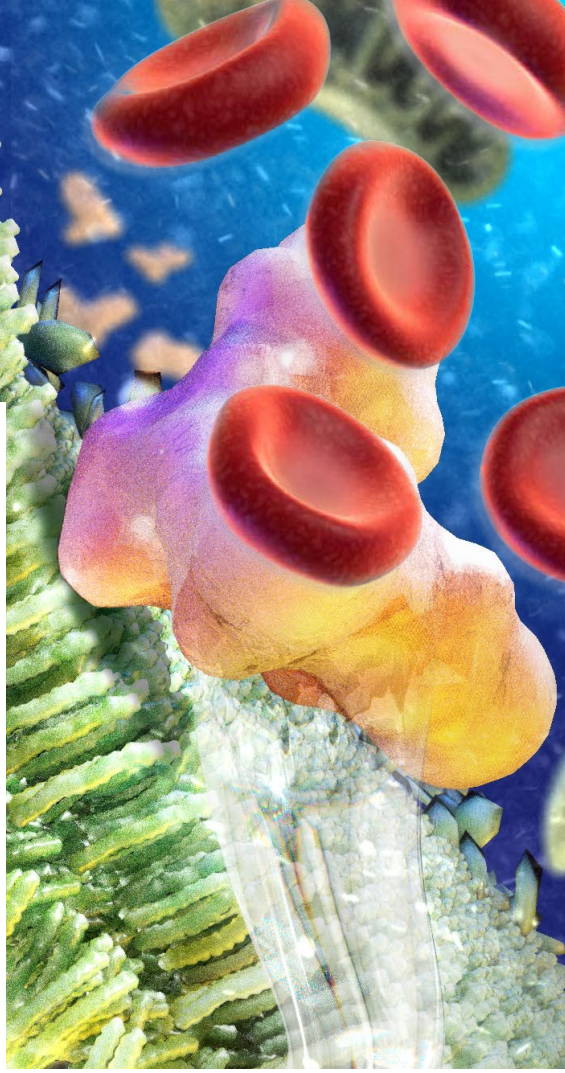
"With Harvey, at one point there were 85 rescue helicopters over the sky," Maidment said. "And hundreds of thousands of people from across the United States and around the world either donated money or traveled to Texas to help on the ground. If that isn't inspiring or isn't cause for optimism for the future, I don't know what is."





INSIDE OUT





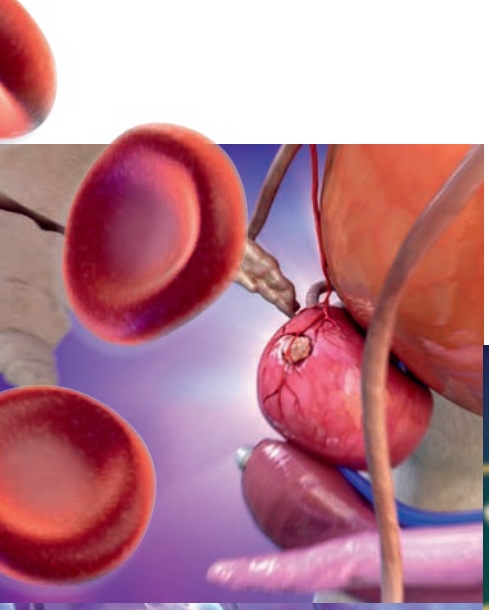
The complexity of the human anatomy continues to pose a significant challenge for aspiring engineers, scientists and physicians. Whether they are preparing to treat patients, conduct research or develop new health care technologies, today's students rely on modern, in-depth educational tools to master this difficult subject. Thanks to the vision and generosity of medical animation pioneer Bruce Blausen, Texas Engineering is now the sole custodian of one of the world's most comprehensive and visual learning resources for students.

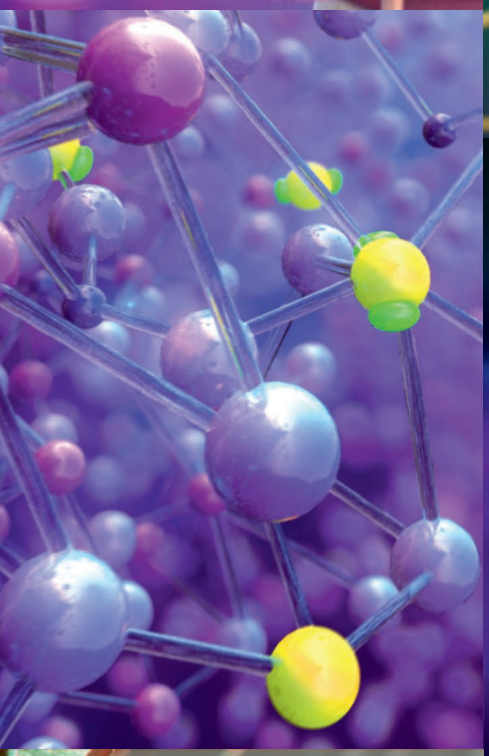
Founded by Blausen in 1991, the Blausen Medical Library has grown to become the largest collection of biomedical and scientific visual aids ever produced. With more than 28,000 3D animations and illustrations detailing everything from allergen vaccines to white blood cells, the library covers over 1,800 topics, including diseases, treatments and the human anatomy from muscles and organs down to the cellular and molecular levels. In May, Blausen gave the entire library to the Cockrell School, making the vast archive of medical images freely available to aid in the education of every student on campus.

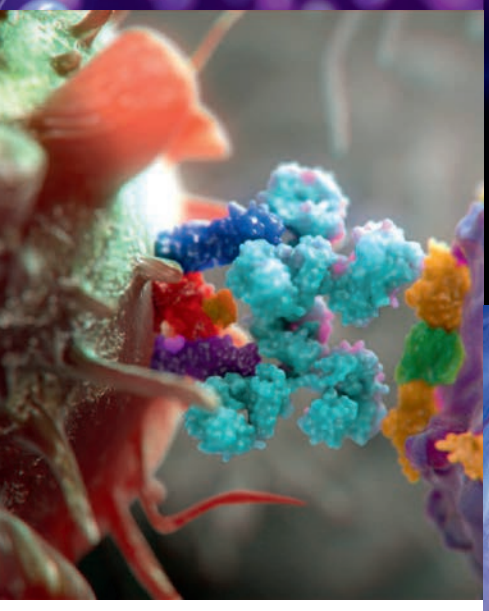
"In my initial conversations with faculty and staff at UT, I could immediately sense their excitement as they envisioned potential applications in labs and classrooms," Blausen said. "I knew then that if I made the full library permanently available, its impact could be immense. It could serve an important purpose for students' technical development."

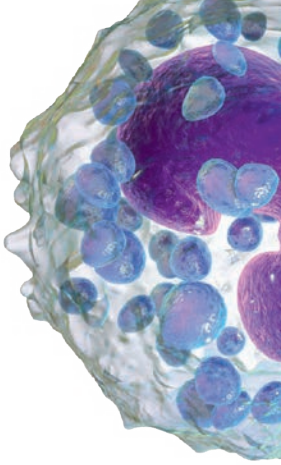
Faculty members throughout the Cockrell School have already identified courses in which students will benefit from access to the library — from tissue physiology classes that prepare mechanical engineers to develop rehabilitative technologies to drug delivery classes that aid biomedical engineers in the fight against cancer.

"Biomedical engineering requires a comprehensive, interdisciplinary knowledge not only of the technologies









A SAMPLING OF THE BEAUTIFULLY DETAILED IMAGES FOUND IN THE BLAUSEN MEDICAL LIBRARY, WHICH WILL PROVIDE UT STUDENTS WITH DEEPER INSIGHT INTO THE INNER WORKINGS OF THE HUMAN BODY.

we use to treat health-related issues but also of the biological conditions underlying those issues," said Shelly Sakiyama-Elbert, chair of the Cockrell School's Department of Biomedical Engineering. "The Blausen Library will help us provide students with the well-rounded education they need to embark on successful careers."

As the formal recipient and host of this extensive database of image and video files, the Cockrell School will also provide access to fellow colleges, schools and units across the Forty Acres.

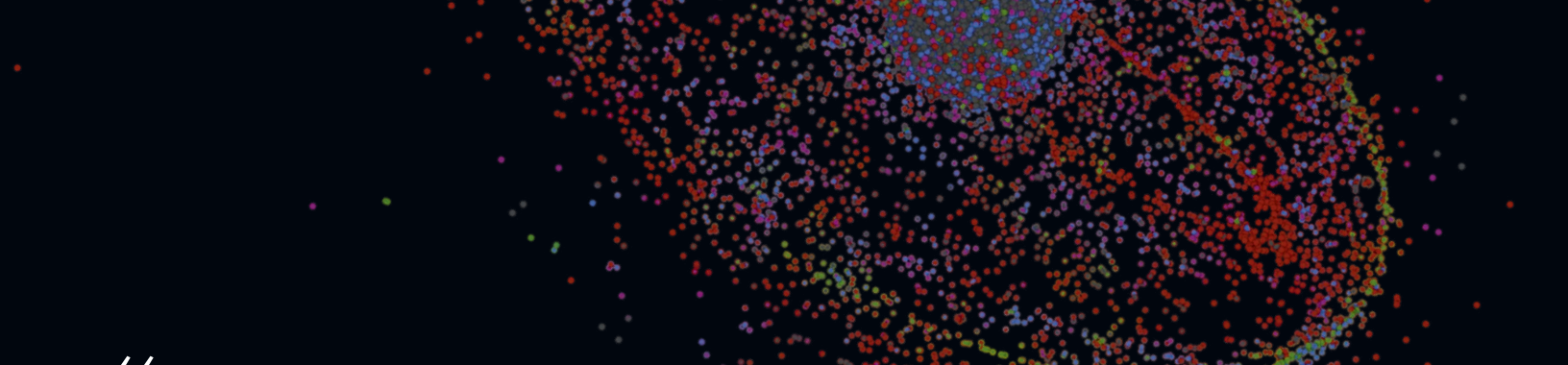
"The Blausen Library is unlike any other in the world, and we are so happy to be able to extend the benefits of this extraordinary resource to the entire UT Austin community," said Sharon L. Wood, dean of the Cockrell School. "I believe that, in sharing this collection with each other, we will also open new channels of communication that help us further establish UT Austin as a global hub for health care delivery, education and research."

In the coming years, advances in virtual reality technology are expected to further enhance the Blausen Library experience, offering opportunities for unprecedented immersion by placing students inside a "digital classroom" where they can watch animations on a large virtual screen or interact with 3D models. Blausen's team is currently exploring the potential of this new learning environment, and Texas Engineers will be among the first to set foot in it.

IN THEIR OWN WORDS

MORIBA JAH

For over a decade, Moriba Jah has been on a crusade to inform the public, along with legislators and U.S. STEM leaders, about the growth and consequences of free-floating space debris that continues to pollute our galaxy. Today, as a Texas Engineering faculty member and a subject matter expert invoked by Congress, the National Space Council and the U.S. Air Force, he has been instrumental in helping shape the dialogue around this uncharted extraterrestrial field.



"If we don't address the debris problem, we'll see more space collisions that could set our space operations, space commerce and space exploration back years. It's a real issue, and believe it or not, it affects all of us."

I HAVE ALWAYS BEEN FASCINATED BY SPACE. I was fortunate enough to get the opportunity to work for NASA fresh out of college, an experience that had a profound impact on my career and my life. And it was there that I started exploring the nature and facets of Earth's orbital environment. Even then, before companies like SpaceX and Amazon were getting into the commercial space-flight game, I was shocked to find out just how much junk—old and defunct satellites, nuts and bolts, random pieces of spacecraft and so much more—is orbiting our planet and ranging in size from tennis balls to tennis courts.

The increasing number of satellites in orbit, used for everything from weather forecasting to cell-phone signaling, are crucial components to the on-demand information revolution we're all experiencing, and seemingly benefitting from, today. But you need to know they come at a price. If we don't address the debris problem, we'll see more space collisions that could set our space operations, space commerce and space exploration back years. It's a real issue, and believe it or not, it affects all of us.

We're estimating that there are nearly 500,000 objects currently orbiting the earth, but the problem is we're tagging and monitoring only 23,000 of them. The rest are totally unaccounted for, floating out there completely untracked.

So how have we allowed all this debris to accumulate? Essentially, the commercial space sector still operates like the Wild West. Satellites and other spacecraft are launched into orbit by companies operating in a lawless jurisdiction where there is no governing body and, therefore, no official bookkeeper for all of the man-made objects in space.

The bottom line: We cannot turn our solar system into an intergalactic junkyard.

To find a solution, I've tapped experts from a variety of fields—teaming up with social scientists and anthropologists as well as engineers and physicists—to develop culturally competent behavioral knowledge graphs in tandem with our predictive and prescriptive analytics to build a system for monitoring or potentially removing space debris.

My goal is to deliver the technology and knowledge needed to create a safe, secure and operationally sustainable space domain. We have a good starting place—our research team in UT's Advanced Sciences and Technology Research in Astronautics (ASTRIA) program recently invented the ASTRIAGraph, a first-of-its-kind searchable knowledge graph for space traffic monitoring, but we have a long, long way to go. And I invite all you engineers, scientists and space enthusiasts to help me advocate for this important issue and advance the narrative. Let's solve this problem together.

Moriba Jah is an associate professor in the Department of Aerospace Engineering and Engineering Mechanics and the director of the Advanced Sciences and Technology Research in Astronautics (ASTRIA) program in the Cockrell School of Engineering. He also directs the Computational Astronautical Sciences and Technologies group in the UT Institute for Computational Engineering and Sciences and is a distinguished scholar in UT's Robert Strauss Center for International Security and Law.

→ LEARN MORE ABOUT ASTRIAGRAPH AND TRACK SPACE OBJECTS IN REAL TIME AT **BIT.LY/ASTRIAGRAPH**

PUTTING A FACE TO THE NAME

Over the past year, two extraordinary Cockrell School alumni have made transformative gifts in support of two engineering departments—Petroleum and Geosystems Engineering and Mechanical Engineering—boosting their respective resources and positioning them for success well into the future. And in recognition of the investments, both departments were officially named in their honor, in perpetuity.

THE HILDEBRAND DEPARTMENT OF PETROLEUM AND GEOSYSTEMS ENGINEERING

After earning his master's degree in petroleum engineering and his bachelor's degree in geology from UT Austin, Jeffery Hildebrand went on to found Hilcorp Energy Company, one of the largest and most successful privately held oil and natural gas exploration and production companies in the U.S.

Believing that he owes a great deal of his success to his UT professors and the education he received on the Forty Acres, Hildebrand and his wife, Mindy, who earned her bachelor's degree in management from UT's McCombs School of Business, decided that now is the optimal time to make an impact. Through their gift to Petroleum and Geosystems Engineering, the Hildebrand family provided significant resources for student and faculty initiatives and new teaching and research technologies.

"This department is already a destination for the best and brightest," Hildebrand said. "But more important than the accolades is our responsibility to put our graduates at the helm of discovery, innovation and industry leadership and to use our precious natural resources to power the world in the most effective way possible. There is no question in my mind that UT will be an outstanding steward of these resources for decades to come."

Home to the nation's top-ranked petroleum engineering program, the Hildebrand Department's alumni, faculty and students are well known throughout the energy community for their leadership, accomplishments and contributions. In addition to student and faculty support, the family's gift will establish additional academic-industry partnerships and community outreach initiatives that advance technologies, develop energy industry leaders and share the story of energy with a broader audience.

THE J. MIKE WALKER DEPARTMENT OF MECHANICAL ENGINEERING

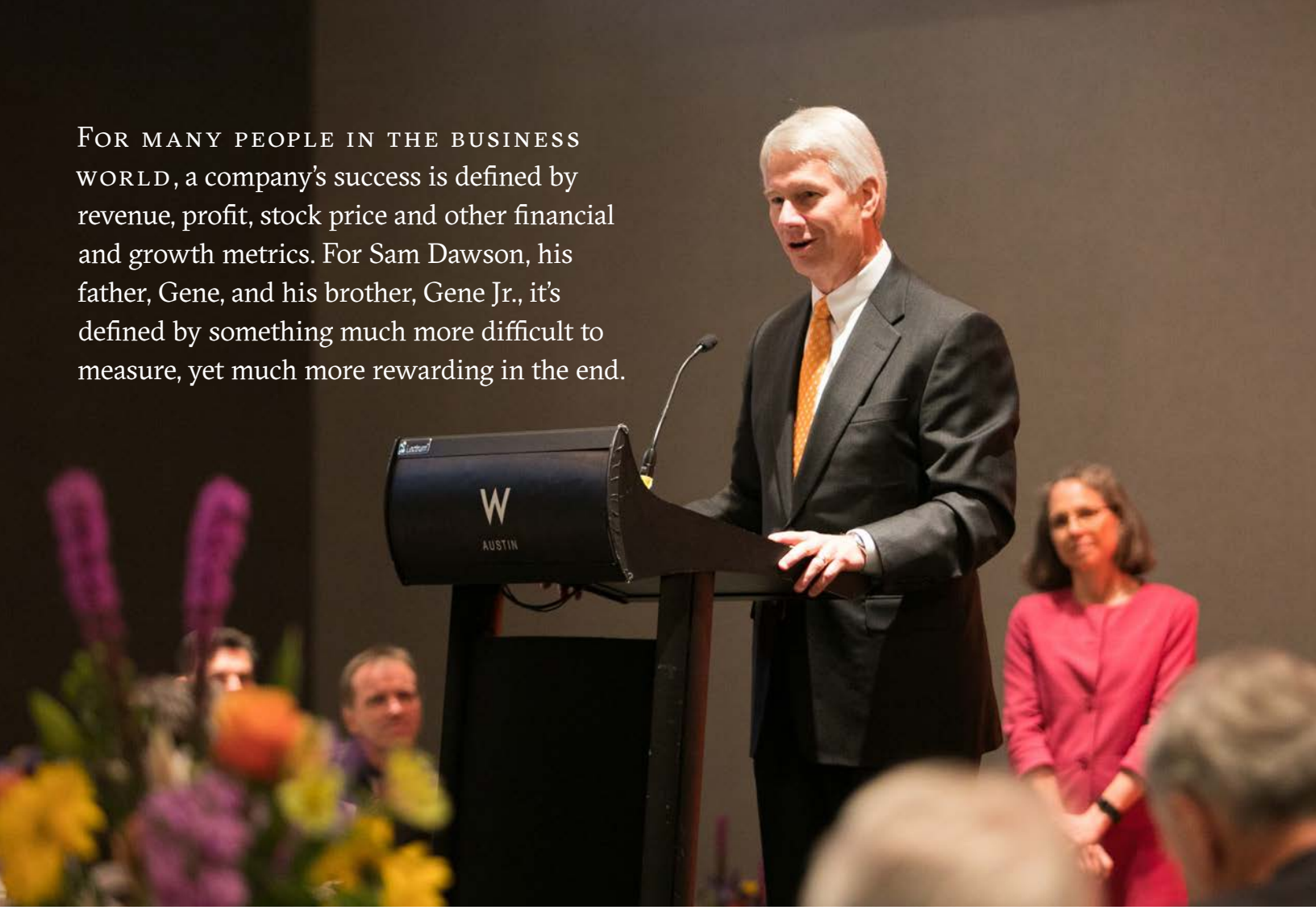
Like the Hildebrand family, J. Mike Walker believes in the value of a world-class education—and he knows that the Cockrell School can provide it. A high school valedictorian, Walker graduated at the top of his undergraduate mechanical engineering class at Texas A&M University, received a National Science Foundation fellowship to pursue his master's degree at UT Austin and earned his Ph.D. from Texas A&M with a 4.0 GPA.

Walker has translated his excellence as a student into a successful career. In 1981, Walker co-founded Dril-Quip, one of the world's leading manufacturers of offshore drilling and production equipment. When he retired from his role as chairman, president and CEO in 2011, Dril-Quip had a market cap in excess of $4 billion. And through generous gifts to the mechanical engineering departments at both UT Austin and Texas A&M, he and his wife, Donna, have made it possible for future generations to follow in his footsteps.

"My experiences at these two universities certainly helped me grow as an engineer," Walker said. "But they also taught me how to be a leader—how to collaborate on big ideas, persevere through tough challenges and bounce back from failure. My education shaped who I am today, and I want to make that same opportunity available to as many students as I can."

Students in the J. Mike Walker Department of Mechanical Engineering, which provides a top-10-ranked education for both graduate and undergraduate students, will benefit from the lab and classroom renovations, equipment upgrades, diversity initiatives and student organization support provided by the Walkers' gift.

From professorships and fellowships that support the recruitment of top faculty to seed grants that enable them to develop groundbreaking innovations, the Walkers' gift will also further strengthen the department's leadership position in key research areas.



For many people in the business world, a company's success is defined by revenue, profit, stock price and other financial and growth metrics. For Sam Dawson, his father, Gene, and his brother, Gene Jr., it's defined by something much more difficult to measure, yet much more rewarding in the end.

'OUR PURPOSE HAS TO BE ABOUT TRANSFORMING LIVES'

Sam Dawson began his career at Pape-Dawson Engineers — the prominent San Antonio-based civil engineering firm co-founded by his father, Gene — after receiving his bachelor's degree in civil engineering from UT Austin in 1983. Since then, the company has undergone tremendous growth, all while remaining true to the founding principles established by his father over 50 years ago.

"Pape-Dawson is relentlessly focused on one thing — being the most respected engineering company in Texas," said Dawson, who has served as the company's CEO since 1997. "Not the biggest. Not the richest. The most respected."

Though the company has become one of the largest engineering firms in the state, with high-profile projects ranging from Six Flags Fiesta Texas and SeaWorld San Antonio to the AT&T Center and Pearl Brewery redevelopment, Dawson believes that this success only tells half of the company's story.

"Remember that when you begin your career, there is never a job too small."

"If all we do is produce plans and reports and put projects on the ground, then we have failed as a company," he said. "We have to be bigger than that and better than that. Our purpose has to be about transforming lives, which sometimes has nothing to do with technical engineering."

The company's passionate focus on community engagement has led to Pape-Dawson's involvement in a number of philanthropic ventures, and Dawson himself has been actively engaged in many engineering societies, community and state boards, and cultural arts boards as well as the Cockrell School's Engineering Advisory Board, of which he served as chair for three years.

"The Pape-Dawson philosophy is about taking care of the people in the communities where we do business," Dawson said. "It's about helping the elderly, feeding the hungry and mentoring young students to change the trajectory of their lives and to give them a vision of what they can become. It's about making a difference."

This philosophy is shared not only by Dawson and his brother, Gene Jr., who has served as president since 1997, but also by their many employees across the state. For Dawson, hiring the right people has been crucial not only to Pape-Dawson's financial success but also to its ongoing mission to serve the community.

"We look for people of integrity and good character, and then we encourage them to pursue excellence without compromise in everything that they do," Dawson said. "Whether it's a telephone conversation or a personal encounter with a client, we want people walking away from Pape-Dawson saying that they were treated fairly, respectfully and honestly by a company that truly cares about the people we serve. If these core values lend themselves to growth and success as a business, that's great. But it's not the endgame."

After establishing additional offices in Austin, Houston, Fort Worth and Dallas, the company now serves clients throughout the state of Texas, providing technical expertise in land development, transportation, water resources, hydraulics and hydrology, surveying and environmental projects.

In presiding over this growth for the past two decades, Dawson and his brother have embraced the significant responsibility of leading the company that their father, Gene — who now serves as chairman of the board emeritus — started.

"My father gave up a lot to get this company off the ground, and our job is to protect his investment and honor the sacrifices he made for Pape-Dawson," Dawson said. "I never think about my name being on the door. It's my family's name."

Having received so much advice and mentorship from his father over the years, Dawson is proud to now pass the family ethos down to his own son, Taylor, who serves as vice president of land development at Pape-Dawson, as well as the many current Cockrell School students he meets when he visits the UT campus.

"I encourage our young Texas Engineers to be willing to say, 'I don't know,'" Dawson said. "Learn from anyone and everyone you meet throughout your entire career and share that knowledge with others. And remember that, when you begin your career, there is never a job too small."

Considering Pape-Dawson's impressive array of projects stretching across the state — particularly in San Antonio where Dawson was born, raised and still resides — rarely does a day go by when Dawson doesn't encounter a roadway, corporate building or public venue with his company's stamp on it.

"When you drive through and pass by projects that you've worked on, you want to know that you've done them right," Dawson said. "It's certainly exciting to see the fruits of our labor throughout our community, but those opportunities come with a great responsibility to not only represent the engineering profession well but also to represent Pape-Dawson well."

As thrilling as it is for Dawson to see the company's tangible engineering impact across the state, these projects are not the validation that he ultimately seeks.

"It's my hope that one day in the future, when people hear the name Pape-Dawson Engineers, they will say, 'I'm pretty sure they're an engineering company, but let me tell me you about the things they've done across Texas to change people's lives,'" Dawson said. "That would be a fantastic day for me."

COMING HOME

AFTER GRADUATING from the Cockrell School in 2007 with a bachelor's degree in chemical engineering, Adrianne Rosales knew that research was her passion. The next step was finding the right way to make it a fulfilling career. She went on to earn her Ph.D. from the University of California, Berkeley, in 2013—the only question remaining was whether to conduct her work on biomaterials in academia or industry.

Ultimately, the opportunity to train the next generation of engineers led Rosales down the academic path, which brought her to the University of Colorado, Boulder, as a postdoctoral research fellow. When she was recruited to return to her undergraduate alma mater as a faculty member in 2017, she knew she couldn't pass up the offer. We sat down with Rosales, an assistant professor in the Cockrell School's McKetta Department of Chemical Engineering, to talk about the importance of teaching and the significance of returning to the Forty Acres, where multidisciplinary collaboration shaped her undergraduate experience and continues to shape her career.

How did teaching influence your decision to become an engineer?

I had a really good physics teacher in high school who had a way of building confidence in his students. After one test, he pulled me aside and said, "Just so you know, the last people who did this well on this test became engineers." He talked to me at length about where they went to school and how their careers panned out, and that advice and mentorship planted the seed for me.

How did your undergraduate experience inspire you as an engineer and researcher?

I started out in both engineering and UT's Plan II honors program, and I really loved the literature and philosophy courses I was able to take. A significant part of my current job is writing research proposals and grant applications, and the skills I acquired through Plan II have been a huge help in these areas. By offering programs like Plan II and encouraging students across campus to work together on projects and ideas, UT makes it so easy to get a well-rounded education. I also like how large and diverse this community is, and I enjoyed being at a university that was so good at so many things. As an undergraduate, I had a feeling that there was no limit to what we could accomplish here in the Cockrell School. Today as a professor, I am certain of it.

Why was academia—and its combination of research and teaching—the right choice for you and your career?

I like the flexibility of doing research in academia and working on difficult problems, but I also like working with young engineers. I particularly love my interactions with undergraduates. It's so inspiring to talk to them about their lives, their career plans and how they see chemical engineering evolving in the future. Many of our students go into industry, but some are considering more nontraditional careers, too. Their optimism about the many ways they will be able to use their degrees is infectious.

Describe the experience of returning to UT Austin as a faculty member.

It means a lot to me. When I accepted my offer, [McKetta Department of Chemical Engineering chair] Tom Truskett talked about 'coming home' to the department, and that really is what it feels like. I've interacted with many professors who were here when I was a student, and connecting with them on a different level has been incredible. I'm also teaching in the same classrooms from my undergraduate days, so I feel a great degree of personal connection with the students. Ten years ago, I was literally where they are now!

How has the growing collaborative environment in the Cockrell School enriched your work?

My research focuses on designing ex-vivo (on the benchtop) environments that better mimic the human body, which has applications in a number of areas. For example, if you can screen drugs in an environment that more closely resembles the body, you can get more accurate results. Since my work pulls not just from concepts in chemical engineering but also from materials, biology and other fields, it's great to walk across the street and talk to colleagues in biomedical engineering or molecular biosciences and get their input. The UT community is so vibrant and collaborative.

What is the most important advice you pass on to your students?

These students are so smart. You can give them almost any math problem, and they can probably figure it out on their own. But what I encourage them to think about is the open-ended problem where there is no one right answer. For some engineering students—and this was true for me, too—such a concept can be very frustrating because you've been trained in high school to always find that one right answer. But, with engineering, things are more complex. You have to see the big picture, work with mentors and teams, and be willing to take risks and try multiple approaches. You can't get discouraged if things don't work out because sometimes the problems themselves are dynamic and the best solution changes with new information. That's what it means to be an engineer.

The University of Texas at Austin
Cockrell School of Engineering

10 WAYS TO STAY CONNECTED

As a graduate of the Cockrell School of Engineering, you are a member of one of the nation's largest and best professional networks, with over 70,000 fellow alumni living and working around the world. In just 10 easy steps, you can re-establish contact with former classmates, connect with your favorite professors, mentor current students, access exclusive resources and help strengthen the Texas Engineering community for decades to come. Get active and get involved — starting today.

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[1] Update your contact information and stay connected. [2] Use the Engineering Career Assistance Center to keep building your career. [3] Activate your Texas Exes membership. Your first year is free. [4] Network with 70,000+ Texas Engineering alumni in our LinkedIn community. [5] Stay in the know by following @CockrellSchool on Twitter, Instagram and Facebook. [6] Attend an engineering alumni event (just update your contact info and you'll receive invitations). [7] Email your favorite professors once a year (remember, it's important to keep in touch). [8] Sign up for opportunities to mentor future UT students. [9] Give back once a year—whether $1 or $100—to the area of the school that means the most to you. [10] Show your Texas Engineering pride!

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ALUMNI NOTES

Texas Engineering alumni lead industries, launch companies and help develop solutions that improve lives around the world. We're proud to share just a few of their accomplishments from the past year.

1970s

Michael Mahaffey (B.S. ASE 1973) was recognized as one of 10 Engineers of the Year by L3 Technologies, where he has been conducting numerous flight tests of state-of-the-art ISR systems and developing cutting-edge signal processing algorithms for several major national ISR platforms.

Mark Richards (B.S. ES 1977) was named provost of the University of Washington. Previously, he was a professor of Earth and planetary science at the University of California, Berkeley.

1980s

Alan Stern (M.S. ASE 1980) received the 2018 Lowell Thomas Award in Engineering Exploration from The Explorers Club, an award that celebrates people who have engineered groundbreaking expeditions and expeditionary science. Stern is the lead principal investigator of NASA's New Horizons mission to explore the Pluto system.

Susan C. Howes (B.S. PE 1982) received the Society of Petroleum Engineers (SPE) Honorary Membership, which is given to individuals for outstanding service to SPE and/or in recognition of distinguished scientific or engineering achievement in fields encompassed in SPE's technical scope. Honorary Membership is the highest honor SPE confers and is limited to .1 percent of SPE's total membership.

David C. Baldwin (B.S. PE 1985) received the 2018 Hoover Medal from the American Society of Mechanical Engineers. The medal is awarded for "outstanding extra-career service by engineers to humanity." Baldwin joins the ranks of other impressive winners, including U.S. Presidents Dwight D. Eisenhower and Jimmy Carter.

Mike Krames (B.S. ECE 1989) was named an IEEE Fellow for leadership in gallium-nitride-based LED physics and its commercialization.

1990s

U.S. Air Force Brig. Gen. Jeannie Leavitt (B.S. ASE 1990) assumed command of the Air Force Recruiting Service in June 2018.

Hongming (Melissa) Chen (B.S. ChE 1992) was elected to the National Academy of Engineering for her contributions to the research, development and translation of drug delivery technologies.

Nimmi Ramanujam (Ph.D. BME 1995), who is a biomedical engineering professor at Duke University, was named a fellow of the National Academy of Inventors for her work in photonics-based health technologies.

2000s

Tyler Ley (M.S. CE 2002, Ph.D. CE 2007), a civil engineering professor at Oklahoma State University, received the prestigious Oklahoma Medal for Excellence in Teaching from the Oklahoma Foundation for Excellence.

Pooja Jesrani (B.S. ASE 2007) was named a NASA flight director, joining a group of fewer than 100 people since NASA's first flight director in 1958. She will lead teams of flight controllers, research and engineering experts and support personnel around the world to make real-time decisions to keep astronauts safe in space.

John Slater (Ph.D. BME 2008), an assistant professor at the University of Delaware, received a National Science Foundation CAREER Award to study microstrokes and the clots that cause them.

2010s

Kelly Moynihan (B.S. BME 2012), an associate at Third Rock Ventures, was named one of Boston Business Journal's 40 Under 40, an honor given to young executives, entrepreneurs and innovators in Boston.

David Waters (B.S. BME 2012) was one of five to be named a Fannin Innovation Studio Entrepreneurship Fellow, a two-year full-time fellowship for scientists, physicians and engineers who have an entrepreneurial interest in drug or medical device development.

Zachary Smith (Ph.D. ChE 2014) won a U.S. Department of Energy Early Career Award, which is designed to bolster the nation's scientific workforce by providing support to exceptional researchers during early career years.

Yogashri Pradhan (B.S. PE 2015) won the Society of Petroleum Engineers (SPE) Young Member Outstanding Service Award, which recognizes contributions to and leadership in the public and community arenas, as well as in SPE, the profession and the industry, by a member under the age of 36.

REX TILLERSON HEADLINES COCKRELL SCHOOL'S INAUGURAL DISTINGUISHED LECTURE

Rex W. Tillerson says he never intended to become chairman and CEO of ExxonMobil. But, at some point, he said, "you realize that you have the capacity to do more and contribute more, not just for your own personal benefit but for your organization."

As the inaugural speaker of the new Cockrell School of Engineering Distinguished Lecture Series, Tillerson discussed the topic of leadership and ethics in a global society. He talked about his ascension at ExxonMobil, emphasized the importance of energy innovation, especially in Texas, and reminisced on his time as a Texas Engineering student.

And one theme was central throughout his lecture and Q&A session—integrity.

"Leadership is not a position or title," he told the crowd of students, faculty, UT leaders and invited guests. "Becoming a leader is what happens to those who embrace a life of integrity."

The Distinguished Lecture Series, which aims to bring influential technology, business and policy leaders from around the world to the Cockrell School, offers students an opportunity to hear and learn from successful individuals at the top of their fields. The event is led by the school's Student Engineering Council and supported by the Texas Engineering Executive Education division.

The inaugural event was held on October 25, in the James J. and Miriam B. Mulva Auditorium in the school's Engineering Education and Research Center.

The Q&A session with student leaders elicited memories from Tillerson's time on campus and thoughts on being an engineer who pivoted to executive roles.

"I think almost all of you appreciate that while you're learning a lot of technical specifics in the discipline you're studying, and that is obviously crucial for you to go out and undertake the things that you're going to do, what engineering really teaches you is a way of thinking."

Tillerson graduated from UT Austin in 1975 with a degree in civil engineering and joined Exxon Co., U.S.A. the same year as a production engineer. He spent his entire career with ExxonMobil until holding the position of U.S. Secretary of State under the Trump administration until March 2018. In 2013, he was elected to the National Academy of Engineering.

Tillerson has been a dedicated supporter of the Cockrell School and UT Austin for many years. He serves as a member of the school's Engineering Advisory Board, the UT Development Board and the UT System Chancellor's Council. He was named a Distinguished Engineering Graduate of the Cockrell School in 2006 and a UT Austin Distinguished Alumnus in 2007.

"This new lecture series offers engineering students an amazing opportunity to learn from and meet some of the most established leaders in their fields," said Aashima Garg, president of the Student Engineering Council. "We are excited to collaborate with Cockrell School leadership to bring distinguished speakers to our campus, and we were honored to welcome Rex Tillerson back to the Forty Acres."

→ VIEW THE FULL LECTURE AT
BIT.LY/TILLERSON-LECTURE-VIDEO

PHOTO: UNIVERSITY OF TEXAS BUILDINGS COLLECTION, ALEXANDER ARCHITECTURAL ARCHIVES, UNIVERSITY OF TEXAS LIBRARIES

TEXAS ENGINEERING: THEN & NOW

THE CLASSROOM

For its first few decades of existence, UT Engineering occupied the "Old Engineering Building" (now the Dorothy Gebauer Building) right next door to the Tower. The classrooms inside, like the drawing lab pictured above from the early 1900s, reflected an educational experience vastly different from that of the modern age. The learning environments of today, such as chemical engineering professor Brian Korgel's virtual-reality-enhanced materials science class pictured below, are designed for group collaboration, hands-on experimentation and the development of specific skills needed for the jobs of the future.

The University of Texas at Austin
Cockrell School of Engineering

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RETURN SERVICE REQUESTED

A HOUSE UNLIKE ANY OTHER

THIS PAST SUMMER, THE COCKRELL SCHOOL OF ENGINEERING hosted the nation's largest-ever indoor air quality experiment in the one-of-a-kind UTest House, a high-tech testing facility designed to replicate a family home. Aimed at identifying key causes of pollution that can result in health problems, the monthlong experiment, called HOMEChem, was funded by the Alfred P. Sloan Foundation and brought leading researchers from 13 universities to the UT campus. Among the activities included in the experiment was a holiday dinner simulation, which analyzed the environmental impacts that cooking, cleaning and socializing have within a confined space.

WHAT STARTS HERE CHANGES THE WORLD

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