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NOBEL PRIZE

Engineering professor wins
2019 award in chemistry

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AMERICAN INGENUITY

Alumnus Gary Thomas makes
his mark on the UT Campus

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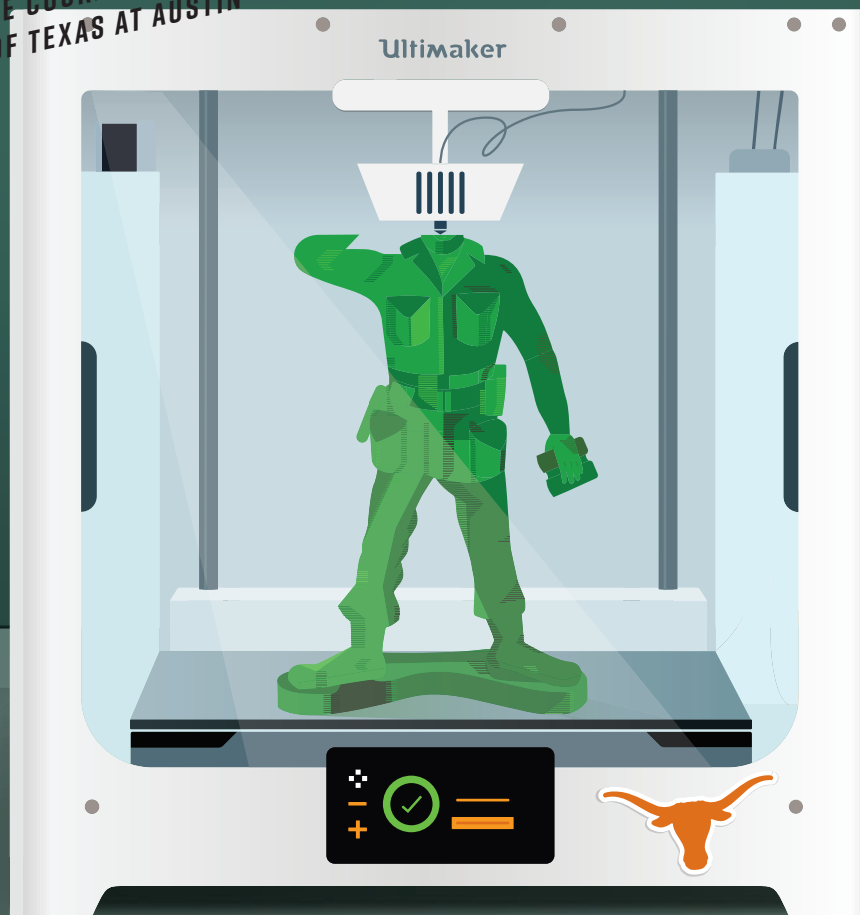
WEARABLE WORLD

Creating incentive-driven
health technologies

TEXAS ENGINEER

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

2019
2020

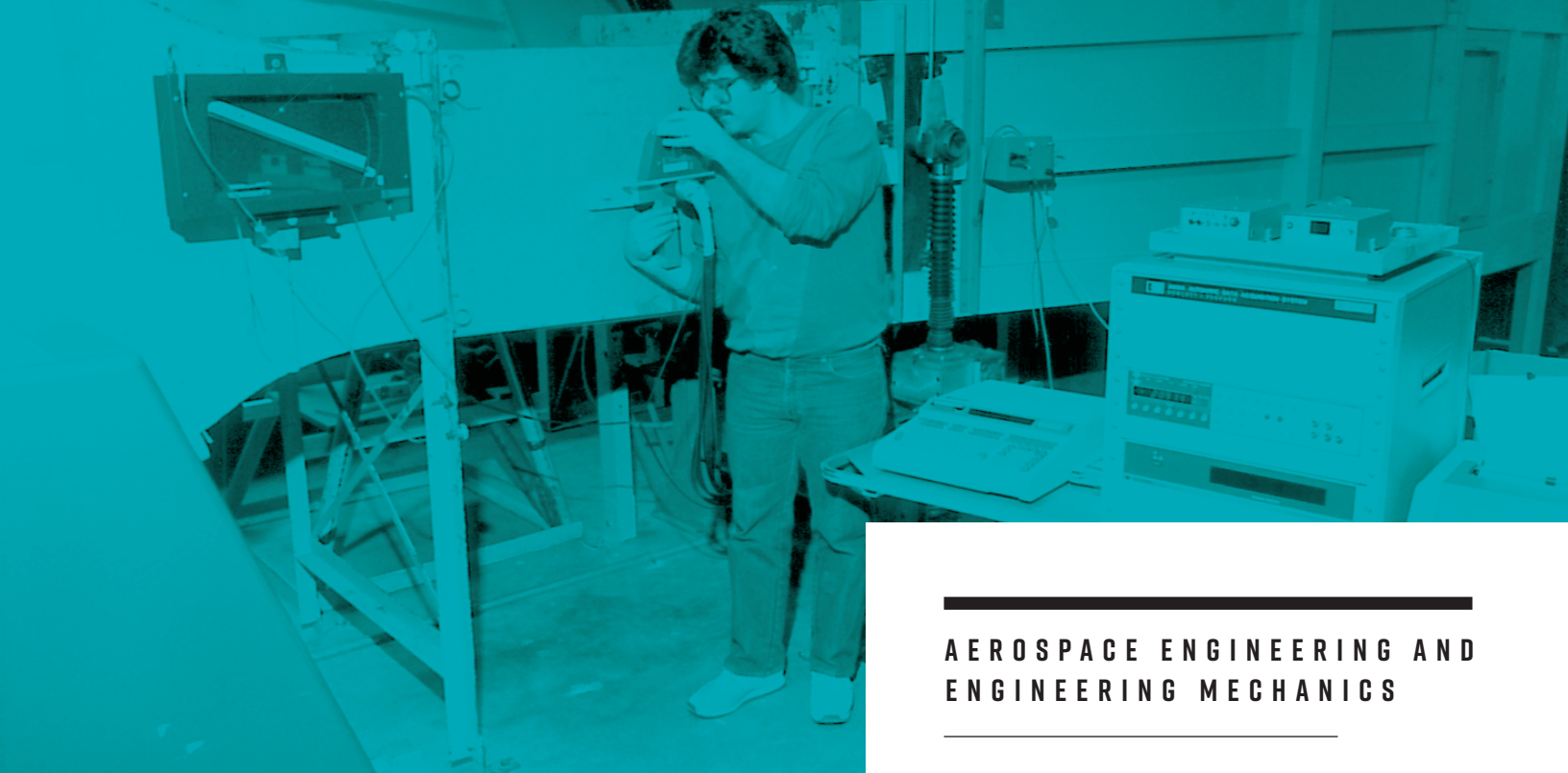


THE FUTURES COMMAND

The U.S. Army's bold new Austin-based operation has arrived,
and UT Engineering is at the center of it all.

ALUMNA **AASHIMA GARG** CHALLENGED WHAT IT MEANS TO BE A "BRO" IN MALE-DOMINATED FIELDS IN HER TEDXUTAUUSTIN TALK. LEARN ABOUT ANOTHER INCLUSIVE EVENT AASHIMA HELPED TO ORGANIZE FOR COCKRELL SCHOOL STUDENTS ON PAGE 32.





AEROSPACE ENGINEERING AND ENGINEERING MECHANICS

EARLIER THIS YEAR, the Department of Aerospace Engineering and Engineering Mechanics moved from the old W.R. Woolrich Laboratories building to the newly renovated Aerospace Engineering Building, a modern facility designed with collaborative project areas, cutting-edge labs and high-tech classrooms. Among the building's most significant upgrades is a new wind tunnel lab that can facilitate a wider range of experiments. And while its predecessor was slow and analog (above image), the new tunnel is fully digital and can reach velocities greater than 70 miles per hour. [E](#)

TEXAS ENGINEERING: THEN & NOW




TEDx TAKES OVER TEXAS ENGINEERING

IN ITS SECOND YEAR, TEDxUTAustin TOOK OVER THE COCKRELL SCHOOL'S James J. and Miriam B. Mulva Auditorium for a sold-out event titled "Origins of Tomorrow," bringing UT students and faculty members together to discuss topics ranging from social engineering to internet meme culture.

The daylong event, which included talks, breakout sessions and artistic performances, was launched by a group of students looking for an outlet to spread innovative ideas and connect a community within Austin that was eager to grow their impact on the world. While the event is hosted and largely led by Texas Engineering students, interdisciplinary collaboration has been fundamental to the success of the event.

"The holistic nature and interconnectedness of this platform can only be fully explored through the creative ingenuity of a diverse group of students," said Samyukta Singh, TEDxUTAustin president and a biology/premed student.

This year's event focused on initiatives that bridge the gap between modern and future societies. While each year of TEDxUTAustin tackles a new theme, the series has an overarching goal of creating an inclusive space where novel ideas transform thinking.

"TEDxUTAustin is about uniting minds and creating solutions to the world's biggest challenges," Singh said. "It is about forming endless connections, changing perspectives and reimagining the future." 

WATCH

View all of the 2019 TEDxUTAustin talks on YouTube: bit.ly/2IXsckz





LEADERSHIP

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Dean

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*Executive Director of
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COLLABORATION IS NOT JUST A BUZZWORD

When you work on a university campus, in the tech industry, or at a new startup, there are certain words that you are likely to hear all the time. Innovation, ideation, incubation—the list goes on and on. But there is one word—*collaboration*—that we hear more frequently than all the rest. And there is a reason: collaboration produces results. It is not just a buzzword.

In the Cockrell School of Engineering, multisector research collaboration has become the key to unlocking breakthroughs that can be applied immediately in the real world. Strategic partnerships with organizations like the Army Futures Command, the Portuguese Foundation for Science and Technology, British Petroleum, and Lockheed Martin are bringing Texas Engineers together with industry and government experts to tackle big yet pragmatic problems, enabling our researchers to make a greater impact on society than ever before.

This issue of *Texas Engineer* magazine shines a light on these collaborations while celebrating the successes of the students, faculty, staff and alumni that make up our extraordinary community. I hope you enjoy this small sample of the amazing things happening in the Cockrell School.

Hook 'Em Horns!



Sharon L. Wood, Dean

Cockrell Family Chair in Engineering #14

Jack and Beverly Randall Dean's Chair for Excellence in Engineering

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The University of Texas at Austin

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QUESTIONS OR COMMENTS?

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JOINING FORCES

UT FORGES NEW PARTNERSHIP
WITH ARMY FUTURES COMMAND



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HOW INTEGRATED
DATA DRIVES
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NEW ROCKET
ENGINEERING
PROGRAM
LAUNCHES
THANKS TO GIFT OF
\$1,000,000
FROM FIREFLY ACADEMY

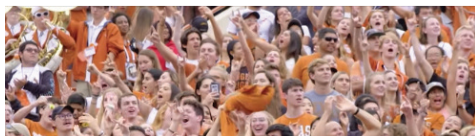
THIS YEAR SO FAR



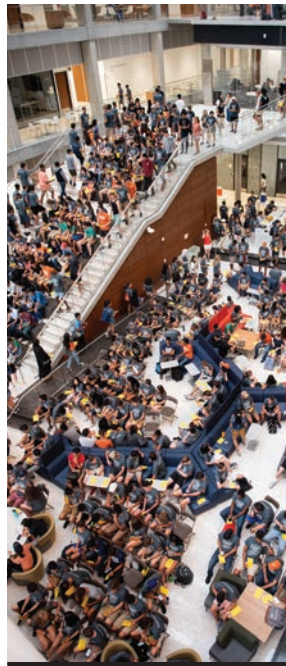
Cockrell School of Engineering - UT Austin
April 5

#TexasEngineers, THANK YOU! Together, we raised more than \$96K during #UT40for40, SHATTERING our goal & providing funding to so many areas of need. We couldn't have done it without you all.

Hook 'em! <http://bit.ly/ENGR40for4019>



ONE
OF THE **LARGEST-EVER**
INCOMING TEXAS
ENGINEERING CLASSES **8,104**
STUDENTS



NEW AEROSPACE
ENGINEERING
BUILDING OPENS



JOHN MCKETTA JR.
(1963-1970)



EARNEST GLOYNA
(1970-1986)



HERBERT H. WOODSON
(1986-1996)

WE CELEBRATED THE
LIVES AND LEGACIES
OF THREE FORMER DEANS,
EXTRAORDINARY LEADERS
WHO PASSED AWAY LAST WINTER.

FACULTY
MEMBERS
GARNER
NATIONAL,
INTERNATIONAL
RECOGNITION:

TODD HUMPHREYS

PRESIDENTIAL EARLY CAREER AWARD FOR SCIENTISTS AND ENGINEERS

SHELLY SAKIYAMA-ELBERT

ELECTED PRESIDENT OF SOCIETY OF BIOMATERIALS

NICHOLAS PEPPAS

FOREIGN MEMBER OF CANADIAN ACADEMY OF ENGINEERING

JON OLSON, ZOYA HEIDARI, CARLOS TORRES-VERDIN

HONORED BY SOCIETY OF PETROLEUM ENGINEERS

ADELA BEN-YAKAR & LYDIA CONTRERAS

FELLOWS OF AMERICAN INSTITUTE FOR MEDICAL AND BIOLOGICAL ENGINEERING

FERNANDA LEITE

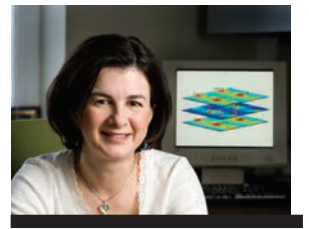
FELLOW OF IASPIRE LEADERSHIP ACADEMY FOR STEM
FACULTY FROM UNDERREPRESENTED BACKGROUNDS



CHRISTINE JULIEN
NAMED NEW ASSISTANT DEAN FOR
DIVERSITY, EQUITY & INCLUSION
IN THE COCKRELL SCHOOL

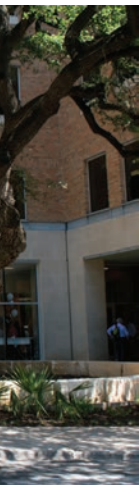


ODEN INSTITUTE FOR
COMPUTATIONAL ENGINEERING AND
SCIENCES HOSTS THEIR FIRST-EVER
WORKSHOP FOR NATION'S TOP
WOMEN GRADUATE STUDENTS &
POSTDOCS PURSUING ACADEMIC
AND RESEARCH CAREERS



DIANA MARCULESCU
NAMED NEW CHAIR
OF ELECTRICAL &
COMPUTER ENGINEERING

- SERVED ON FACULTY
AT CARNEGIE MELLON
UNIVERSITY FOR
NEARLY 20 YEARS
- PIONEER IN ENERGY-
AWARE COMPUTING
- FELLOW OF INSTITUTE
OF ELECTRICAL AND
ELECTRONICS ENGINEERS
AND DISTINGUISHED
SCIENTIST OF ASSOCIATION
FOR COMPUTING
MACHINERY



ALUMNUS PATRICK CODDOU
STRIKES A DEAL ON
“SHARK TANK”
WITH VETERAN “SHARK”
ROBERT HERJAVEC
FOR HIS AEROSPACE-GRADE
RAZOR COMPANY, SUPPLY



NEW RESEARCH FUNDING FOR HIGH-IMPACT AREAS

\$8,000,000
FOR WATER-BASED ENHANCED
OIL RECOVERY EFFORTS

U.S. DEPARTMENT OF ENERGY

\$1,500,000
TO EXPLORE THE
FOUNDATIONS OF DATA SCIENCE

NATIONAL SCIENCE FOUNDATION

\$1,000,000
TO DEVELOP GEOTHERMAL
ENERGY TECHNOLOGIES

U.S. DEPARTMENT OF ENERGY

\$550,000
TO DEVELOP NEW WAYS TO
IDENTIFY HEART ATTACK RISK

NATIONAL SCIENCE FOUNDATION

\$200,000
FOR PEDIATRIC BRAIN RESEARCH

CANCER PREVENTION & RESEARCH
INSTITUTE OF TEXAS

TEXAS
INVENTIONWORKS
STUDENTS DEVELOP
INNOVATIVE TOOLS
TO ADDRESS BIG
CHALLENGES
IN HEALTH

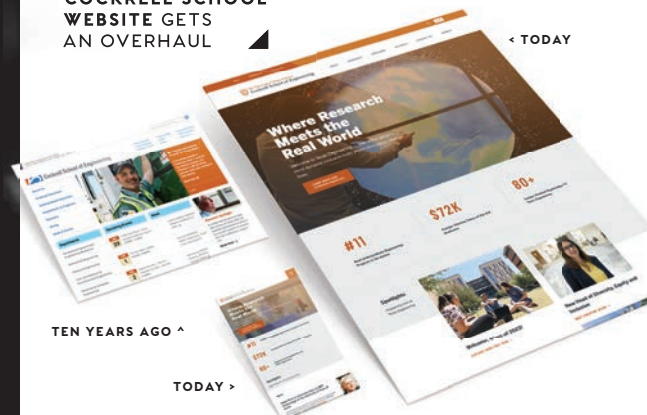


ELECTRICAL & COMPUTER ENGINEERING ADVISERS WIN

2019 NACADA OUTSTANDING ADVISING PROGRAM AWARD

ADVISING TEAM: VERONICA VASQUEZ, SHARON
BRESSETTE, NIKKI TINNETTE, MELISSA ARMSTRONG,
YESENIA ROMAN, MELANIE GULICK, BARRY
LEVITCH, ABI GARZA, ISIANA RENDON

COCKRELL SCHOOL
WEBSITE GETS
AN OVERHAUL



THAT'S THE
ENGINEERING
EDUCATION &
RESEARCH CENTER

CREATING A PLATFORM FOR CHANGE

**5 QUESTIONS WITH
ENGINEERING STUDENT
MAMADOU BALDE —→**

THE COCKRELL SCHOOL
OF ENGINEERING



THE UNIVERSITY OF TEXAS
AT AUSTIN

GROWING UP IN GUINEA, WEST AFRICA, Mamadou Balde loved solving the riddles his father would give to him at the dinner table. Though the more challenging problems took weeks to solve, Mamadou never gave up—a trait that has helped him overcome. We sat down with Mamadou to learn more about his plans for the future, his passion for helping others and his entrepreneurial pursuits on behalf of our most underrepresented communities.

I'm sure you considered many options for college. Why did you choose UT?

UT was one of the first schools I visited. I participated in a week-long business camp on campus during the summer after my junior year of high school, and I thought it was very welcoming to students like me who come from very little but believe we can change the world. Since enrolling, my peers have been very supportive and the two student organizations I've joined—the National Society of Black Engineers (NSBE) and the American Institute of Chemical Engineers (AIChE)—are committed to similar principles of personal and professional growth through support. I ultimately chose to major in chemical engineering because of the variety of career options that the field offers.

What is MamBa Inspire Co., and what motivated you to launch it?

Everyone has their own story to tell. When I first arrived at UT, I thought my story was especially unique but I soon realized it actually wasn't. Many students must overcome their own challenging obstacles, and their stories just fascinate me. In 2015, I had an idea for a motivational speaking project that gives people a platform to their share stories to help change the diversity and inclusion conversation and hopefully inspire more people to pursue their dreams.

With the help of my good friend Khalid Osman, a Ph.D. candidate in construction

engineering and project management, MamBa Inspire Co. was born. Currently, MamBa airs two podcasts—"You Are Not Alone," in which we recruit underrepresented minority students to talk about their experiences overcoming adversity, and "You Can Do It," which features faculty members who share their career experiences in higher education.

The future of MamBa has changed since its initial debut. My goal was to build an organization that would become my legacy after I graduate but it really is my passion project—it makes me happy. I've been developing the content and message each day in order to be in a position to sustain it's success and I see myself continuing to do so after graduation, wherever life may take me.

Why do you feel it's so important for students and faculty—especially those who come from our underrepresented communities—to share their stories?


Sharing stories connects people. Stories provide a platform that facilitates deeper understanding, conversation and comradery. Students hold faculty on a pedestal and believe that in order to pursue a career in higher education, their college experience has to be flawless. They are smart, experts in their fields and essentially unattainable. Many people do not realize that faculty are

just people like everyone else. When faculty share their stories, they become more relatable to students. Similarly, when accomplished students share their stories, they can motivate students who are in the thick of it. Stories narrate the past but that story can be the foundation for someone else's future.

How has your engineering education influenced your work at MamBa and vice versa?

My engineering education at UT has opened up opportunities for me that I never thought would be possible. While MamBa Inspire allows me to take a break from my studies, I wouldn't have had the opportunities to connect with such intelligent students and faculty had I not chosen this school. Through UT, I've expanded my global perspective by studying abroad in Barcelona, interned at both LyondellBasell Refinery and Chemicals and ExxonMobil, and co-founded a nonprofit organization called the Women's Relief Initiative, which provides menstrual pads to women in underdeveloped countries. Basically, I just really enjoy helping people. Whether it's through chemical engineering or MamBa Inspire, I find it an essential part of building character through education.

What is your plan after graduation? Do you have a dream job or opportunity that you're aiming for?

My ultimate goal is to go to medical school and become a doctor like my father. My father is my hero, and I grew up watching him spend hours helping people as a physician, community leader and family man. I think that is where I get my passion for helping people, and I would like to follow in his footsteps. I want a career where every day is different—where I can come home and tell my kids about the lives I've touched. I will most likely choose orthopedics or trauma. 

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](#)





INVENTING THE RECHARGEABLE WORLD

Texas Engineering's Lithium-Ion Battery Pioneer Wins Nobel Prize in Chemistry

JOHN GOODENOUGH has seen a lot of change in his 97 years. When he began his career in 1952, power tools only had gasoline engines, computers were as big as buses and cell phones were the stuff of science fiction. He couldn't have known at the time that his work would enable the creation of portable electronics and eventually land in the pockets of billions of people across the globe.

Goodenough's work developing the lithium-ion battery has changed our lives forever, and yet he somehow remains modest about his discovery — even after being awarded the 2019 Nobel Prize in Chemistry.

"Live to 97 and you can do anything," he said. "I'm honored and humbled to win the Nobel Prize. I thank all my friends for the support and assistance throughout my life."

When the Nobel Foundation announced on October 9 that the prize in chemistry would go to Goodenough — jointly with Stanley Whittingham of the State University of New York at Binghamton and Akira Yoshino of Meijo University — the entire UT campus was abuzz. The prize is a distinction that makes anyone proud to be a Longhorn.

"Billions of people around the world benefit every day from John's innovations,"

“Live to 97 and
you can do
anything.”

—JOHN GOODENOUGH
NOBEL LAUREATE



said Gregory L. Fenves, president of The University of Texas at Austin and former dean of the Cockrell School. “In addition to being a world-class inventor, he’s an outstanding teacher, mentor and researcher. We are grateful for John’s three decades of contributions to UT Austin’s mission.”

Goodenough, who was born in 1922, identified and developed the critical cathode materials that provided the high-energy density needed to power electronics like mobile phones, laptops and tablets, as well as electric and hybrid vehicles. His work ultimately initiated the worldwide wireless revolution. In 1979, he showed that by using lithium cobalt oxide as the cathode of a lithium-ion rechargeable battery, it would be possible to achieve a high density of stored energy with an anode other than metallic lithium. This discovery led to the development of carbon-rich materials that allow for the use of stable and manageable negative electrodes in lithium-ion batteries.

“John is an extraordinary man and engineer, and I am delighted that his world-changing work is being recognized with the Nobel Prize,” said Cockrell School Dean Sharon L. Wood. “Everyone in the Texas Engineering community — our faculty, staff, students and alumni around the

world — are proud of his accomplishment and inspired by the example he has set.”

Goodenough began his career at the Massachusetts Institute of Technology’s Lincoln Laboratory in 1952, where he laid the groundwork for the development of random-access memory (RAM) for the digital computer. After leaving MIT, he became professor and head of the Inorganic Chemistry Laboratory at the University of Oxford. During this time, Goodenough made the lithium-ion discovery. In 1986, he joined UT Austin, where he serves as the Virginia H. Cockrell Centennial Chair of Engineering in the Cockrell School. He holds faculty positions in the Walker Department of Mechanical Engineering and the Department of Electrical and Computer Engineering.

Goodenough received a bachelor’s degree in mathematics from Yale University in 1944 and holds a doctorate in physics from the University of Chicago. He is the recipient of numerous national and international

honors, including the Japan Prize, the Enrico Fermi Award, the Charles Stark Draper Prize and the National Medal of Science.

At 97 years old, the quick-witted professor still comes to work every day. You can hear his infectious laugh reverberate through the halls of Texas Engineering buildings. He and his team of students and researchers continue to push the boundaries of materials science with the goal of inventing more sustainable and energy-efficient battery materials.

A better battery may be on the horizon, but John Goodenough’s work laid the foundation. Without it, our world would be a much less connected, informed and sustainable place.

In the words of the Nobel Foundation, about the recipients, “They created a rechargeable world. Through their work, they have created the right conditions for a wireless and fossil fuel-free society, and so brought the greatest benefit to humankind.” **TE**

Goodenough joins physicist Steven Weinberg as one of two current Nobel laureates at UT Austin. Weinberg won the prize in 1979 for contributions to the theory of the unified weak and electromagnetic interaction between elementary particles. Two other UT Austin professors, both now deceased, also won Nobel Prizes: Hermann J. Muller in medicine and physiology (1946) and Ilya Prigogine in chemistry (1977). Alumnus J.M. Coetzee won the Nobel Prize in literature (2003). Two UT Austin alumni have also won Nobel Prizes during the past two years, Michael Young and Jim Allison, who respectively won the prize for medicine or physiology in 2017 and 2018.

I'm 'proud' to be a first gen because...

I will help my family...

I made my family proud!

NAVIGATING THE 'HIDDEN CURRICULUM'

FOR FIRST-GENERATION STUDENTS, THE UNWRITTEN RULES AND EXPECTATIONS OF HIGHER EDUCATION CAN PRESENT REAL CHALLENGES

A STUDENT'S TRANSITION FROM HIGH SCHOOL TO COLLEGE is typically an exciting time for families. While moving their kids into residence halls and reviewing busy course schedules, parents often reminisce on their own college days, passing along invaluable wisdom in the process. Although the transition may be stressful for students, they can usually fall back on the advice and support of their family members, many of whom have already lived through the highs and lows of the college experience. But what if they haven't? What if college is a complete unknown?

For first-generation students — who come from families in which neither parent or guardian has a four-year degree or higher from a college or university — this can be a

daunting reality, and the transition from high school to college comes with the added pressure of learning a new kind of language — a collegiate jargon — completely on their own.

First-generation students don't have the luxury of hand-me-down wisdom, which has come to be known as the "hidden curriculum" of social and academic norms crucial to academic success in college. What may be ingrained knowledge for students whose parents graduated from a four-year university may be the greatest obstacle for students who are the first in their families to navigate the challenges of higher education.

With the Cockrell School of Engineering's recent rise in first-generation enrollment — a historic 67% increase from 2018 to 2019 — it is boosting its commitment to helping first-generation students unjumble the jargon and master this hidden curriculum.

"25 years ago, new UT engineering students attending orientation were told, 'Look

go to UT. / be

I am awesome.

be able to
a difference.

awesome!!!

you can do it.

I am proud of doing what I can.

Education
is a RIGHT.

I'm lucky to have the opportunity that my parents worked so hard to give me. ♥

I will be able to make a difference and provide my hardworking parents with a better life. ♥

college!

I'M PROUD OF ALL OF YOU! ♥

to your left and right — one of these people won't graduate,” said Sharon L. Wood, dean of the Cockrell School. “That is no longer the case. Through our student success initiatives and dedicated support team, we have shifted the focus from weeding students out to helping every student — no matter who they are or where they come from — succeed and reach their full potential.”

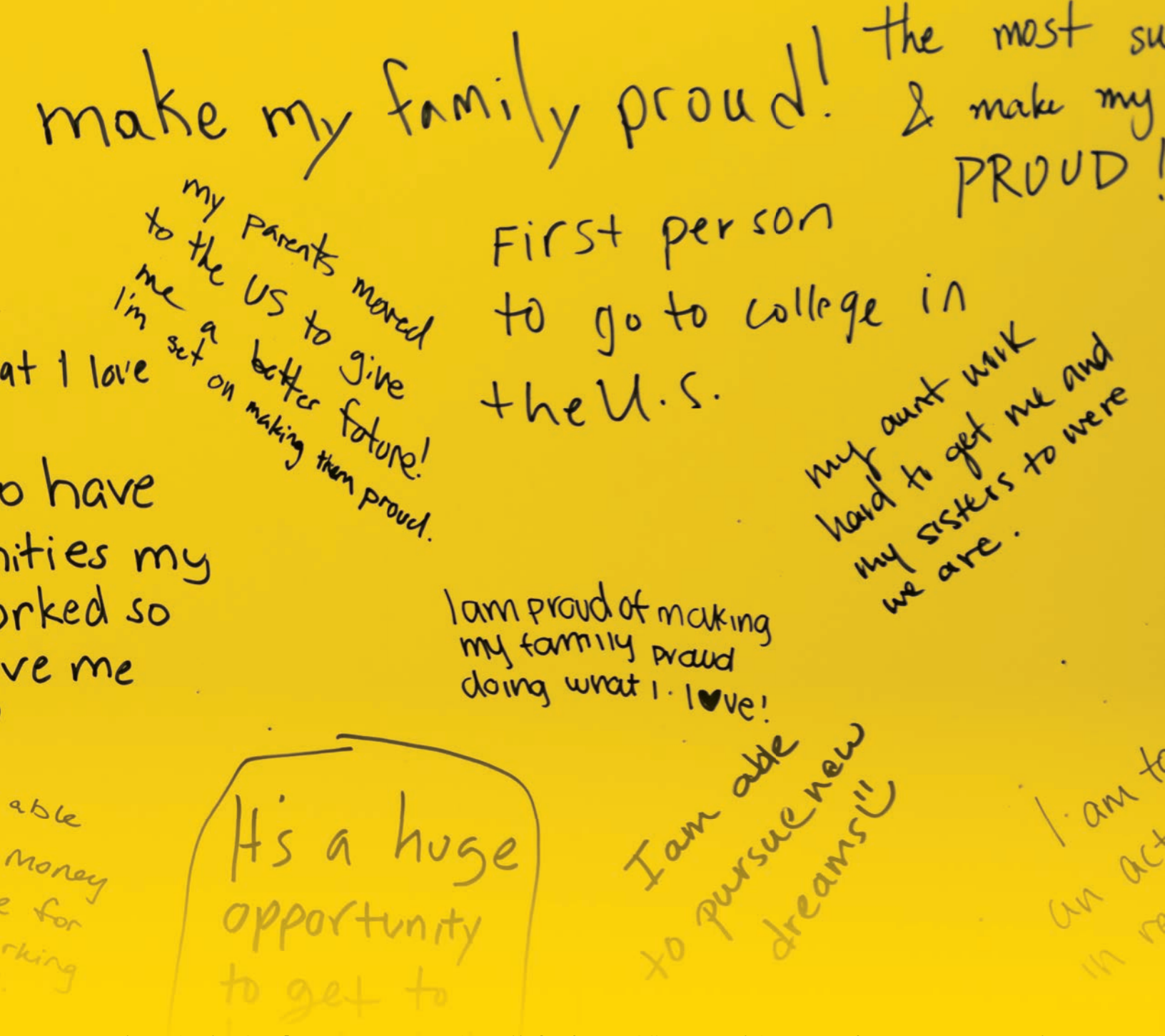
Michele Meyer, assistant dean for Engineering Student Services in the Cockrell School, works to bridge this knowledge gap for students. By providing key resources like supplemental instruction courses, specialized first-year interest groups (FIGs) through programs like the Ramshorn Scholars and expanded pre-professional leadership and development opportunities, Meyer hopes to make every stu-

dent's transition as smooth as possible while refining the leadership qualities they already possess — resilience, grit and work ethic.

And, as a first-generation college graduate herself, Meyer is no stranger to the unique challenges these students face.

“It can be difficult, and sometimes even overwhelming, to navigate a large university structure like UT,” Meyer said. “That’s why I’m so passionate about what the Cockrell School is doing — it is our responsibility to be as inclusive as possible while helping all students step forward toward graduation and a successful future.”


The Cockrell School's efforts to help first-generation students are only a small part of the university's commitment toward easing the first-generation transition for the 9,000 undergraduate stu-



dents who identify as first-generation — more than 20% of UT's undergraduate population. As Texas' K-12 public school enrollment steadily rises — an increase of almost 15% from 10 years ago, with more than 60% of currently enrolled students identifying as economically disadvantaged — UT is dedicated to ensuring that all future Longhorns have the resources and support needed to thrive, regardless of their financial background. Through social events and specialized programming, the university is shifting the paradigm of what it means to be a first-generation student from a label that was once a stigma to a title worth celebrating.

Carmel Fenves, wife of UT President Gregory L. Fenves, is a first-generation college graduate. Over the past two years, she has

fully supported the university's commitment to expand opportunities and resources for first-generation students. Carmel and President Fenves both welcome first-generation students to tour the president's office. She has also shared her story with first-generation students and contributed to the first-gen online newsletter.

"I have experienced many of the hurdles that first-generation students have to overcome," Carmel said. "First-generation students bring such a richness to the university culture. Every student deserves the opportunity to reach their full potential while attending UT Austin. I am thrilled about the steps UT is taking to empower these students with the resources they need to thrive." 

JOINING FORCES

*UT Austin Launches Groundbreaking Partnership
with the U.S. Army Futures Command*

In a major speech this past spring, the soldier in charge of modernizing technology for the U.S. Army and leading the Army Futures Command (AFC) issued a sweeping challenge to the nation's engineers. Said Four Star General John Murray, "I never want to put a soldier in a breach again."



“Because of the opportunities created by the Army Futures Command, other entities are circling... This could become a whole ecosystem.”

—JOHN EKERDT

ASSOCIATE DEAN FOR RESEARCH,
COCKRELL SCHOOL

HIS VISION, HE EXPLAINED, is to keep flesh-and-blood soldiers out of harm's way. When there's a minefield to be traversed or barbed wire to be cut, it should be done by robots. Then he disclosed his primary partners in meeting this challenge: The University of Texas System and its flagship university, UT Austin.

UT Austin is building a new robotics center, as part of a multi-million-dollar partnership with the AFC, a newly launched command that represents the Army's biggest reorganization since 1973. It could turn out to be just as big for some research areas in the Cockrell School of Engineering.

Under an initial contract, Texas Engineering faculty and students, along with researchers from UT's College of Natural Sciences, will contribute futuristic research on robotics, as well as positioning, navigation and timing; network security; and hypersonics.

“It's a real endorsement for the Cockrell School and for UT in general,” says Todd Humphreys, associate professor in the Department of Aerospace Engineering and Engineering Mechanics and one of UT's collaborators with the AFC. “There are really compelling problems here—at the edge of what we can currently do. For students interested in pushing the frontiers of science and research, it's inspiring, it will have consequences, and the U.S. desperately needs it.”

The school's breakthroughs could also spin off whole new civilian industries, says John Ekerdt, associate dean for research in the Cockrell School.

“Because of the opportunities created by the Army Futures Command, other entities are circling around,” he says. “This could become a whole ecosystem. Because we're at the center, we believe we will see long-term benefits for the school.”

A PEEK AT NEW UT-AFC RESEARCH

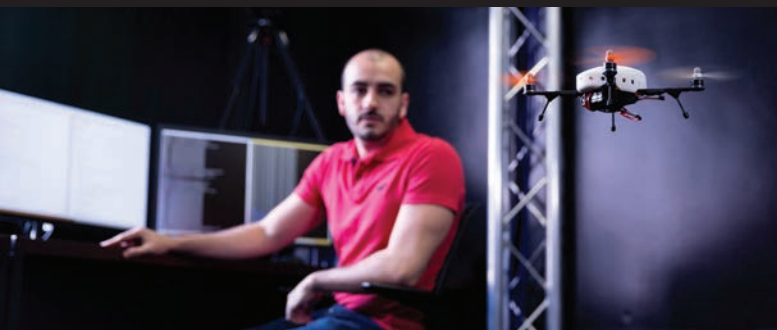
Picture a commando team of a not-too-distant future. Its members are a robot, an autonomous armored vehicle and a swarm of drones. Though they're cyber-soldiers, they face the same challenges as their human counterparts, from setting courses to making group decisions. Here are some collaborative Cockrell School-AFC projects that might help meet those challenges — and non-military ones, as well:



TECHNO-TEAMING On a polar icepack, a robotic rover gathers scientific data while a self-flying drone tracks it from above. That's a prototype that Maruthi Akella, professor in the Department of Aerospace Engineering and Engineering Mechanics, developed for NASA. Now he's adapting it, on a larger scale, for the AFC.

He's created self-organizing algorithms, which allow very different kinds of vehicles to communicate and work with each other. In three years, he aims to demo a system with 10 vehicles to show how they can work together as a team, with or without human help.

"We figure out what part of the work you will do and what part I will do," he says. "It's machines that are making these decisions, based on what they perceive to be their own strengths and skills."



BEYOND GPS Global Positioning Systems turn up in every military vehicle, phone and radio. But they've gotten more and more vulnerable to jamming by hostile forces, says Humphreys.

His solution is a sensorium, a box bristling with several other kinds of location devices, from inertial sensors to radar and cameras. They might include receivers that could read signals from networks of satellites in low-earth orbits, like those planned by SpaceX and Amazon. The goal is to make it the size of a shoebox, so that it could be bolted onto a jeep or a tank.

"It's much like the box you see on Google's self-driving vehicles," Humphreys says, "except that ours is operable in complete whiteout conditions."

AUSTIN MEANS INNOVATION

The AFC's mission is no less than to bring America's military defense technology into the 21st century. Under existing procurement procedures, new systems can take decades to develop — like a replacement for the Bradley Fighting Vehicle, which has been in the works since 1999. In an age when adversaries are now testing hypersonic missiles, the Army doesn't have decades.

"Four years ago, the Department of Defense realized we were losing our technical edge," says Rex Eiserer, director of their University Technology Development Division. "It was time for a structural change."

That change was a new command to focus on a single task: innovation. In place of a military chain-of-command, it would tap resources from other worlds, like the flexibility of high-tech startups and the experimental and applied research happening at the nation's tier 1 research universities.

"In World War II, we did well because we had an industrial base to build off of," Eiserer says. "Today, what's also needed is an intellectual base. Fifty years ago, innovation was happening inside the government. Today, it's happening outside the government — at corporations and universities."

There's no better place to find both, the AFC decided after a nationwide search, than Austin. Another attraction: nearby bases in Killeen and San Antonio, where discoveries could be field-tested quickly and efficiently. And, the Army already had a UT connection. The Army Research Lab South, headquartered at UT's J.J. Pickle Research Campus in North Austin, oversees pioneering engineering and science at universities across the South.

For the AFC, UT Austin and the UT System strengthened the bond. In addition to \$24 million from the Army, UT System and UT Austin combined to put up \$50 million for investments to strengthen the faculty and to upgrade facilities where AFC-UT collaborations may thrive. UT System offered two floors of its headquarters downtown to build operations headquarters for the AFC, and in August 2018, the Army started moving in.

The university will also build a new facility at the Pickle Research Campus — in the same building as the Cockrell School's Center for Electromechanics — for work needing tighter physical security. But the crown jewel will be on UT Austin's main campus, where the historic Anna Hiss Gymnasium is being remodeled to house the new Robotics Center of Excellence.

AYE, ROBOTS

When the AFC was looking to set up a robotics center, it was drawn to the fact that UT already had one—a very, very good one.

In 2015, Cockrell School faculty joined forces with Department of Computer Science faculty to launch Robotics at UT Austin, a consortium led by computer science professor Peter Stone that offers a Graduate Portfolio Program in Robotics from both schools. More than that, it's a one-stop shop for robotics efforts across the whole campus. It includes seven labs and research groups, as well as faculty from UT's School of Information and Dell Medical School.

"We recognize that robotics transcends and spans many departments," says Mitch Pryor, research scientist in the Walker Department of Mechanical Engineering who will serve as director of the Robotics Center of Excellence. "We created this consortium so that we could collectively engage the industry as a group. It put us in a strong position to respond to the AFC."

UT Austin had already committed additional faculty lines and begun the renovation of facilities to house the research in robotics. When completed next April, the renovated gymnasium will house the consortium, bringing together faculty from several departments along with the new Robotics Center of Excellence.

But the Army's not waiting for new facilities. In May, it sent teams to the Cockrell School to present its needs in eight areas, ranging from networking and navigation to future vertical-lift vehicles. Professors responded with proposals, which were winnowed down to 19. Three-year grants will then be provided for select projects spread among the Cockrell School, the Department of Computer Science, the Robotics Center of Excellence and the Applied Research Laboratory at the Pickle Campus.

For most of the projects, the task is not to create finished products, but to do foundational research, which the Army can incorporate into its own designs—particularly into next-generation combat vehicles, including the successor to the Bradley.

"We're not asking UT to build the Next-Generation Combat Vehicle," Eiserer says. "But we need technologies we can get out the door quickly and into these next-generation systems."

Speed is of the essence, says Pryor. "They want to accelerate the pace of a technology's maturity from government scale to a three-year commercial scale. These capabilities will be delivered to the army as software repositories or as demos of relevant hardware. The Army is less interested in reading a journal paper."

This accelerated pace is just fine with Noel Clemens, professor and chair of the Department of Aerospace Engineering and Engineering Mechanics, who will be testing materials for hypersonic flight. "We told them we can start tomorrow, if we need to."

TALKING TO MACHINES

Imagine an Alexa that not only hears commands, but also sees gestures and judges whether it should obey them. That's the kind of human-machine interface Pryor is developing.

"Somebody at a command center tells a robot to patrol an area," he says. "But then it encounters a friendly soldier who wants to give it a different order. If it receives commands from multiple operators, it needs a protocol to make decisions."

Another goal is a robot that can devise on its own a specific series of steps to execute a general command. Explains Pryor, "Someone can say, 'Go retrieve a canister from the second cabinet on the left,' instead of 'Go forward 12 feet and raise your arm three feet.'"



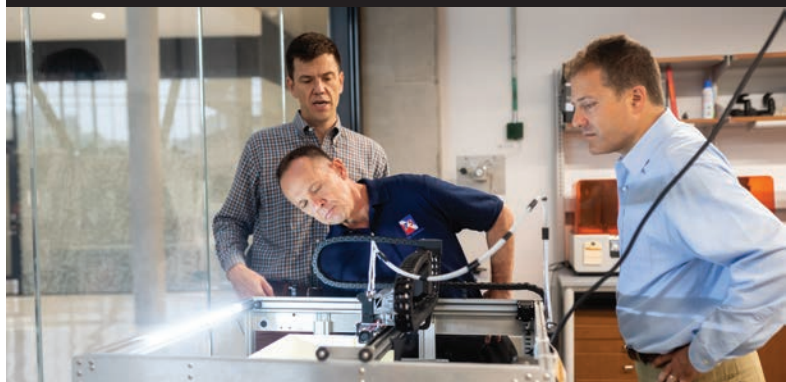
SPOTTING DIRTY DATA

An autonomous car might view millions of images in learning to recognize a wrecked car or fallen tree.

Those pictures might be gathered from sites across the internet, and some of the sites might be malicious. Deliberately altering just a few pixels could completely confuse a computer.

"The naked eye can't tell them apart, but the machine sees a picture of a rifle and thinks it's a flower," says Caramanis. "That could lead to disaster on the battlefield."

He's working on ways machines can test such images, to recognize when they've been doctored. He says, "We need to certify the trustworthiness of machine learning systems and make them resistant to data attacks."



MATERIALS FOR SUPER SPEEDS

Hypersonic vehicles, now on the drawing boards, would fly well over five times the speed of sound. Such devices will require radically new materials, says Clemens. They'll have to perform in environments hotter than the surface of the sun.

As the Army devises such materials, they'll be tested at the Pickle Campus, where the Cockrell School has a unique plasma torch. It's already been used for NASA—to test heat shields for its next-generation Orion spacecraft. Like a super-hot wind tunnel, it can vary the speed and temperature of the air flowing around a material.

Then, says Clemens, "We do laser-based measurements. We can peer into the hot flow and see what's happening."

A FUTURE WITH THE FUTURES COMMAND

Those initial projects will be the first of many, Eiserer hopes. “We chose Austin for the long haul,” he says. Agrees Ekerdt, “I hope we’ll look at this 10 years down the road, and it will still be going.”

Over that time, the Army’s needs will change, and so will UT’s engineering research. Each year, the AFC will hold a symposium to present its latest priorities. From back-and-forth discussions with professors, specific projects will emerge.

“It’s not a single deliverable, but a pipeline,” says Pryor. “As they’re designing new systems, we can continuously be injecting new technologies into them. We have the ability at UT to pull from a range of faculty and specialists, to perform research in the areas where they have needs.”

That pipeline will extend well beyond the military, school officials predict. Technologies first developed for the Pentagon have revolutionized the civilian world, from GPS to the internet. The Cockrell School’s research for the AFC could spark businesses — even industries — of tomorrow, for everything from robots to autonomous vehicles:


- Networks that help drones communicate could make passenger cars safer, says Constantine Caramanis, professor in the Department of Electrical and Computer Engineering. “If your car can talk to a car that’s around a corner, it can effectively see what’s around the corner.”

“We have the ability at UT to pull from a range of faculty and specialists, to perform research in the areas where the Futures Command has needs.”

—MITCH PRYOR
DIRECTOR, UT ROBOTICS
CENTER OF EXCELLENCE

- A positioning system that’s more precise and resilient than GPS could be critical for package-delivering drones and even air taxis. “One has to have a reliable sense of its position, in three dimensions,” says Humpreys. “If somebody jams one signal, it has to be able to tap into different sources.”

For the present, though, both students and faculty will have the satisfaction of seeing immediate impacts from their work — far past the walls of their laboratories.

“People want to work on problems that make a difference,” Ekerdt says. “This is an opportunity to do that.” 



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A MEETING OF MINDS AN OCEAN APART

POSITIONED ON THE WESTERN EDGE of the Iberian Peninsula, Portugal has shielded its European neighbors from the unforgiving Atlantic Ocean waves crashing against its coastline for centuries. Back when people thought the earth was flat, they saw Portugal as the last port of call on the edge of their world — a theory the locals hoped to disprove in the 15th and 16th centuries, using their world-class engineering skills to design and build tools and ships so advanced that they helped establish the nation as one of the first true trans-Atlantic empires.

Five centuries later, the Portuguese are still seeking adventure, only this time the compass has led them to Texas. And thanks to a mutual love of science and exploring

the unknown, an extraordinary partnership between the Cockrell School of Engineering and Portugal's homegrown science and engineering research community is thriving.

To understand how this unique relationship began, we don't need to go quite as far back as the 16th century. In 2007, the Portuguese government announced a long-term strategic plan to increase its STEM-based research output and jumpstart innovation through international research collaborations. Portuguese authorities encouraged top research universities in the U.S. and elsewhere to share mutually beneficial ideas and goals, which led to several collaborative agreements with U.S. institutions. UT was among the few selected.

The partnership, which was officially (and appropriately) named the UT Austin Portugal Program, initially began at the IC² Institute before moving to the McCombs School of Business thanks to the enthusiasm of Marco Bravo, UT's executive director for the program. An engineer and entrepreneur, Bravo is also a Portuguese native, an expert in global technology commercialization and the co-founder of four companies. He has been the driving force behind the program, nurturing the ongoing research collaborations that have emerged over the past decade.

As the partnership progressed, sponsor and program managers both at UT and in Portugal noticed that many of the strongest research connections were being made in engineering. "It was clear then that, as we push forward and pursue new areas of in-



novation and research, the Cockrell School would have a larger role in defining things in the future,” said Bravo.

And so a renewed partnership signed in 2018 by leaders from the Portuguese Foundation of Science and Technology (FCT) and UT Austin placed the research baton firmly in the hands of Texas Engineering.

Five key research areas are being funded during the current program cycle: advanced computing, nanotechnologies, space-earth interactions, medical physics and technology innovation and entrepreneurship. It is no coincidence that four out of the five themes chosen by the sponsor and UT Austin Portugal Program directors for this phase of the partnership happen to encompass research fields where Texas Engineers are already leading the way in terms of innovation and thought leadership.

While Texas Engineering may have its fair share of leaders in specialized fields, there can only be one captain of the ship and, given the new emphasis on engineering, John Ekerdt, associate dean for research at the Cockrell School, will now be at the helm as the new principal investigator of the program from UT. “Partnerships between ourselves and other top-tier international research institutions provide numerous benefits for all involved,” said Ekerdt. “We already have ongoing research collaborations with Portuguese engineers, and, thanks to the renewed agreement, these collaborations will be allowed to grow alongside new partnerships. It’s a really exciting prospect.”

Ekerdt isn’t the only one who is optimistic about this unconventional partnership. The FCT — Portugal’s equivalent of the National Science Foundation — funds the entire UT Austin Portugal Program. Last year the foundation decided to increase its investment from \$20 million in the ini-



“That kind of learning can’t happen in the lab.”

tial project to \$50 million in this renewed project. This includes not only research collaborations but also student exchanges and various other activities over the five-year cycle of the program.

This major increase in available funds is significant for a number of reasons. Not only does it afford greater research scope and opportunities to researchers, it demonstrates how confident Portuguese authorities are that the partnership will produce long-term results.

“We expect this partnership with UT to result in real economic and societal benefit for Portugal. Impact in research is the goal of the program, which is aligned with the Portuguese government’s strategy and science policy,” said José Manuel Mendonça, the National Director of the UT Austin Portugal Program.

Aside from its economic ambitions, the UT Austin Portugal Program also provides invaluable opportunities for students to take classes while living in a foreign country, gain a broader perspective on the world

and develop an edge over the competition when applying for jobs in various sectors.

“That kind of learning can’t happen in the lab,” Ekerdt said.

Likewise, faculty actively engage in international research collaborations because they can provide access to fresh ideas and different perspectives. But, there’s more to the UT Austin Portugal Program than just a sharing of ideas. Texas Engineers may be providing much of the expertise, but this program also provides our researchers with access to crucial resources and equipment. For instance, Portugal has over 1,000 miles of the aforementioned Atlantic coastline to explore, and, through this program, the Cockrell School’s world-renowned Center for Space Research will gain access to the Portuguese-owned satellite launch port located in the Azores Archipelago.

Even after a decade in partnership, Texas Engineers and their Portuguese counterparts continue to develop dynamic research agendas that not only feed intellectual curiosities but also align with the Portuguese government’s goals for long-term economic growth in key scientific and technological areas. The UT Austin Portugal Program is a true example of successful international STEM collaboration, and with the renewed partnership agreement and additional financial injection, its success seems likely to continue for a long time to come. **TE**

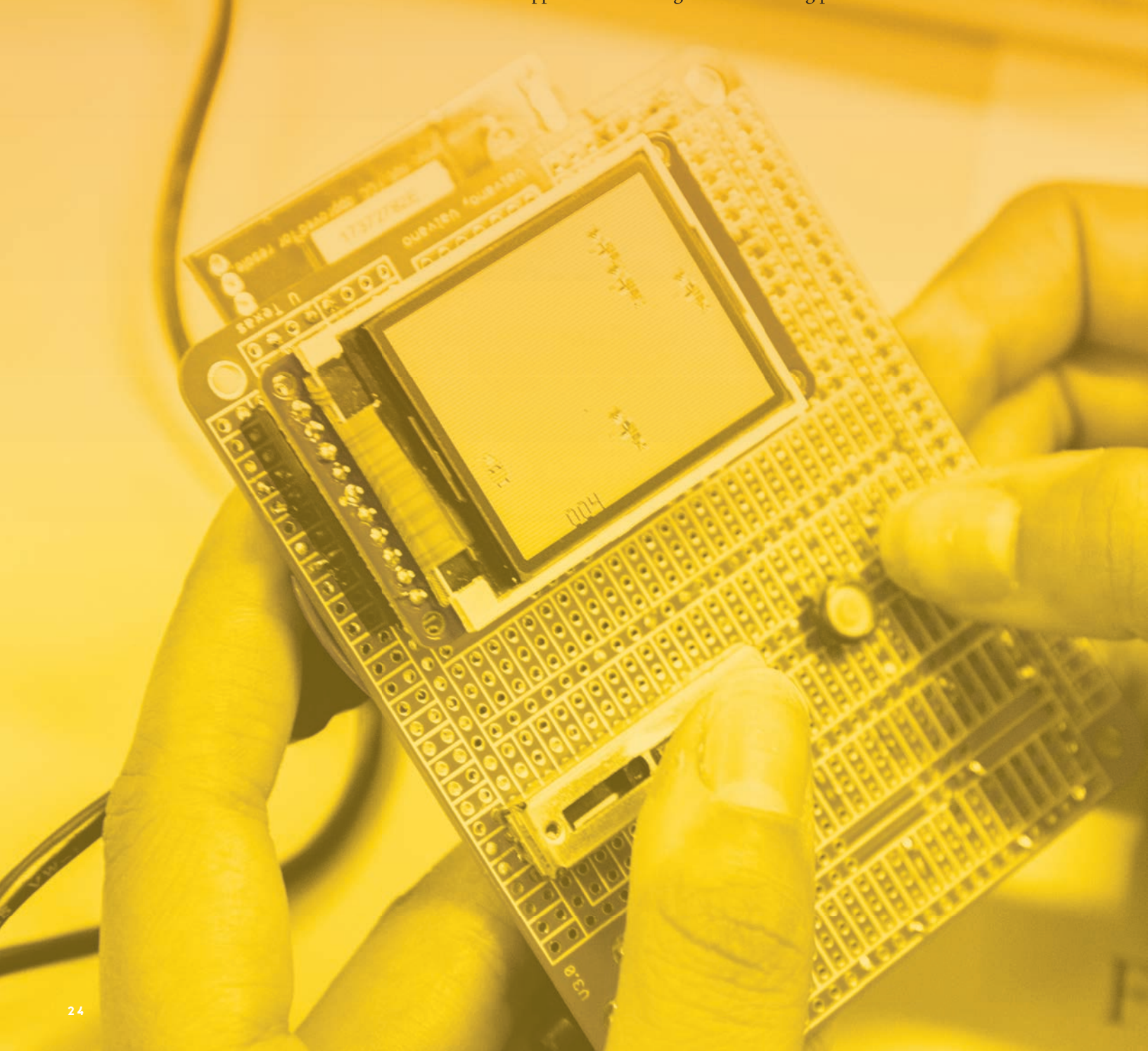
CREATIVITY + COURSEWORK

It's no secret that engineering education is transforming. At UT, an abundance of new high-tech classrooms, modern teaching labs and fully stocked makerspaces is unleashing creativity and experimentation in ways never before imagined. There is no better example than in the Cockrell School's Department of Electrical and Computer Engineering, where entire courses are being developed around hands-on projects that teach students not just how to build something that works, but how to design something that doesn't yet exist.

LET'S TAKE A CLOSER LOOK AT SOME OF THOSE PROJECTS—>

STARTING WITH THE BASICS

IN INTRODUCTION TO EMBEDDED SYSTEMS, freshmen and sophomores tackle the basics of computers, programming, implementing data structures and understanding how software uses memory—all through the creation of video games. By the end of the semester, students use their programming skills to manufacture a fully functional, classic arcade-style handheld game. But they're developing more than just Pong and Pac-Man. The skills gained in this course teach these engineers how the embedded systems that can be found in video game consoles can be applied to technologies that solve big problems.





FURTHERING THE APPLICATION

THE CONCEPTS OF EMBEDDED SYSTEMS CONTINUE in the Embedded Systems Design Lab, a course that helps students become proficient with software and hardware while pushing the limits of their creativity. For their final project, students design embedded systems for LCD displays, motors, keyboards sensors, speakers and more. The result? Devices like a spinning LED-lit globe that reacts to the beat of music, a homemade wearable fitness tracker and an interactive basketball game with a moving hoop are built and tested.




ACCELERATING THEIR SKILLS

WE ENCOUNTER REAL-TIME OPERATING SYSTEMS EVERY DAY in our computers, cell phones, appliances and even in traffic lights. In the Embedded and Real-Time Systems Lab, students develop their own operating system in an autonomous robot and then put the robots to the test on the racetrack. From the design and development stages through the preliminary and final Autonomous Robot Races, students learn to test, debug and continually improve their operating system so the robot can better maneuver through the racetrack without bumping into barriers or moving in the wrong direction.



PIECING IT ALL TOGETHER

THE CAPSTONE DESIGN PROGRAM is the culmination of an electrical and computer engineering student's undergraduate experience. Through the yearlong program, students work in groups and collaborate with industry mentors to develop a solution to a real-world engineering problem. They carry out the design process from start to finish, from defining the problem and developing the concept to building an actual working prototype. In past years, students have created potential world-changing technologies like a smart residential door opener that makes homes more accessible, a wearable tech that reads the vitals of infants and even an augmented reality headset that can be used outdoors. 



AMERICAN INGENUITY

IN 1963, HENRY FORD II TASKED Carroll Shelby with designing a car that could defeat Ferrari's dominant racing team in international competitions. Three years later, Ford's resounding victory in the 24 Hours of Le Mans represented a triumph of American ingenuity that inspired thousands of car enthusiasts across the nation—none more so than distinguished Cockrell School alumnus and recently retired president of EOG Resources, Inc., Gary Thomas (B.S. PE 1972), who has spent the past 40 years assembling one of the largest-known private collections of Ford automobiles.



When Shelby's Ford GT40 crossed the finish line first on that summer day in Le Mans, Thomas was 16 years old and only just beginning to think about which university he wanted to attend. But he knew one thing for sure—he loved cars, despite the fact that the only vehicle he had ever owned was a \$150 pickup truck that was nearly as old as he was.

Thomas got his first glimpse of the Forty Acres while traveling with his high school basketball team to the state playoffs held at UT's Gregory Gym, and he decided to become a Longhorn after receiving a scholarship to study petroleum engineering at UT. He also

decided to trade up on his mode of transportation ... to a 10-year-old Volkswagen. It would be a few more years—two weeks after his college graduation, to be exact—before his penchant for collecting cars truly began.

"I was in a training program with Unocal in Oklahoma, and I heard about a sports car that was just lying dormant in a barn a few miles down the road. I found the barn and propped the door open, and, sitting there in the dust, was a red '57 Thunderbird," Thomas recalled. "I got the last name of the farm owner and called everyone in the phone book with that name until I found the right person, who said he wanted \$1,200 for it. I had to

take out a loan just to afford it, but it was worth it to own my very first collector car."

No matter where Unocal transferred him, Thomas brought his T-Bird with him, and he eventually found a kindred spirit in Tulsa when he met a fellow collector who introduced him to the basics of car collecting.

"He truly took me under his wing, and he not only let me store my car in his garage but also helped me restore it," Thomas said.

Thanks to that restoration work and the growing demand for early T-Birds, Thomas was able to sell the car to another collector for \$50,000. The considerable profit he turned on that car taught him a valuable lesson.

"I realized that you need to be a first mover and find a car that is few in number but highly sought after," Thomas said. "Buy it at a low cost, and then watch its value rise. It's a lesson that served me well in the oil and gas industry, too."

It was also at this time that Thomas learned more about Carroll Shelby's story and began dedicating any work bonuses he received to purchasing and restoring Shelby models.

"This wasn't just about collecting any car — for me, the story of Carroll Shelby and the Ford Motor Company reflects the American dream and the dedication to problem-solving that motivates every engineer," Thomas said. "It's the story that first instilled a passion in me for collecting these cars over 40 years ago."

Now, that same passion has led Thomas to support a building that will help UT students and faculty apply their own ingenuity toward solving the most complex problems facing the energy industry. On

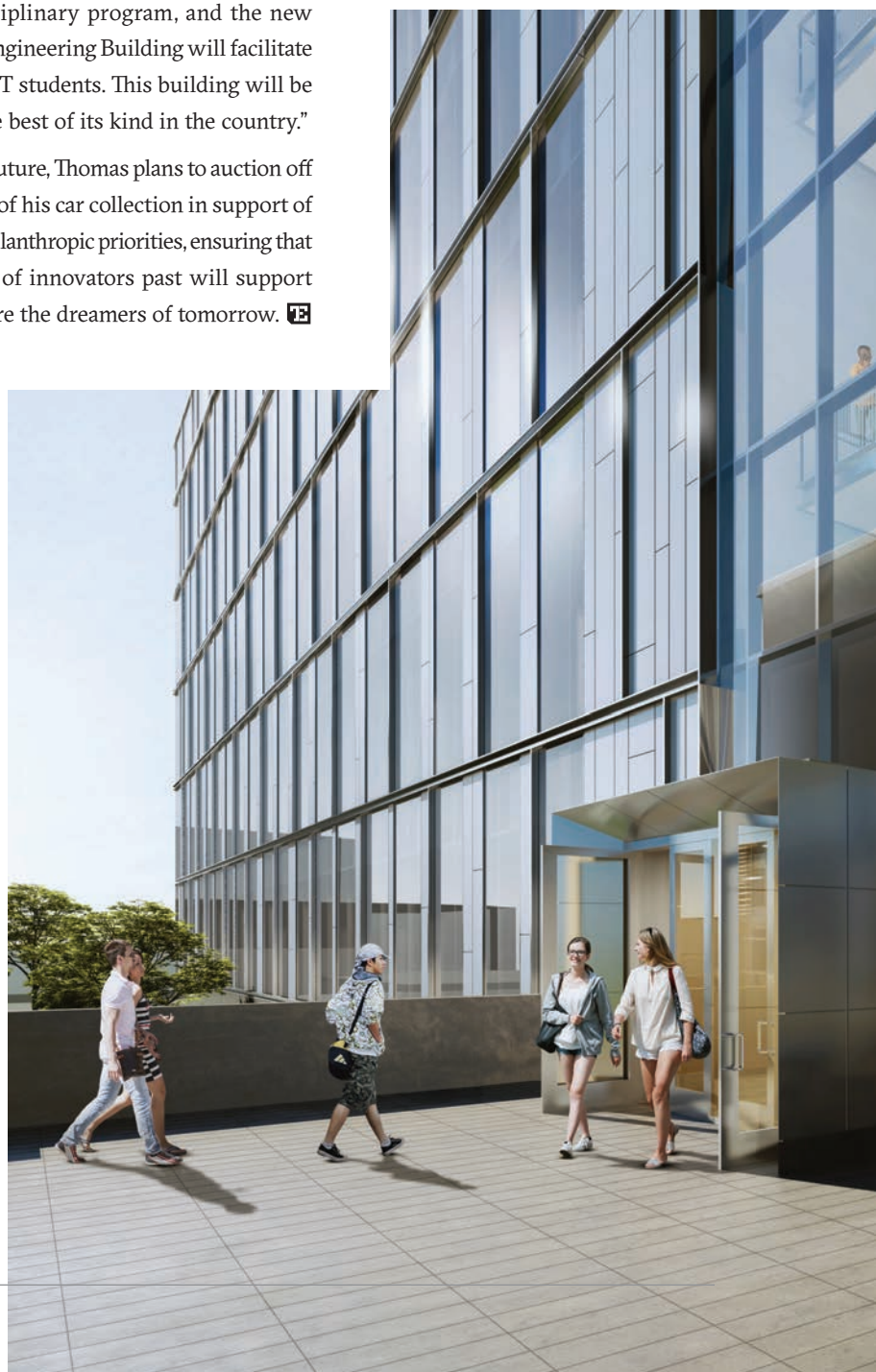
October 3, 2019, UT President Greg Fenves announced that the Cockrell School's new multidisciplinary hub for energy education and research will be named the Gary L. Thomas Energy Engineering Building in recognition of Thomas' transformative financial commitment to the facility.

"I was so fortunate to have been given a scholarship that encouraged me to go to UT, and it felt like the right thing was to return a portion of my good fortune to the university," Thomas said. "The way students are taught today is quite different than when I was in school — it is so critical to have a multidisciplinary program, and the new Energy Engineering Building will facilitate that for UT students. This building will be one of the best of its kind in the country."

In the future, Thomas plans to auction off a portion of his car collection in support of his UT philanthropic priorities, ensuring that the work of innovators past will support and inspire the dreamers of tomorrow. **TE**

“*This building will be one of the best of its kind in the country.”*

—GARY THOMAS



A BUILDING WITH PURPOSE

WITH WORLD-CLASS petroleum, chemical and mechanical engineering programs, over 20 energy-related research centers and a location in the heart of the nation's most energy-producing state, The University of Texas at Austin has already firmly established itself as the energy university in the U.S. But, through the years, the only missing piece has been the existence of a cutting-edge facility that can bring the campus together in pursuit of innovative solutions to the energy challenges of the future. Until now.


The Gary L. Thomas Energy Engineering Building (GLT) will help UT Austin build partnerships across Texas, utilize the plentiful resources provided by the nation's premier energy state and strengthen the Cockrell School's reputation as a leader in energy education and research.

"When completed, the Gary L. Thomas Energy Engineering Building will set the Cockrell School apart from all the rest," said Sharon L. Wood, dean of the Cockrell School. "By giving our researchers a truly state-of-the-art experience, we

can help them explore new solutions and new frontiers in energy technology. And by involving our students in that research, we can give them the hands-on experiences they need to make an impact on the energy industry immediately after graduation."

Like the Engineering Education and Research Center (EER), the Cockrell School's sparkling new hub for innovation and student projects, the 184,000-square-foot GLT is designed not for any one department but for all, encouraging more collaboration among the many disciplines and departments that involve energy. The GLT will function entirely as a multidisciplinary building, making it the first theme-based educational facility on the Texas Engineering campus.

Moreover, the GLT has been tailor-made to suit the specific needs of the energy researchers who inhabit the building over the decades to come.

"At 430,000 square feet, the EER was envisioned as a wide-open canvas that could be whatever you need it to be," said Alex O'Briant, associate principal at Ennead Architects. "The GLT's compactness and density, on the other hand, creates a purpose-driven merger of research and teaching. If the EER was about *potential*, the GLT is about *purpose*." 





TAKING CARE

Burgeoning 'Cockrell School Cares' initiative takes peer support to the next level



FOR TWO FULL WEEKS IN THE SPRING SEMESTER, a passionate group of Texas Engineering students shine a bright spotlight on challenging conversations—highlighting important themes of wellbeing and belonging that aren't always openly discussed in classrooms and academic buildings.

"As engineers, our everyday conversations are often centered around logic and numbers and coming up with creative solutions," said Prasanna Tamminayana, who graduated this past May with a bachelor's degree in chemical engineering. "While this type of dialogue is helpful in preparing us for our future careers, it doesn't address many of the larger issues we will face in life, nor does it address

how we should be supporting one another as peers throughout the college experience."

Centered around traditionally sensitive topics that are now being discussed more openly across new and traditional media—topics like mental health, self-care and diversity and inclusion—the Cockrell School Cares event that Tamminayana created with recent electrical engineering grad-

uate Aashima Garg brings the community together to share advice, experiences and resources in a safe and welcoming setting.

"Our generation is so lucky to have these topics more frequently and freely addressed in industry," Garg said. "We hope that after participating in the events held during Cockrell School Cares, engineering students are prepared to engage in, lead, and champion these discussions after graduation. These events help students to develop interpersonal skills that make engineering environments healthier and more inclusive."

Cockrell School Cares, which is led and sponsored by the Student Engineering Council, launched in 2018 as a one-week



“These events help students to develop interpersonal skills that make engineering environments healthier and more inclusive.”

—AASHIMA GARG

event with just a few students on the planning team. But in 2019, it grew exponentially, with forty students — in and out of the Student Engineering Council — leading a two-week campaign that included 25 individual events and engaged 1,600 total students.

The first week focused on mental health and self-care, with talks and panels aimed at helping friends who are in distress, healthy eating habits and embracing failure, as well as community-building activities like yoga on the lawn of the Engineering Education and Research Center. The second week focused on diversity and inclusion — addressing issues of accessibility, racial barriers and discrimination in the workplace — and LGBTQIA acceptance in STEM. It also featured keynote speaker John Sims, who serves as the deputy director for human health and performance at NASA’s Johnson Space Center.

“The thought and effort that was put into this year’s programming was outstanding, and I think it was especially meaningful that this is developed by and for students,” said Michele Meyer, assistant dean for student services in the Cockrell School. “These conversations are not easy, and I


am extremely proud of our students. As Cockrell School Cares grows and evolves in the future, I am certain it will continue to help our students cope with the difficult challenges they face.”

The initial inspiration for Cockrell School Cares came from Tamminayana and Garg’s personal experiences in their early college years. Tamminayana participated in a work experience where she did not feel like she belonged. She felt isolated and alone. Garg often looked around in her classes and realized she was one of only a few women. Both Tamminayana and Garg reference having “imposter syndrome,” the feeling of doubting one’s abilities and accomplishments, which was one of the discussion topics during this year’s event.

“We want our fellow students to have access to information and support they may not have had otherwise — information we sought out from our personal experience,” Tamminayana said. “We wanted to make sure that if students were put in our positions, they would have the resources, support and knowledge to navigate the situations better than we did.”

As a way to build buzz and grow excitement among the student body, the Student Engineering Council got creative. They posted a “Cockrell School Shares” series of student-made videos on social media, attended department and program meetings and posted QR-coded posters linking to the full event schedule. And they worked with nearly 20 faculty members to offer extra credit to students who attended certain events.

“It might seem strange to offer extra credit to get students to care about mental health and diversity and inclusion, but it gets the students in the door and they ultimately participate in the conversation,” Tamminayana said. “We realized that students care about these issues; they just don’t always prioritize them.”

While Tamminayana and Garg have since moved on to their first jobs, both expressed satisfaction over what they had created — and also a serious case of FOMO (fear of missing out) for next year’s event. But with 100 students already expressing interest in planning for 2020, it’s clear that our student community is committed to making Cockrell School Cares a major priority for years to come. 

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.



JAMES HITZFELDER

TITLE: FACILITIES MANAGER

YEARS AT UT AUSTIN: 30

Within the walls of the Microelectronics Research Center (MRC) at UT's J.J. Pickle Research Campus, Cockrell School engineers are advancing the fields of electronics, optics, physics and more to develop next-generation materials and devices. And James Hitzfelder is the person who ensures the researchers have what they need to perform this work, that the building and its labs are running smoothly.

As the MRC facilities manager, Hitzfelder and his team of 10 are responsible for helping the community of faculty members and student researchers who work at MRC, doing everything from customizing equipment and optimizing research spaces to stocking supplies and making sure the lights stay on.

Hitzfelder credits his team for working diligently to keep the MRC afloat.

“This team — their daily enthusiasm — they really make this job a piece of cake,” he said. “Their diverse personalities work so well together to get things done.”

With a master's degree in mechanical engineering from UT and a passion for blacksmithing and machining, Hitzfelder has developed the philosophy that if there isn't an obvious solution, just build one.

“We want the faculty and students who use this facility to feel spoiled,” Hitzfelder said. “Every day is different, and it's our job to find creative solutions to the various problems that arise in the building.”

“*We face daily challenges head-on, because our goal is to help faculty and students however we can so that they can get the world-changing work done in the most efficient and accessible way.*”

—JAMES HITZFELDER

“*The Cockrell School is home to me. I feel like I make a difference here. Every day is different and can be hard, but I love what I do.*”

—YMA REVUELTA



YMA REVUELTA

TITLE: DIRECTOR OF ADVISING

YEARS AT UT AUSTIN: 10

Academic advising is one of the most important things a Texas Engineering student can participate in to ensure success. Under the direction of Yma Revuelta, advising in the Engineering Student Services office goes beyond simply helping students select their course schedules.

Her average day might include meeting with students to discuss their academic and career goals, checking in on the advising team to offer guidance and direction, mentoring a first-year interest group or welcoming new students at orientation. And while the role is fast-paced and everchanging, Revuelta says it's easy to keep motivated.

“Whenever a student asks for help, I’m immediately motivated to get things done,” she said. “Our approach as advisors is to meet with any student who walks through our doors. We consider it our duty to follow through and to make students feel respected and heard.”

After years of guiding students from their first class to their last final exam, one of the most rewarding things for Revuelta is to watch her students walk the stage at graduation, knowing everything they have encountered along the way.

“We produce tough engineers,” she said. “And I’m happy to say that I get to meet many of them, play a part in their college experience and then watch them become the innovators that will one day change the world.” **TE**

REACHING FOR THE STARS

AS THE PRINCIPAL INVESTIGATOR ON NASA's New Horizons mission, UT alumnus Alan Stern (B.S. Physics 1978, B.A. Astronomy 1981, M.S. ASE 1980, M.S. CE 1981) led a team of more than 2,500 scientists and engineers in a history-making effort to explore the Pluto system and the Kuiper Belt.

PHOTO: NASA

NEW HORIZONS LEFT EARTH ON JANUARY 19, 2006, as the fastest spacecraft ever launched, and, after a nine-year, three-billion-mile journey through the solar system, the mission completed its flyby exploration of Pluto on July 14, 2015, providing us with our first-ever close-up glimpses of the dwarf planet Pluto and its five surrounding moons. Encouraged by the mission's success thus far, the New Horizons team obtained a mission extension through 2021, allowing them to explore even farther into the Kuiper Belt. For his role in New Horizons and other career accomplishments, Stern was named to the Time 100 list in both 2007 and 2016. We sat down with him to discuss the mission to Pluto and learn more about what the near future holds for commercial space travel to destinations closer to home.

After all the work that you and your team put into New Horizons, what was it like to watch the spacecraft complete its mission?

These flyby events are very intense, working around the clock. We're getting new data every day at that point, and there is a need for quick turnaround for data analysis. Add to that the public and press events taking place, and it all makes for very long days during these flybys. I'm not exaggerating when I say that, during the week surrounding the most recent flyby, I was getting at best four hours of sleep a night. That's how busy we were.

Missions like New Horizons are reigniting the public's fascination with space exploration. What are some of the benefits of having a thriving space program?

One is soft power projection. Kids all around the world read about the exploration of the planets in their science classes, and that's essentially an American brand because it's been led by the United States since the 1960s. It's a tremendous way to define our image as a nation, to emphatically state what kind of nation we are—that we are an economic powerhouse, yes, and also a scientific and technical powerhouse. And we are a nation of explorers. Moreover—and I think this is the greatest benefit of space exploration—I've found that space, more than anything else, first turns kids on to STEM education. When I was growing up, most of the kids I grew up with wanted to be in the space program. Most of them didn't end up there. Instead, they went out and developed computers, advanced the Internet revolution, etc. The same thing is taking place today. Space exploration turns kids on to STEM, and that ultimately fuels our entire tech economy.

Over the next 20 years, what do you see as the most exciting thing that could happen in terms of our understanding of space?

We are progressing quite rapidly with the advent of commercial spaceflight—from spaceflight having been rare to spaceflight becoming routine. And I think the 2020s—I like to call them the “Roaring Twenties”—are going to be transformational. We're going to see space tourism blossom. We're going to see humans back on the Moon, off to Mars, and then, probably within the next 20 years, to other destinations as well. And you'll see non-governmental entities doing this in many cases. We tend to think of space as something that is largely governmental because, when it started, it took giant government agencies like NASA to

pull off spaceflight. But now individual companies can do it, and we have literally 100 or more such companies in the United States that either commercially build satellites or launch vehicles or the systems that go in them. We're seeing a new space race blossom—this time in the private sector.

This is a very different environment that new graduates are entering into, compared to when you began your career. What advice would you give to students and young alumni today who are hoping to have a long-term career in space? What should they be doing now? How should they be preparing?

I would encourage them to figure out what discipline in engineering they like best and pursue that, whether it's electrical or aerospace or mechanical or something else. Because all of them are needed by space companies and by NASA. They have all the branches of engineering working for them, so my best advice to aspiring space workers, particularly engineers, is to find what you love in engineering and follow your heart. Your skills will be valuable in the space economy, but, more importantly, when you do something you love, you're going to excel at it.

Often, when people get to do their dream job, they discover that the stress of the job can make it difficult to remember why they fell in love with it in the first place. Are you as passionate about space now as you were the day you began your studies at UT? How has that passion evolved over time?


I'm absolutely just as passionate about it as I was when I began. I'm now far enough along in my career that people who are just a few years ahead of me are starting to think about retirement. But I'm not—I love it! It's just getting more interesting, and, if anything, my passion for it has grown thanks to being able to do some larger-than-life things. Getting to lead the 2,500 people involved in New Horizons to execute the farthest exploration in history? That is not something I thought

I would ever get to do. I look forward to the next phase, when I hope to go to space many times myself as a researcher.

So, you will be first in line when the opportunity arises to actually fly into space?

Oh, absolutely. My firm, the Southwest Research Institute, based in San Antonio, has a project that I run that plans to do research using commercial suborbital vehicles, and we've already purchased three space flights from Virgin Galactic to fly our people to space to do research. We plan to purchase even more flights from other companies, and they're probably going to inaugurate commercial service later this year. As the project leader, I expect to be flying quite a bit over the next decade or two.

This concept of space travel that has, for so long, been the basis of science fiction movies and novels is now becoming part of our everyday life. Do you find that it's hard for people to fathom that this will become routine?

You know, space isn't that far away! [Laughs] The boundary with space is about as far away from you in Austin as Temple, Texas, is. And yet it's been largely inaccessible to us. Until now. The societal consciousness is funny—if you ask people what life will be like on some distant date, say 100 years from now, you will hear them talk about spaceflight being routine by then. But for so long, since the beginning of spaceflight in the 1950s, it's just been inaccessible unless you were a government astronaut. So, it's not that people didn't think it would happen, they just felt certain that it wouldn't happen in their lifetimes. And that's what is changing. It's happening as we speak, this year or next year. If you're reading this, commercial space travel is going to happen before you know it. 

SELF- TRACKING TODAY CAN KEEP THE DOCTOR AWAY

*Alumna Jackie
Leverett Wasson
Discusses the
Rise of Incentive-
Based Wearables*



WE'VE ALL HEARD THE SAYING, USUALLY FROM well-meaning friends and family giving unsolicited health advice: *An apple a day keeps the doctor away.*

Though this childhood rhyme may seem overly simplistic, its deeper implication about the importance of discipline and daily decision-making speaks to a growing healthcare trend, better known as the “quantified self” movement.

Self-quantification, which empowers individuals to gain access to their personalized, real-time health data, is making major strides in both the consumer and commercial healthcare

industry, and Texas Engineering alumna Jackie Leverett Wasson has her finger on the pulse of this technological breakthrough.

Wasson, a biomedical engineer who earned her bachelor's degree from UT in 2012 and her master's degree in electrical engineering from the University of California, Berkeley in 2014, has a passion for designing novel devices that make healthcare more accessible, intuitive and effective. After working as a research electrical engineer at Fitbit for over three and a half years, she now works at Eko Health in Berkeley, California as a senior systems engineer, developing new products and improving cardiovascular technology.

"Wearable technology really started to take off when I was a student at UT," Wasson said. "I had the opportunity to be one of the early adopters of the most primitive devices. It's been exciting to see how the technology has evolved from the perspective of both a consumer and a professional."

Wasson notes that, historically, health decisions have been tied to the rhythm of annual doctors' visits, placing full responsibility on physicians to solve their patients' problems. Doctors run tests, review data and share suggestions for diet and lifestyle changes that will likely improve a patient's health, and that patient is expected to adhere to the doctor's orders without real-time feedback.

However, with the evolution of wearable technology, data that was previously exclusive to doctors, nurses and hospital staff is now making its way into the hands — and onto the wrists and skin — of consumers. From heart rate monitors and sleep trackers to exercise moderators and calorie counters, we are now able to customize our wearable devices to monitor areas of highest concern.

"As humans, we need more incentives and data than a yearly check-up to keep us motivated," Wasson said. "When we can turn data collected from everyday activities into something meaningful for people, we're providing them with the incentives they need to remain in control of their own health."

This incentive-based healthcare model is proving to be a driving force behind advancements in preventive healthcare. Now that consumers have acquired a more comprehensive profile of their overall health, they are placing themselves in a position to make the best long-term choices on a daily basis, transforming an historically doctor-driven relationship to a more patient-driven experience.

"My dream is for each individual to be keenly aware of how their body functions. Wearable technology has the potential to be a truly powerful tool for physicians to better guide their patients toward healthier outcomes and for patients to get constant feedback on their progress. I want general trends and traditional


medical recommendations to be replaced with specific advice that is generated for each unique human body," Wasson shared. "We are redefining what it means to be a healthy human being both physically and mentally. You might say 'no' to that cheeseburger or cupcake if you saw the resultant spike in your blood triglycerides or glucose levels!"

Although wearable technology has benefited from remarkable advancements over the last few years, there are still many challenges biomedical engineers face as they seek to further hone the technology.

"One of the primary challenges we'll need to overcome is in handling all the data we've collected," Wasson said. "The real innovation will occur in how we process that data and transform it into something very actionable for people. There's a lot of untapped power that we've yet to realize."

In addition to harnessing the power of mass amounts of data, engineers are also working to determine how to best collect bio-signals from the body's available real estate and craft those signals into sensors that are precise and reliable yet discreet.

Despite these formidable challenges, the quantified self movement continues to gain momentum as consumers take charge of their own health. The possibilities are endless, particularly for patients dealing with chronic illnesses. When real-time, personalized data is combined with periodic reviews by medical professionals, these patients can craft a well-integrated and highly individualized health plan that provides daily peace of mind — and gives them their lives back.

"It's really about maximizing control over living your best and healthiest life," Wasson shared. "It's inspiring. As wearable technology continues to advance, we are discovering more ways to give people power over their health." 



WASSON, A SENIOR SYSTEMS ENGINEER AT EKO HEALTH, DEVELOPS INNOVATIVE DEVICES LIKE THIS DIGITAL STETHOSCOPE THAT COMBINES ECG AND HEART SOUNDS WHILE MONITORING PATIENTS AT HOME.

BREAKING THE MOLD

A full-page background image with an orange tint. It shows two men in a brewery or kombucha production facility. The man on the left is wearing a t-shirt with a 'Garden of Eatin' Kombucha Austin TX' logo. The man on the right is wearing a cap and glasses, holding a small bottle of kombucha. They are both smiling and looking at each other. The background is filled with shelves of kombucha bottles.

*How Two 'Anti-Establishment'
Alumni Entrepreneurs are
Reshaping the Probiotic
Beverage Market*



DID YOU KNOW?

Kombucha is a drink made from combining black or green tea with a naturally occurring bacterial mix of lactobacillus and acetobacter, known as a SCOBY (symbiotic culture of bacteria and yeast).

“The Cockrell School taught us to think scientifically... That process-driven approach has led to our success.”

—DAVID LEIGH,
TEXAS MECHANICAL ENGINEERING,
CLASS OF '91

IT'S ANOTHER HOT SUMMER DAY IN TEXAS. The thermostat is creeping above 100 degrees. The cicadas are chirping. The smell of BBQ is wafting through the air. You need to quench your thirst, so you reach for your ice-cold can of ... locally brewed kombucha tea?

Thanks to two Texas Mechanical Engineering alumni—Tim Klatt (B.A. Plan II Honors 2006, B.S. ME 2006, M.S. ME 2013) and David Leigh (B.S. ME 1991, M.S. ME 2011, Ph.D. MSE 2019)—and their team—Nathan Klatt (BBA 1995, MPA 1995), Rick Boucard (B.S. ChE 2006), Adam Blumenstein, Gavin Booth and Andrew Rentschler—this picture of a perfect summer day can now be a reality. Their new venture, called Greenbelt Craft Kombucha, is a low-sugar, locally brewed kombucha tea high in probiotics and low in additives.

The best part? After realizing that the high price and glass-bottle packaging of most kombucha teas were turning away potential buyers, Klatt and Leigh identified an opportunity to make drinking kombucha a more accessible and affordable experience: They packaged their fizzy drink in a convenient 12-ounce can.

"We're breaking the mold on kombucha teas," Klatt said. "We want to incorporate gut health into mainstream conversation and make naturally probiotic-rich drinks accessible to the public, so we bottled our ideas into a 12-ounce can."

Klatt and Leigh originally met during their graduate studies in the Cockrell School of Engineering. "We were a little more anti-establishment and more entrepreneurial than most," Klatt joked. "It worked well." They kept in touch after graduation and supported each other's entrepreneurial ventures before officially joining forces to create the beverage company in the spring of 2018.

"Our engineering education at the Cockrell School was really pivotal to shaping the way we now think about our business," Leigh said. "The courses taught us to think scientifically — what do we know, what do we not know, what are our assumptions and how can we use this information to solve the problem? That process-driven approach has led to our success."

As long-time Austin residents, it was important to Klatt and Leigh to pay tribute to the cultural vibrancy of the city in the branding and vision of the company. Aside from the nod to Austin in the company's name — as Austin is a city rich with greenbelts — their mission is to provide a healthy, environmentally friendly, locally made drink to fit Austinites' active lifestyles.

The company's winning formula of producing a health-minded drink with local flair is enjoying tremendous success. The teas can now be found in over 130 H-E-B grocery stores across Texas with future plans to take the product nationwide. And, at about \$2 and 40 calories per can, it has proven to be the affordable, health-conscious beverage that Klatt and Leigh set out to provide.

"It's really about the spirit of a Texan," Leigh explained. "Texans are fiercely independent, yet very loyal. UT embodies that spirit, Austin embodies that spirit, and



"It's really about the spirit of a Texan ... fiercely independent, yet very loyal. UT embodies that spirit, Austin embodies that spirit, and we want Greenbelt Craft Kombucha to embody that spirit, too."

we want Greenbelt Craft Kombucha to embody that spirit, too."

In addition to their goal of brewing the best kombucha tea, Klatt and Leigh hope to inspire current Cockrell School students who have dreams to start their own entrepreneurial ventures. They advised current students to find the "why" behind their business ideas, while also encouraging students

to surround themselves with mentors who elevate not only their skills but also their character as engineers and entrepreneurs.

"It's a journey, and it won't happen in a day," Leigh said. "It's a lifetime's worth of work and development and experimentation. If you have the commitment and drive to succeed, you will." **TE**

“By providing scholarships to more students, we hope to encourage them to persevere and give back, ensuring that their own success is helpful to others in a perpetual circle of support.”

— ERIC GONZALES
B.S. '04, M.S. '05

ENGINEERING OUR LEGACY

Eric Gonzales has never forgotten about the scholarship that helped him earn a UT degree and launch a successful career in the energy industry. Now, through an estate plan, Eric and his wife Debby are giving back by investing in today's students and establishing a legacy of generosity that will inspire our community for years to come.

Through your own planned gift — of any amount — to the Cockrell School of Engineering you too can shape the future of engineering education and provide students with life-changing support to pursue their degrees. Every gift counts, so make your plans to change the world today.



The University of Texas at Austin
Cockrell School of Engineering

To learn more about the benefits of planned giving, visit www.plannedgift.org or contact Tim Arndson at arndson@cockrell.utexas.edu or 512-497-7449.



THE IDEA OF AUTONOMOUS MACHINES doesn't sit well with everyone — at least not when it is in reference to driverless cars. You can thank some recent high-profile autonomous ride-sharing accidents for that.

But a less intimidating and perhaps more accurate way to understand the concept of driverless vehicle technology is by describing it as “personalized vehicle control.” That is the preferred phrase of one Texas Engineer who is leading the way by integrating three data sources simultaneously to help improve safety and reliability and eventually bring driverless car technology closer to reality.

Junmin Wang, director of the Mobility Systems Laboratory in the Cockrell School's Walker Department of Mechanical Engineering and considered one of the world's leading minds in autonomous vehicle research, is reluctant to use words like “autonomy” when discussing his work, opting instead for “personalized” as a more appropriate, less jarring description.

“In the same way that modern smartphones do so much more than make calls, cars of the future will do much more than get us from one place to another,” he said. “They will be data-driven, smart, intuitive and tailored to individual drivers' requirements.”

Smartphones are constantly collecting data based on how we use our devices in order to curate a more seamless interaction between human and machine. Though similar, the technology underpinning personalized vehicle control is more complicated than what you'd find in a smartphone, which utilizes mobile internet search data to determine, for example, how much you like products from a particular store before sending you special sales at that store.



AUTONOMY JUST GOT PERSONAL

With an autonomous vehicle, however, there is no margin for error. Simply collecting data on past driving habits and applying that information in future scenarios would be fine if every journey were the exact same. And while the drive to work can sometimes feel repetitive, no two trips are alike.

According to Amit Bhasin, director of UT's Center for Transportation Research (CTR), there are a number of key elements to analyzing that data that must first be understood before autonomous vehicles become a reality.

"It will require a radically different approach to engineering—an approach that allows engineers to search for new solutions by combining research in human behavior, automotive technology and transportation infrastructure altogether," he said.

That combination is being made possible by Wang, a pioneer in the integration of data who has begun analyzing driving behavior by interconnecting three different data sources—a driving simulator; a standalone engine, or powertrain; and a fully equipped autonomous vehicle prototype designed by UT researchers. He believes this unique approach provides a broad vantage point from which he can observe what drives human behavior when a person is controlling the engine that powers the car.

THE SIMULATOR

Wang's lab recently acquired one of the most sophisticated driving simulators in the world. Its 210-degree, cinema-size screen has a limitless number of unique driving scenarios and a specially designed driving seat simulator that is controlled by a cluster of computers. The computers control six degrees of motion, providing an assortment of physical sensations one might experience in any and all driving conditions. The simulator also generates noises, such as those made by an engine, and familiar weather sounds, such as heavy rain or wind.

"The simulator is the only one of its kind in the entire country and was designed with our exact research requirements and specifications in mind," Wang said. "It provides a reliable platform to discover and safely test methods in order to design new infrastructure and renovate existing networks."

THE POWERTRAIN

Data from the simulator is sent in real time to a standalone engine, or powertrain, located in an adjacent lab. The engine is used to determine how individual differences in people's driving behavior impact performance as well as to inform artificial intelligence software that will enable the engine to learn the most efficient performance techniques to match a range of driving styles. For this project, Wang is using a diesel engine that can be switched to also test gasoline, plug-in HEV or electric power sources.



THE PROTOTYPE


Data from both the simulator and engine are then shared with a fully equipped autonomous vehicle prototype, designed by Texas Engineers. The prototype vehicle includes multiple remote sensors, such as LIDAR (a laser-based way to measure distance between targets) and AI-informed software.

This third and final data source is perhaps the most exciting for many people eagerly

awaiting a future where they can just sit back and relax while the car does all the work. CTR demoed all three aspects of Wang's research at a recent event held at UT's J.J. Pickle Research Campus for leaders and representatives of the Texas Department of Transportation. Some said the loud "oohs" and "aahs" of the delegation could be heard blocks away from the experiments.

Though great progress has been made as researchers like Wang continue to bring autonomous technologies from concept closer to reality, more data needs to be analyzed and more work needs to be done before we

will see cars driving themselves down our streets with any frequency.

"I am optimistic that lower levels of personalized autonomy and technology will penetrate the existing automobile market in the near future," Bhasin said. "Sensors and on-board safety features are rapidly being integrated into several commercially available car models and, while not nearly as exciting as a robot driving a car, they can be very effective in enhancing safety and ultimately making driverless cars a concept that more people can buy into." 



DRIVING OUR AUTONOMOUS FUTURE
(FROM LEFT TO RIGHT): PH.D.
STUDENT MINGCONG CAO, LEAD PI
DR. JUNMIN WANG, AND POST-DOC
RESEARCH FELLOW CHUAN HU.



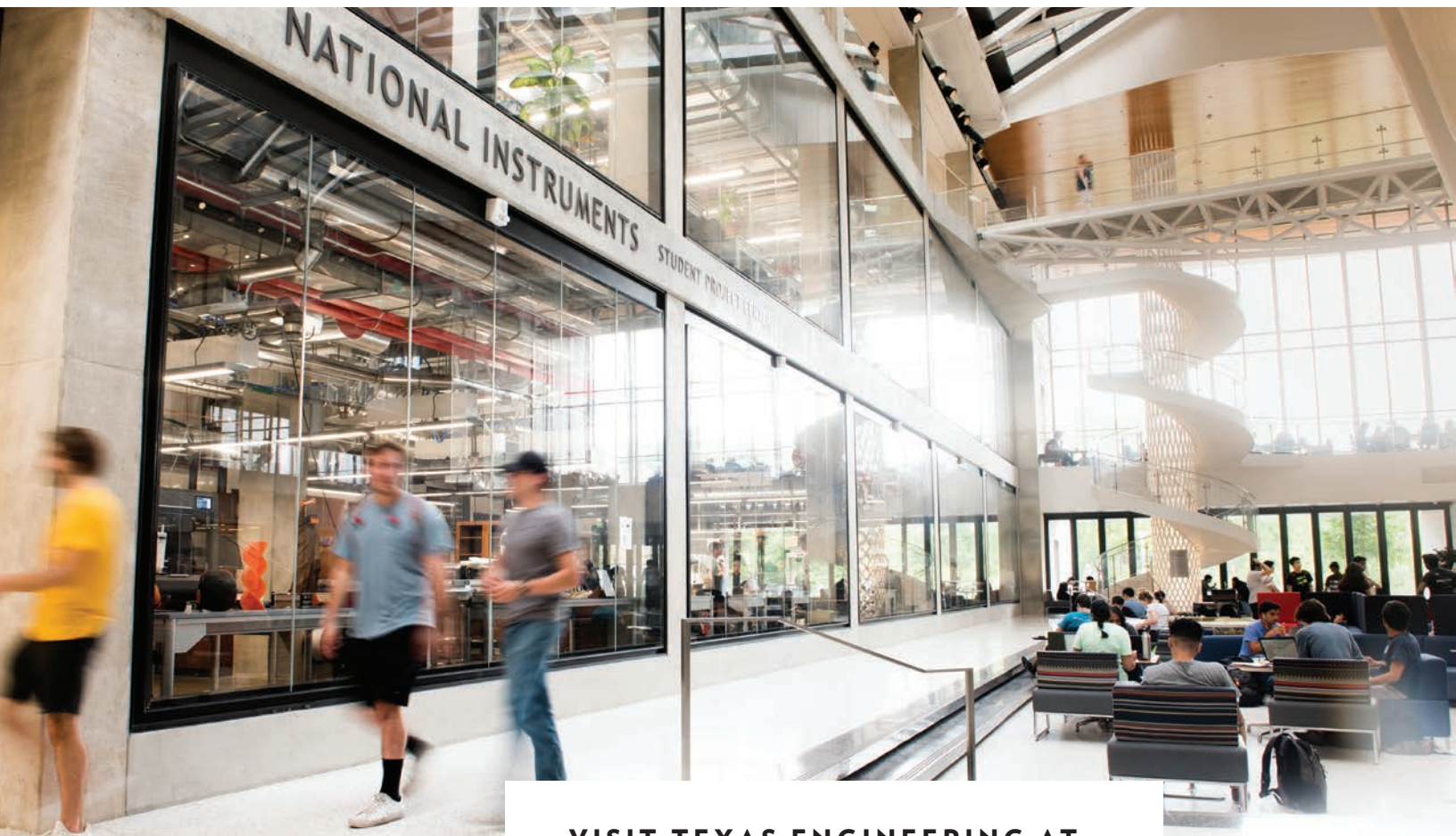
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THE ENGINEERING EDUCATION AND RESEARCH CENTER (EER), the Cockrell School's 430,000-square-foot masterpiece opened two years ago as the new hub for engineering innovation on campus. A structure of this size and style—with its 23,000-square-foot student project center, 299-seat auditorium and three-story atrium—rarely goes unnoticed. The EER has become one of the country's most decorated new educational facilities, winning awards for “Best New Building Designed and Constructed by American Architects” at the 2018 American Architecture Awards, “Excellence in Structural Engineering” from the National Council of Structural Engineering Associations and “Innovative Design in Engineering and Architecture with Structural Steel” from the American Institute of Steel Construction.



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