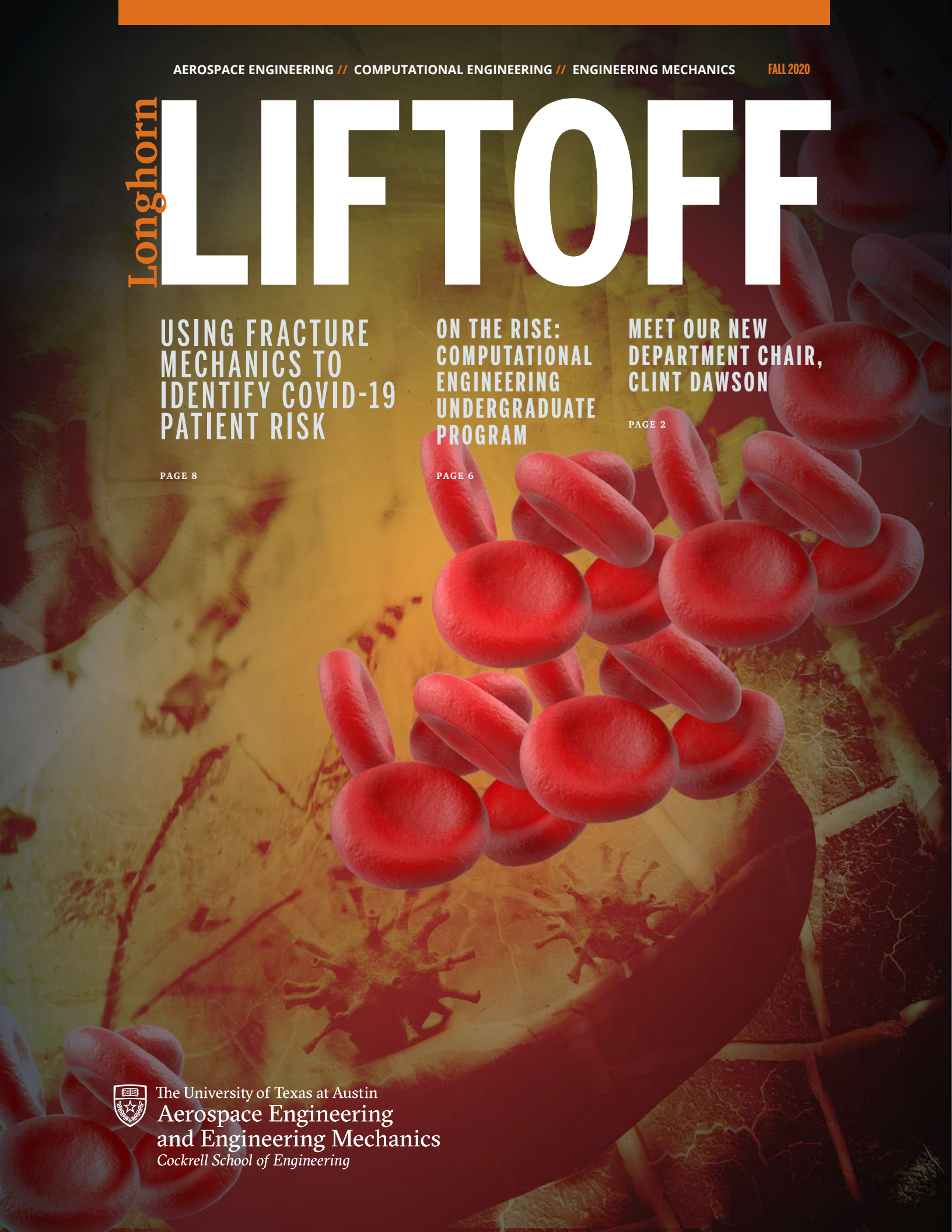
AEROSPACE ENGINEERING // COMPUTATIONAL ENGINEERING // ENGINEERING MECHANICS FALL 2020

Longhorn LIFTOFF



The University of Texas at Austin
Aerospace Engineering and Engineering Mechanics
Cockrell School of Engineering

CONTACT US

LONGHORN LIFTOFF

Longhorn Liftoff is published for alumni and friends of the Department of Aerospace Engineering and Engineering Mechanics in the Cockrell School of Engineering at The University of Texas at Austin.

EDITORIAL

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longhornliftoff@fortyacres.utexas.edu

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ALUMNI UPDATES
ae.utexas.edu/alumni/stay-engaged

WANT TO SUPPORT TEXAS ASE/EM?

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FROM THE CHAIR

LOOKING FORWARD

I am pleased to introduce the Fall 2020 issue of Longhorn Liftoff, my first as chair of the Department of Aerospace Engineering and Engineering Mechanics. I have big shoes to fill on the heels of Noel Clemens, who served as department chair for the past eight years, and I look forward to building upon the accomplishments and strides that our community has made under his leadership.

With the current COVID-19 pandemic, things are looking quite a bit different on campus this year, but one thing that hasn't changed is the dedication and determination of our entire community – faculty, students, staff and alumni alike. I'm also excited to introduce three new faculty members who are joining our family this year. I hope you'll take some time to read these stories that highlight just a sampling of the challenges that members of our community are tackling, even during the toughest of times. I look forward to the day when we can all be in person together again. Until then, please remember to keep in touch by sending us your updates and news. It's always great to see how our alumni are using their education, training and experiences in Texas ASE/EM to change the world.

Hook 'em Horns!

CLINT DAWSON
CHAIR, DEPARTMENT OF AEROSPACE ENGINEERING AND ENGINEERING MECHANICS
J.J. MCKETTA CENTENNIAL ENERGY CHAIR IN ENGINEERING

WATCH CLINT DAWSON'S WELCOME VIDEO ON YOUTUBE
bit.ly/WatchASE

STUDENTS WIN GRANTS

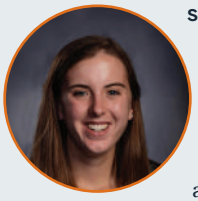
PRESTIGIOUS FUNDING TO SUPPORT RESEARCH

NATIONAL SCIENCE FOUNDATION GRADUATE RESEARCH FELLOWSHIP (NSFGRF)

The NSF Graduate Research Fellowship supports students pursuing graduate degrees in a STEM field at a U.S. university. Fellows receive a $34,000 annual stipend over a three-year period, along with a $12,000 cost of education allowance for tuition as well as fees and opportunities for international research and professional development.

ERIC GAGLIANO | B.S. Computational Engineering, 2020
Faculty Advisor: Jingyi (Ann) Chen

During his undergraduate studies in computational engineering at UT Austin, Gagliano worked on tracking velocities of glaciers in Western Greenland by building interferograms from Synthetic Aperture Radar data. Gagliano said he decided to pursue an undergraduate degree in computational engineering because it "offered the tool set he needed to pursue cool research in the geosciences." He plans to pursue a Ph.D. at the University of Washington where he will use remote-sensing techniques to better understand the cryosphere (frozen water on Earth).



STEPHANIE SALINGER | Graduate Student, Aerospace Engineering
Faculty Advisor: Karen Willcox

Salinger will use the grant to support research on the evolution of a self-aware unmanned aerial vehicle (UAV), which has the ability to collect information about itself and its surroundings and to use this information to alter the way it completes missions via on-board dynamic decision-making. Salinger is working with faculty advisor Karen Willcox on the project, which she said if successful, will result in the "first demonstration of in-flight structural health monitoring using adaptive physics-based reduced models."

NASA EARTH AND SPACE SCIENCE TECHNOLOGY AWARDS (FINESST)

NASA grants FINESST awards to graduate students who are pursuing research that is aligned with the NASA Science Mission Directorate. Recipients are awarded a $135,000 stipend over a three-year period which covers tuition, research activities and travel costs to attend workshops and conferences.

KE WANG | Graduate Student, Aerospace Engineering
Faculty Advisors: Jingyi (Ann) Chen and Clint Dawson

Wang will conduct research using InSAR (satellite) data to estimate the properties of Earth's surface on the Texas coast. Radar measurements will be integrated with the Advanced Circulation (ADCIRC) modeling framework to provide a new way to analyze how land subsidence and other environmental factors may have contributed to storm surge flooding. Research results will inform future decision-making for disaster preparedness and mitigation.

SOPHY WU | Graduate Student, Aerospace Engineering
Faculty Advisor: Jingyi (Ann) Chen

Wu's research will use the InSAR technique to study the hydrological properties of the Arctic tundra soils. In 2018 and 2019, Wu joined a UT research team and collected field samples of permafrost soil in the Arctic foothills on the North Slope of Alaska. InSAR data are combined with these field measurements to estimate soil properties like water content and organic carbon. This study will establish a relationship between the amplitude of InSAR-observed surface deformation and the amount of water and soil organic carbon, two keys for predicting future greenhouse gas releases.

TABLE OF CONTENTS

WELCOME NEW FACULTY

From aviation and urban air mobility to remote sensing, propulsion and hypersonics, Texas ASE/EM's newest faculty members span a wide range of engineering expertise. Learn more about how our newest faculty members are pushing technological boundaries and changing the world.

JOHN-PAUL Clarke

PROFESSOR, ERNEST COCKRELL, JR. MEMORIAL CHAIR IN ENGINEERING
PH.D. MASSACHUSETTS INSTITUTE OF TECHNOLOGY

John-Paul Clarke is joining the department in January 2021 as a professor. He will hold the Ernest Cockrell, Jr. Memorial Chair in Engineering. Clarke comes to UT Austin from the Georgia Institute of Technology, where he was the College of Engineering Dean's Professor and held appointments in the Daniel Guggenheim School of Aerospace Engineering and the H. Milton Stewart School of Industrial and Systems Engineering. He also served as the director of the Air Transportation Laboratory and recently, while on leave from Georgia Tech, held the position of vice president of Strategic Technologies at United Technologies.

Clarke is world renowned for his work on aircraft trajectory prediction and optimization, particularly as it relates to improving flight procedures that reduce the environmental impact of aviation. He is also an expert in the development and use of stochastic models and optimization algorithms to improve the efficiency and robustness of airline, airport and air traffic operations. Clarke's work has influenced air transportation theory, policy and practice both at the national and international level. His current research interests include urban air mobility (UAM) and the development of autonomous aircraft, including air traffic management and control for these systems. He testified before Congress to the House Science Committee in 2018 about the challenges of UAM.

Clarke's leadership and service history are extensive and include service as co-chair of the National Academies of Science, Engineering and Medicine (NASEM) committee that developed the U.S. National Research Agenda for Autonomy in Civil Aviation. He has also served on several other NASEM committees including the committee chartered at the request of the U.S. Congress to review the Enterprise Architecture, Software Development Approach, and Safety and Human Factor Design of the Next Generation Air Traffic System. Additionally, he has chaired or served on advisory and technical committees chartered by the AIAA, European Union, Federal Aviation Administration, International Civil Aviation Organization, NASA and the U.S. Department of Transportation.

Clarke holds S.B., S.M. and Sc.D. degrees from the Massachusetts Institute of Technology, where he served as a junior faculty member. He has received numerous honors and awards including the AIAA/AAAE/ACC Jay Hollingsworth Speas Airport Award, the FAA Excellence in Aviation Award, the National Academy of Engineering Gilbreth Lectureship and the 2012 AIAA/SAE William Littlewood Lectureship. He is a fellow of the AIAA and a member of AGIFORS, INFORMS and Sigma Xi.

WHAT ATTRACTED YOU TO TEXAS ASE/EM?

First and foremost, it's a great university. Secondly, there is a lot of research activity around urban air mobility and autonomy, including a non-profit autonomy institute nearby. But most importantly, I felt I could fill a niche where my background and experience could be helpful. UT Austin seems like an ideal place for me to do this.

WHAT DO YOU ENJOY MOST ABOUT YOUR RESEARCH?

I like doing research that makes an immediate difference in people's lives. For example, the flight procedure design methodology that I developed was used to design the current flight arrival procedures into Los Angeles for aircraft coming in from the east. I worked with air traffic controllers and aerospace designers there to optimize that procedure. Known as CDA (continuous descent arrival), aircraft effectively 'glide' from cruise through descent and approach to landing instead of the traditional 'step-down' approach, which allows for the engine to be left at idle during descent. This has many advantages, including minimizing fuel use, reducing gaseous emissions and noise pollution, and saving the aircraft from additional wear and tear.

LORI Magruder

ASSOCIATE PROFESSOR
PH.D. THE UNIVERSITY OF TEXAS AT AUSTIN

Lori Magruder is joining the department this fall as an associate professor. Magruder is a subject matter expert in remote sensing and 3D geospatial data exploitation for earth science. She has held positions at the NASA Jet Propulsion Laboratory and the Johns Hopkins Applied Physics Laboratory prior to returning to UT Austin as a senior research scientist at the Applied Research Laboratories. Magruder was selected to be the ICESat-2 Science Definition Team Leader in 2014 to support mission development and early on-orbit satellite operations. She also is the principal investigator for the satellite's precision pointing determination operational program and geolocation validation studies. In 2020, Magruder was selected by NASA to lead the new ICESat-2 Science Team. In addition to her leadership responsibilities within the mission, she will be providing scientific research in bathymetric science discovery and continuing her efforts for data product validation. She leads many other NASA and Department of Defense remote sensing programs with her expertise in geospatial topics and applications.

Magruder holds a B.S. degree from the University of Southern California in aerospace engineering, an M.S. degree from Princeton University in mechanical and aerospace engineering and a Ph.D. in aerospace engineering from UT Austin.

WHAT ATTRACTED YOU TO TEXAS ASE/EM?

The department has an amazing longevity in technical innovation and is on the forefront of so many diverse areas of study. I'm inspired by the collaboration among the faculty and the quality of the student population. The possibilities are inspiring!

WHAT DO YOU ENJOY MOST ABOUT YOUR RESEARCH?

It seems as if I get to solve a new problem every day, and I am continually encouraged by the potential applications. I get tremendous joy from working with a research team and am encouraged by new discoveries with data from unique technologies or systems.

THOMAS Underwood

ASSISTANT PROFESSOR
PH.D. STANFORD UNIVERSITY

Thomas Underwood is joining the department in January 2021 as an assistant professor. Underwood has worked in a broad range of areas, including propulsion, optical diagnostics, hydrodynamic stability, interfacial chemistry, microfluidics, chemical separation and electrochemistry. His current research interests focus on understanding how the chemistry and dynamics of reactive flows can be leveraged to address challenges in energy, transportation, the environment and security. Specifically, his research aims to understand how reactive transport in fluids and gases can be coupled with interfacial chemistry in the context of hypersonics, space propulsion, catalysis, chemical separation/recovery and as a platform for unconventional computations.

Underwood received a B.S. degree from the University of Florida in physics and nuclear engineering. He received a Ph.D. in mechanical engineering from Stanford University with Mark A. Cappelli. At Stanford, he studied how instabilities form and can be mitigated in hydromagnetic plasma jets. He received his postdoctoral training in chemistry at Harvard University with George M. Whitesides.

WHAT ATTRACTED YOU TO TEXAS ASE/EM?

There are so many fantastic features of the ASE/EM department at UT Austin. The first thing I noticed was the activity, engagement and curiosity of the students. During my interview, I was surprised by the types of questions that students asked me and how motivated they were to do impactful work. I was also attracted to the reputation of the department as a leader in astronautics, aviation, robotics, reactive fluid flows and mechanics. There are a number of collaboration opportunities that I look forward to leveraging within the department. The combination of world-class facilities, professors and students in the department present a unique opportunity to build a preeminent research program. I look forward to expanding the strengths of the department in the coming years.

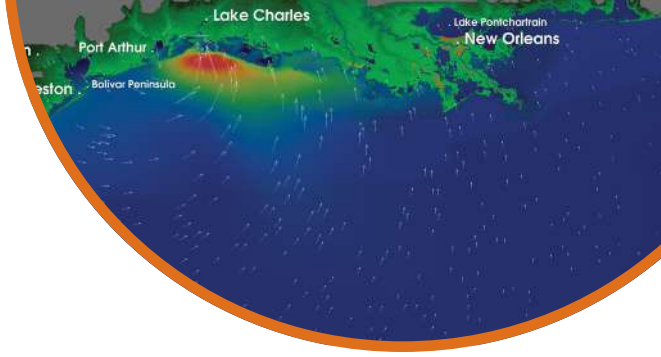
WHAT DO YOU ENJOY MOST ABOUT YOUR RESEARCH?

I am tempted to say my favorite part are those rare moments when a hypothesis is cleanly proven in the laboratory. In my experience, those moments are exceedingly rare. Instead, I have found research to be a process — one that is filled with hard work and careful thought. The iterative process to take an idea and mold that into a scientific discovery is my favorite part. As a researcher, my greatest challenge is to maintain simplicity while researching very complex phenomena. Determining how to pose questions in the most basic form can be both challenging, rewarding and fun. Finally, seeing my work turn into tangible results, a useful technology and a translatable engineering solution drives me to do it all over again. ■

COMPUTATIONAL ENGINEERING
UNDERGRADUATE PROGRAM

ON THE RISE

PROTECT
TEXAS
TOGETHER



1ST EVER

In 2017, the Department of Aerospace Engineering and Engineering Mechanics at The University of Texas Austin became the first U.S. university to offer a bachelor of science degree in computational engineering, a new field that focuses on modeling and simulation to develop solutions for society.

The program offers an interdisciplinary curriculum focused on giving students the opportunity to work on complex 21st-century engineering problems within a wide range of real-world applications. Because of the breadth and depth covered in the curriculum, graduating computational engineers are prepared to pursue careers in a variety of fields, including energy, manufacturing, aerospace, health care, microelectronics and much more. See how the program has grown in just a few short years and learn what our students and alumni are doing with this cutting-edge degree.

NUMBER OF STUDENTS
101 as of September 2020

TOTAL NUMBER OF DEGREES
38 Awarded to Date

NUMBER OF INAUGURAL CLASS GRADUATES
3 2018

LARGEST GRADUATION CLASS TO DATE
19 May 2020

AVERAGE STARTING SALARY
$82K

WHERE COE GRADUATES WORK

- CACI International Inc.
- Capital One
- Epic Systems Corporation
- Lockheed Martin Corp.
- METECS
- Microsoft
- Oden Institute for Computational Engineering
- Proctor & Gamble
- Southwest Research Institute
- Texas Advanced Computing Center

The University of Texas at Austin's computational engineering undergraduate program is accredited by the Engineering Accreditation Commission of ABET.

The B.S. degree in computational engineering includes engineering and science fundamentals, advanced mathematics, software engineering design and more. For more information, visit:

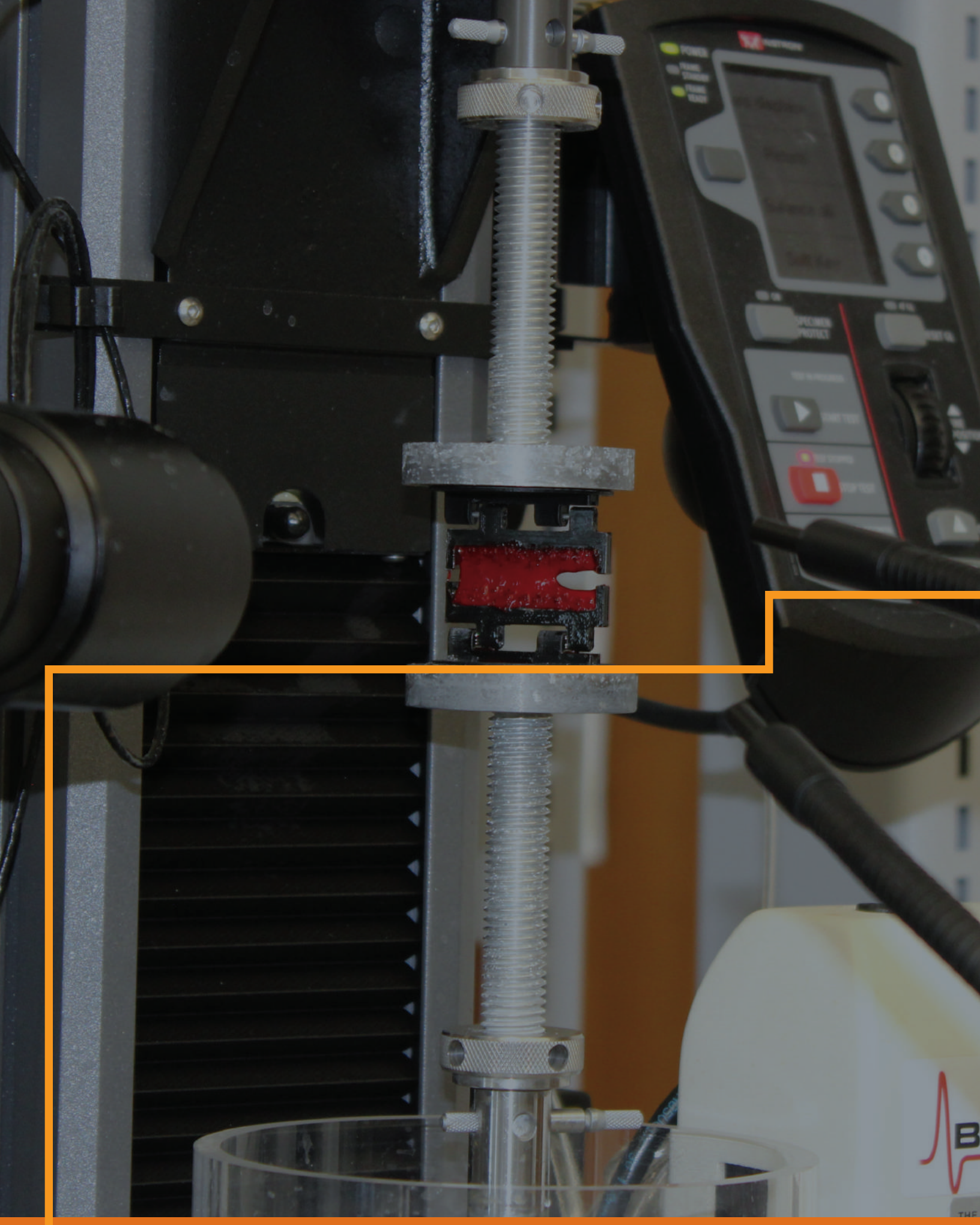
ae.utexas.edu/coe

▲ **MODELING HURRICANE STORM SURGE**
Computational engineering student Marcos Botto Tornielli worked with professor Clint Dawson to produce visualizations of predicted storm surge on the Louisiana coast caused by Hurricane Laura, which made landfall in August. The visualization was developed using results from the Advanced Circulation Model (ADCIRC) run on supercomputers by Dawson's team. These storm surge models have had a major impact on the response to natural disasters on the Texas coastline in real time and on the development of mitigation plans to protect communities from future damage.

"COMPUTATIONAL ENGINEERING COVERS A WIDE ARRAY OF METHODS WITH APPLICATIONS ACROSS THE SCIENCES, AND I APPRECIATE THAT THE COE PROGRAM HAS THE FLEXIBILITY THAT ALLOWS ME TO EXPLORE CONNECTIONS TO VARIOUS FIELDS. I HAVE LEARNED ABOUT SIMULATING THE FLOW THROUGH AN AQUIFER, FORCE ON A BRIDGE, AND THE LIFE CYCLE OF STARS."

– **KATE FISHER, SENIOR, DUAL MAJOR IN COMPUTATIONAL ENGINEERING AND MATHEMATICS**

◀ **COMPUTATIONAL ENGINEERING MAJOR HENRY ROSSITER** spent the summer helping to develop the Protect Texas Together app that helped students, faculty and staff return to campus safely this fall. The app allows people to track their symptoms, record COVID-19 test results, get connected to medical resources and — potentially, in the future — even assist in contact tracing.



BREAKING BLOOD

Blood clots have emerged as one of an increasing number of deadly side effects of the novel coronavirus in some patients. Manuel Rausch and a team of researchers are embarking on a project to learn more about the onset of thromboembolism, the obstruction of a blood vessel by a clot that can cause everything from strokes to heart attacks to pulmonary embolisms, as a result of COVID-19.

The new research will use the concept of fracture mechanics — the study of how and why things crack and break — to understand the relationship between coronavirus and blood clots. The research team aims to compare the blood of coronavirus patients with that of healthy people to see whether it is more likely to break apart under pressure.

> "IF COVID PATIENTS SHOW A HIGHER PROPENSITY FOR BLOOD CLOTS TO BREAK OFF, THAT WOULD BE MONUMENTAL," SAID RAUSCH, AN ASSISTANT PROFESSOR IN THE DEPARTMENT OF AEROSPACE ENGINEERING AND ENGINEERING MECHANICS AND THE DEPARTMENT OF BIOMEDICAL ENGINEERING. "WE COULD THEN BUILD A TEST – USING JUST A FEW MILLILITERS OF BLOOD – TO PREDICT WHETHER THEY ARE MORE AT RISK FOR HEART ATTACKS, STROKES AND OTHER SIDE EFFECTS OF THROMBOEMBOLIC DISEASE THAT DEVELOPS IN COVID PATIENTS."

Though heart attacks, strokes and other similar medical emergencies are typically categorized separately, they all can result from blood clots, making thrombosis one of the most common causes of death.

Rausch and his team recently received approval to collect and analyze blood from COVID patients. That paves the way to begin experiments to mold clotted, or coagulated, blood so it can be analyzed.

The team has submitted the first of several papers on the topic, two of which have recently been accepted.

Blood is a dynamic material, solidifying when it touches a surface or the skin is cut, to stop the bleeding. Blood clots aren't inherently harmful, as they are necessary to stanch bleeding and repair torn vessels. However, when clots break off and travel through the bloodstream, that's when they can become dangerous and lead to strokes and heart attacks. Renegade clots plug up blood vessels, keeping blood from traveling to vital organs.

For the experiment, the team will induce blood to clot around a mold they will use to make it into a thin sheet. They will partially cut it. A mechanical device will attempt to rip it along the cut line. The team will compare the respective "fracture points" of the different blood samples to determine which are more resistant to breaking apart. The lower the fracture point, the more likely the blood is to break off and put a patient at risk for clotting issues.

Rausch sees broader applications of the research, which is funded through the K.C. Williams Faculty Excellence Fund, beyond working with COVID patients. It could be used to measure whether drugs in development weaken blood and make clots more likely to break off and put people who take the drug at risk. Rausch said he wants to build a model that can determine the likelihood that blood clots will fracture under different circumstances.

Rausch specializes in using computational tools to understand the mechanics and behavior of complicated biological soft tissues in the body. He's fascinated by blood and has been working with it since his postdoctoral studies at Yale University several years ago. He's also followed the progress of fracture mechanics, which emerged during World War II to understand why battleships suddenly failed and has recently been adapted to study the mechanics of the human body.

When the COVID pandemic arrived, Rausch said his research projects ground to a halt as labs closed. He

worked on a couple of different coronavirus projects, making masks and parts to help solve ventilator shortages. But those projects didn't fit his areas of expertise. When he started reading reports about COVID patients experiencing strokes, heart attacks and other complications due to blood clots, Rausch started to put together the idea.

"I immediately thought 'this is exactly what I do,'" he said.

Rausch has a unique specialty in combining computational engineering with a focus on biomechanics. His mentor at UT is K. Ravi-Chander, a professor in the Department of Aerospace Engineering and Engineering Mechanics and the editor-in-chief of the International Journal of Fracture. Rausch's interest in blood and fracturing, combined with the expertise to lean on for guidance, helped quickly galvanize the team and idea for the project.

"I've always been interested in blood clots, and I always wanted to study fracture mechanics," Rausch said. "This is an opportunity to step in and use my expertise to try to contribute to the discovery of a potentially new mechanism and translate really basic science into clinical advancement." ■

HAVE 1MIN 32SECONDS?

Check out this video on Rausch's project and follow us for more videos.

youtu.be/MZCdbyFOfiE

For the latest COVID-19 research and news from Texas Engineering, visit:

engr.utexas.edu/covid-19

#ICYMI

Congrats to faculty members Jayant Sirohi, Moriba Jah & Ufuk Topcu on their promotions! These faculty have positively impacted @UTAerospace's teaching & research efforts in VTOL technology, space situational awareness & autonomous systems. bit.ly/33cvB8v

FOR MORE NEWS AND UPDATES FOLLOW US ON SOCIAL

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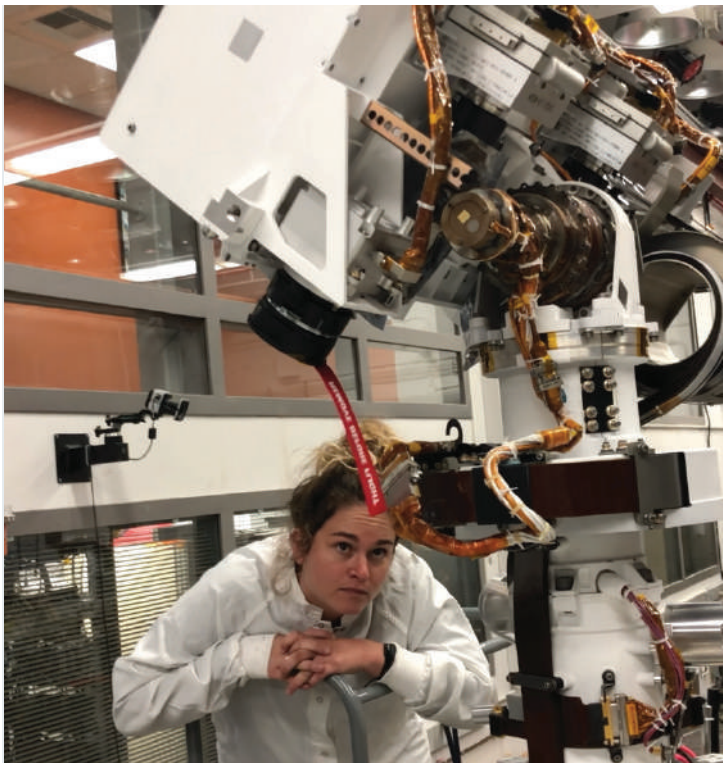


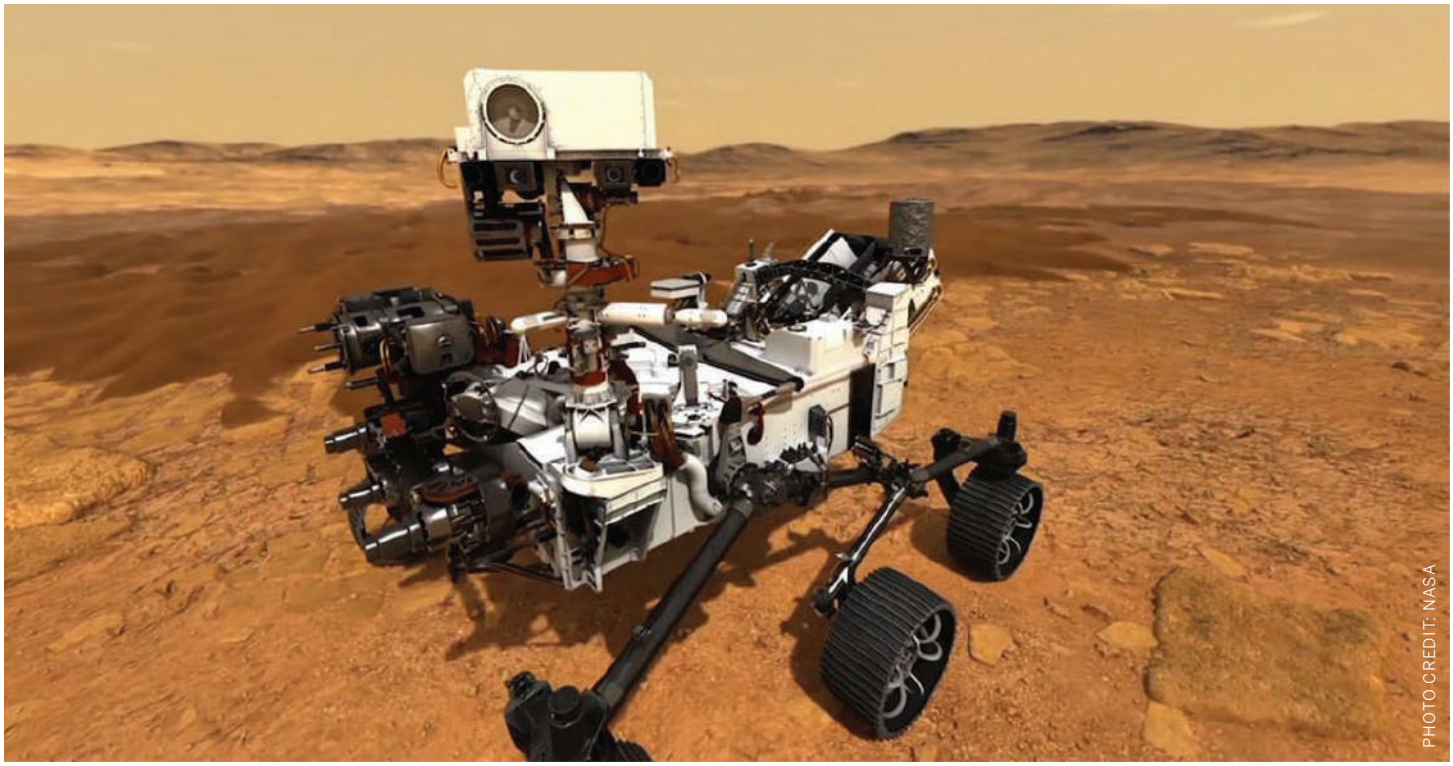


PHOTO CREDIT: NASA

5 QUESTIONS ? 5 QUESTIONS ? 5 QUESTIONS ? 5 QUESTIONS ?

5

ALUMNA REBEKAH SIEGFRIEDT

ON THE MARS PERSEVERANCE MISSION

A systems engineer at NASA's Jet Propulsion Laboratory, Rebekah Sosland Siegfriedt, B.S. ASE 2013, has been working on the Mars Perseverance mission for the past five years. On July 30, the rover sped from Earth at nearly 24,600 mph and is scheduled to land on Mars in February, where it will begin its historic search for signs of ancient life on the Red Planet. Bekah tells us what it's been like to work on the rover and how her education at UT Austin helped her prepare for this important mission.

1 TELL US ABOUT YOUR ROLE ON THE MARS PERSEVERANCE MISSION AND HOW YOU FELT ONCE THE ROVER LAUNCHED.

I'm a mission operations systems engineer on the Mars 2020 project, which means I was responsible for designing and testing the health and safety of Perseverance (Persy) before she left for Mars. Once she lands, I'll be managing the rover's well-being by implementing daily activities and quickly solving problems during the mission.

The launch was so emotional because I've spent years on this project. The night before, I was thinking, "Wow, this is Persy's last night on Earth." It's like sending your kid off to college but never seeing them again! And even though it was a time of celebration, there was still a lot to be done — double checking parameters, crossing our Ts, dotting our Is. At the same time, I was involved with a lot of outreach, including TV

interviews across the nation. All the while, I was working from home with a small child in my lap. To sum it up, the week of launch was pretty hectic but also exciting!

2 WE'VE BEEN TO MARS WITH OTHER ROVERS. WHAT MAKES THE PERSEVERANCE MISSION SO IMPORTANT?

So yes, we've been to Mars before — in 1997 we landed Pathfinder to perform a technical demonstration with Sojourner to prove we could move about on Mars; then, in 2004, we sent Spirit and Opportunity to look for water, followed by Curiosity in 2012 to see if there is evidence that life might have ever existed. Not only did we find out that water once existed there but that it was drinkable water. So, the next step for Perseverance is to search for evidence of ancient, microbial life by drilling down and collecting soil samples. We'll be learning more about the planet's potential to support humans in the future as well. And we'll be doing a technical demonstration of a small helicopter, Ingenuity, to see if we can fly on Mars and to capture videos of the terrain. That's going to be exciting and it's one of the first things scheduled to happen after Persy lands on Mars.

3 WHAT DO YOU ENJOY MOST ABOUT WORKING ON THIS PROJECT AND WHAT DO YOU FIND MOST CHALLENGING?

I've had the opportunity to work with people from many different countries and backgrounds across the globe. It's been great to see everyone come together and work on this project for humanity. We all have the same goal in mind. We all support each other. And it's been a very happy project to work on during this difficult time — a real breath of fresh air.

Most recently, the COVID-19 pandemic has made things extremely challenging. Not only am I working from home, but oftentimes I've had to make decisions about the Mars rover with a toddler in my lap while also being eight months pregnant!

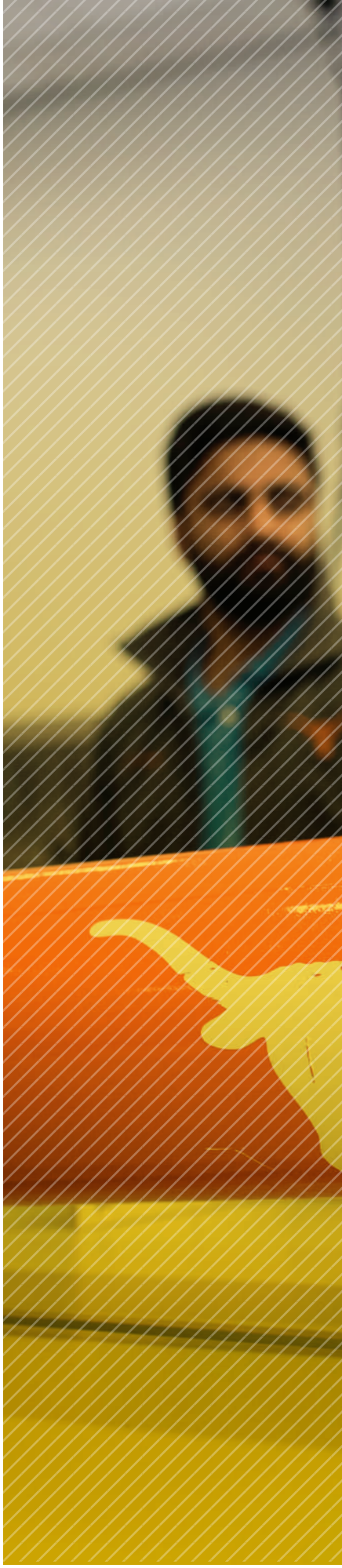
But when I think I've had it, I like to think about Katherine Johnson and the other women at NASA who were faced with such difficult circumstances while they were working to put the first astronauts in space — how they had to run from building to building to use the segregated bathrooms, eat in separate dining spaces, etc. And I think if they can do it, I can certainly do it, too. That helps me put things into perspective.

4 HOW DID YOUR EDUCATION IN AEROSPACE ENGINEERING AT UT HELP PREPARE YOU FOR THIS WORK?

Every single class that I took in the department has helped with my career in some way — spacecraft dynamics, orbital mechanics, propulsion. The systems engineering class is what I continue to pull up notes from. That class was fundamental in getting me into my career at JPL. Being involved with student projects and organizations also helped me more than I thought it would, especially with my communication skills, learning how to work on a team and developing good time management skills. All of these skills are really important in my current position at JPL.

5 WHAT ARE THE NEXT STEPS NOW THAT PERSY IS ON ITS WAY TO MARS?

When Persy finally lands on Mars on Feb. 18, 2021, I will be overseeing the health and safety of the vehicle and the subsystems to ensure they are all working together so that we can perform the science missions. I'll report these findings to the science team each day so that they know what resources are available. I should also mention that our team will be on "Mars time" for the first 90 days. And since a Martian day is 40 minutes longer than an Earth day, that means our work schedule changes 40 minutes each day since we have to communicate with Perseverance at the same time every day. So, for members of the operations team, we will constantly have to change our sleep schedules during this time. It's going to be a weird time for the team as we adjust our lives around Persy's schedule, but it's also going to be a great opportunity for the team to bond. ■



A CLOSER LOOK AT ASE/EM

DEPARTMENT OF AEROSPACE ENGINEERING
AND ENGINEERING MECHANICS

A CLOSER LOOK AT ASE/EM

LEADERSHIP

On Sept. 1 of this year, Professor Clint Dawson began serving as the new department chair. Dawson has served as a professor in the department for 25 years and was instrumental in establishing the new computational engineering undergraduate program. His research in data-driven storm surge modeling has had a major impact on the response to natural disasters in Texas. Dawson's key priorities once he is settled into his new position:

1. **Get us through the COVID-19 crisis** and then assess where we are after the worst passes and we enter a new normal. There is no doubt that things will be different and, at present, we don't know what the future holds.
2. **Work with the faculty to determine our strategic research and educational goals for the next five years.** Perform a self-evaluation and determine where we see strengths and weaknesses.
3. **Continue efforts to increase the diversity** of our faculty, staff, graduate and undergraduate populations.
4. **Expand the department's broader outreach** to the local community and explore educational and research partnerships with Historically Black Colleges and Universities (HBCUs) and Minority Serving Institutions (MSIs).

Learn more about Clint Dawson in our Q&A at *bit.ly/meet-clint-dawson*.

STUDENTS

UNDERGRADUATE

ENROLLMENT	**647**
ASE	546
COE	101
UNDERREPRESENTED POPULATIONS	
ASE	29%
COE	20%
WOMEN	
ASE	22%
COE	26%
AVERAGE STARTING SALARY	
ASE	$69,848
COE	$81,625

1420 average SAT score for admitted students

89% of ASE undergraduates report securing employment or attending graduate school upon graduation

100% of COE undergraduates report securing employment or attending graduate school upon graduation

GRADUATE

ENROLLMENT	**165**
ASE Master's	43
ASE Doctoral	94
EM Master's	2
EM Doctoral	26

17% women

3.68 average GPA of admitted students

96% of Ph.D. students receive full funding

DEGREES AWARDED 2019-2020

ASE Bachelor's	166
COE Bachelor's	23
ASE Master's	16
EM Master's	4
ASE Doctoral	7
EM Doctoral	7

IN THE U.S.

NO. 9 AEROSPACE ENGINEERING
GRADUATE PROGRAM

AEROSPACE ENGINEERING
UNDERGRADUATE PROGRAM NO. 7

U.S. News and World Report

FACULTY

TENURE/TENURE-TRACK FACULTY	**36**
Endowed faculty positions	27
Emeritus faculty	13

HONORS AND AWARDS

8 Winners, National Science Foundation CAREER Award
8 Fellows, American Institute of Aeronautics and Astronautics
7 Members, National Academy of Engineering
7 Fellows, American Society of Mechanical Engineers
4 Fellows, American Academy of Mechanics
4 Fellows, Society for Industrial and Applied Mathematics
3 Winners, AFOSR Young Investigator Program Award
3 Fellows, American Astronautical Society
1 Member, National Academy of Science
1 Winner, Presidential Early Career Award for Scientists and Engineers
1 Winner, American Heart Association Career Development Award
1 Winner, DARPA Young Faculty Award

FACULTY RECOGNITION

- **Thomas J.R. Hughes** was ranked first in Applied Mathematics and second in Engineering (all fields) in a worldwide citation survey based on data for 6 million scientists in 22 major fields.
- **Moriba Jah** was selected for an International Visiting Research Scholar award at the University of British Columbia, Vancouver.
- **Nanhsu Lu** was named a fellow member of the International Association of Advanced Materials and was selected in the first cohort of ACS Nano Rising Star lecturers in the iCANX series.
- **Byron Tapley** was recognized with the annual ASEE/AIAA J. Leland Atwood Award, which recognizes an outstanding educator in the field of aerospace engineering.

DID YOU KNOW?

The University of Texas at Austin is the first ever U.S. university to offer a computational engineering undergraduate program. Learn more about this new and rapidly growing multidisciplinary field that applies advanced methods and analysis to engineering practice:

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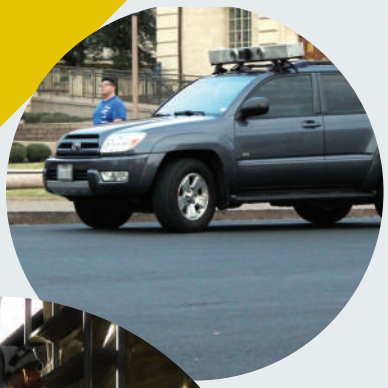
RESEARCH

$17.6 MILLION IN RESEARCH EXPENDITURES

RESEARCH AREAS

- Aerothermodynamics and Fluid Mechanics
- Computational Engineering
- Controls, Autonomy and Robotics
- Orbital Mechanics
- Solids, Structures and Materials

A CLOSER LOOK AT ASE/EM

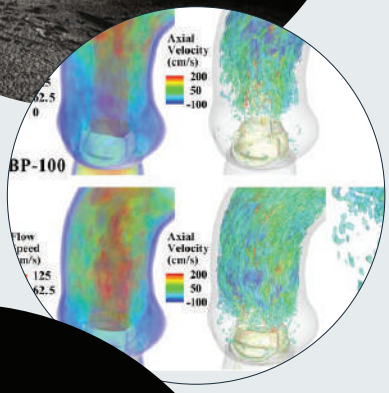


RESEARCH HIGHLIGHTS

With two NSF grants, **Efstathios Bakolas** is developing autonomous robots and vehicles that are programmed to avoid possible collisions and find the best trajectory for their final destination.

Alumna **Parvathy Prem** led a recent study, along with ASE/EM professors **David Goldstein** and **Philip Varghese**, that found that exhaust emitted from lunar landing vehicles could make it harder to study ice deposits on the Moon.

Thomas Hughes co-authored a study to develop computational modeling techniques that, for the first time, enable accurate visualizations of heart valve behavior.



A team of researchers led by **Todd Humphreys** was awarded the Walter R. Fried Memorial Award for best overall paper for their work on developing self-driving cars that use low-cost automotive radars to achieve 50-cm-accurate ground positioning for navigation in urban areas with poor visibility.

Luis Sentis and a team of researchers received the IEEE/ASME Transactions on Mechatronics best paper award for their innovative approach to actuator design known as a viscoelastic liquid cooled actuator, which was implemented into their newly designed legged robot, DRACO.

Karen Willcox is developing new scientific machine learning methods that allow for rapid rocket engine design, addressing the issues of time, cost and safety that make the process of rocket engineering design so difficult. ■

BLAST **FROM THE PAST**

BRYAN D. BOGLE, B.S. ASE 1996, writes, "I was promoted to the rank of Colonel in the U.S. Army Reserves in July of 2020 where I am working with the Defense Industrial Base Cyber Assessment Center (DIBCAC) within the Defense Contract Management Agency (DCMA) out of Fort Lee, Virginia. My organization conducts cybersecurity assessments of defense contractors throughout the United States to ensure compliance with all federal regulations. On the civilian side, I'm currently owner of JetTech Consulting, an IT and cybersecurity consulting firm in Houston."

NIKOLAOS BOUKLAS, PH.D. EM 2014, is an assistant professor at Cornell University, where he leads the Computational Mechanics and Multiphysics Lab in the Sibley School of Mechanical and Aerospace Engineering. According to his research group's website, the team's research focuses on the mechanical and multiphysical behavior of soft, active and biological materials and the development of novel computational tools and techniques for materials modeling.

JOHN DICKS, B.S. ASE 1987, was promoted to the position of director at Maritime Controls Systems for L3Harris Technologies, Inc. In this role, he will be leading the Program Management Organizations in Herndon, Virginia and Ayer, Massachusetts, and serve as the site leader in Herndon. The maritime controls arm of L3Harris is a leader in providing automated machinery control, electrical plant control, propulsion control, integrated bridge, navigation and hybrid electric drive solutions for the U.S. Navy, U.S. Coast Guard and U.S. Military Sealift Command. Dicks has been with legacy L3Harris companies since 1998. Early in his career, he worked at the NASA Johnson Space

John Dicks

Center as a systems engineer and project manager on the Space Shuttle Ascent Guidance, Navigation and Control team and also as a project manager for NASA Robotics Research and Development programs. In 2013, he took on the role of program manager for the development of the highly complex Command, Control, Communications, Computers, and Navigation system for the new Navy hovercraft — the Ship to Shore Connector.

COL. WILLIAM D. KNOX, B.S. ASE 1970 (right) is pictured with son Chief Warrant Officer Five Bernd H. Knox (left) in Khandahar, Afghanistan (2009) when Col. Knox was deployed to Afghanistan

Col. William D. Knox (right) and his son Chief Warrant Officer Five Bernd H. Knox (left)

to fix the rocket system on the OH-58D Kiowa Warrior fleet of aircraft while Bernd was also deployed there. CW Knox called his father in the Joint Attack Munition Systems Program Management Office at Redstone Arsenal, Alabama, and identified a potential problem with the aircraft's rocket system and traveled to Afghanistan to address the issue. During his 30-year career after commissioning at UT Austin's ROTC, Knox commanded Nike Hercules nuclear air defense missile units and a Patriot Missile Battalion in Dexheim, Germany, which deployed to Desert Storm in 1990. He ended his military career as program manager of the Javelin missile program, 1996-2000, and won the 1997 PM of the year. After his service in the military, Col. Knox worked in the aerospace industry for five years and returned to the government as an Army civilian and business director for the JAMS missile program. Fully retired, Knox mentors engineering students at The University of Alabama.

JUAN CARLOS ORTIZ, B.S. ASE 2011, is a senior mechatronics test engineer at Maxar in Pasadena, California.

GRANT ROSSMAN, B.S. ASE 2011, is a senior aerospace engineer at Sandia National Laboratories in Albuquerque, New Mexico.

JACOB SANSOM, B.S. COE 2020, writes, "I'm excited to announce I will be beginning my career with Northrop Grumman's rotational development program! I will be starting in San Diego as a systems engineer."

JORDAN WALLER, B.S. ASE 2015, is a software engineer at L3Harris in Arlington, Texas. ■

LEAVING A LEGACI

Most humans will never set foot on the moon, but a group of students from the Cockrell School of Engineering have an intriguing idea to let anyone make their mark there.

The project, a rover that could write short messages on the surface of the moon, was recently recognized as part of a NASA design contest.

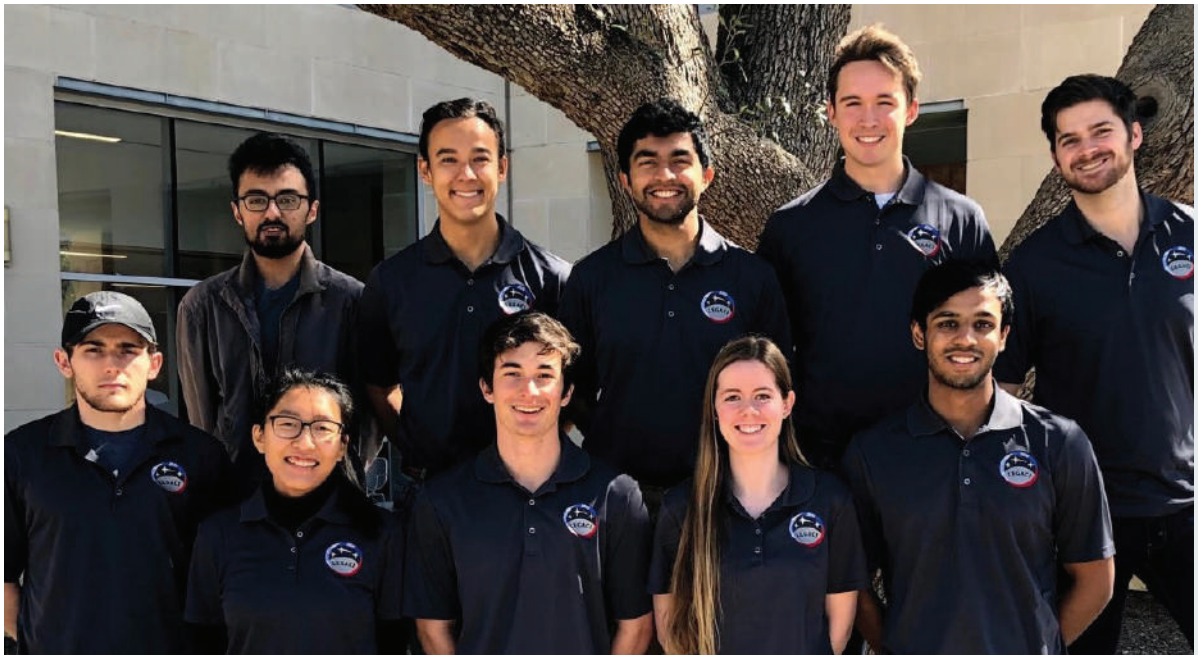
Project LEGACI won two awards at NASA's RASC-AL (Revolutionary Aerospace Systems Concepts Academic Linkage) annual design competition.

The team won in their theme category, Commercial Cislunar Space Development, and won the Excellence in Commercial Innovation Award. The students' plan includes building a rover complete with a robotic arm that can, in just a matter of minutes, write personalized messages on the moon's surface and capture photographs of the etchings.

The 10 students were seniors in the Department of Aerospace Engineering and Engineering Mechanics when they developed the project and graduated in May 2020: Samuel Adams, Ali Babool, David Baier, Brianna Caughron, Jack Davidson, Justin Ganiban, Kevin Hicks, Akshat Ramadurai, Nader Syed and Rebecca Wang. They took two consecutive courses taught by lecturer Adam Nokes. LEGACI — short for Lunar Engraver with Geologic Autonomous Carving Instrument — was their capstone project.

"I am so proud of the work my team has done this year to achieve this great honor," said Caughron, the team leader. "I want to thank them and our faculty advisor for all the effort they have put into our project that helped us be successful. I never imagined an idea I had walking back to my apartment after class last fall could turn into something so rewarding and meaningful."

But this is not your average class project. The pitch deck for LEGACI includes nearly 120 slides that detail everything from the specifications of the rover, to revenue and cost projections, to a timeline for future operations.



The idea is compelling enough on its own, but looking at the financials the team put together to help this theoretical company blast off adds another layer of intrigue. LEGACI doesn't charge by the hour, but by the second. Customers would pay $9.99 per second the rover spends carving images. One example, the company name along with the UT longhorn silhouette, took 445 seconds, bringing the total cost to $449.55.

"At first glance, this concept seemed a little out of left field," Syed said. "But thanks to months of work by people I was lucky enough to be on a team with, it became tangible. Real. And I think that's engineering in a nutshell — making an idea real, something out of nothing. I'm really proud of this project and this team, and I know I'll remember this for a long time."

The team expected the average moon message to cost between $500 and $600. And they noted that the average tattoo costs between $250 and $800, and four out of 10 adults have one, a sign that there's a market for that level of spending.

THE STUDENTS SEE MASSIVE EARNING POTENTIAL FROM LEGACI. THE PROJECT WOULD LOSE MONEY FOR THE FIRST FEW YEARS, DUE TO THE COSTS OF BUILDING THE ROVER AND LAUNCHING IT. BUT BY 2026, THE TEAM PROJECTS LEGACI COULD BRING IN ABOUT $610 MILLION IN ANNUAL REVENUE AND PROFITS OF ABOUT $450 MILLION.

The presentation shows a number of different products that could be created from a lunar etching, including digital prints, canvas prints, journals, buttons, shirts, socks, phone cases and more. And the team included an upfront list of types of messages that wouldn't be allowed: No profane or racial statements, no political language and nothing slanderous or lewd.

With such rosy projections, including the possibility that LEGACI could become a $10 billion business by 2030, will the team attempt to make the idea into a full-fledged space startup? It's certainly a high price tag to launch the project, but the students indicated they might start looking for an angel investor, Nokes said. ■

THIS STUDENT-DESIGNED ROVER CAN WRITE YOUR NAME ON THE MOON

ASE/EM ACADEMY

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2020
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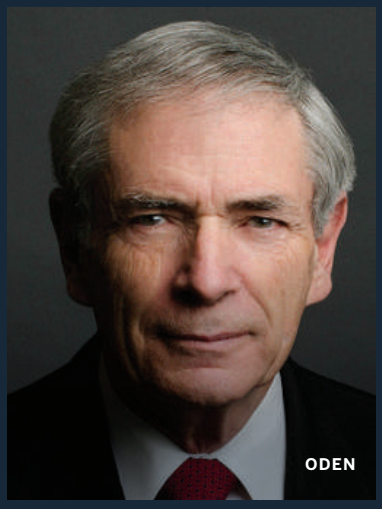
ODEN


OUZTS


PERKINS

OF DISTINGUISHED ALUMNI

Ten alumni and one honorary faculty member of the Department of Aerospace Engineering and Engineering Mechanics at The University of Texas at Austin have been elected to the 2020 class of the ASE/EM Academy of Distinguished Alumni.

The Academy was established in 2019 with the vision to foster excellence within the aerospace engineering, engineering mechanics and computational engineering programs in Texas ASE/EM through recognition, participation, encouragement and support of the department.

Members are honored by the Academy for their outstanding technical contributions to their fields, excellence in leadership and dedication to improving our community. These distinguished alumni include professors, entrepreneurs, government and industry leaders, astronauts, pilots, researchers and more. Learn about the ASE/EM Academy of Distinguished Alumni at *ae.utexas.edu/alumni/ada*

THE MEMBERS ELECTED TO THE ASE/EM ACADEMY OF DISTINGUISHED ALUMNI FOR 2020 ARE:

RICHARD COOK
Associate Director for Flight Projects and Mission Success, NASA Jet Propulsion Laboratory

GEORGE W. DAVIS
CEO, Emergent Space Technologies, Inc.

NOBORU KIKUCHI
President, Toyota Central R&D Laboratories, Inc.

DAVID J. KORSMEYER
Associate Center Director for Research and Technology, NASA Ames Research Center - Silicon Valley CA

PATRICK LE TALLEC
Professor, Institut Polytechnique de Paris France

PAUL LOCKHART
Director of Engineering, PEMDAS Technologies and Innovations

JERRY L. MCDOWELL
Deputy Laboratory Director/Executive Vice President for National Security Programs, Sandia National Laboratories *(Retired)*

BRENDAN M. O'CONNOR*
Vice President of Advanced Programs, Emergent Space Technologies

J. TINSLEY ODEN (HONORARY MEMBER)
Cockrell Family Regents Chair in Engineering #2; Professor, Aerospace Engineering, Engineering Mechanics, Mathematics, Computer Science, The University of Texas at Austin

SUSAN OUZTS
Vice President, F-16, Japan F-2 & India F-21 Programs, Lockheed Martin Aeronautics Company, Lockheed Martin

RICHARD (DICK) PERKINS
Co-founder, Cox & Perkins Exploration, Inc. *(Retired)*

* Brendan O'Connor passed away on Sept. 27, 2020.

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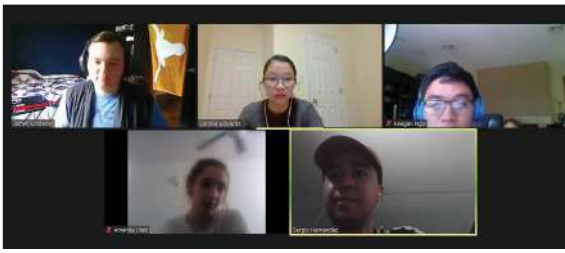

GIVING BACK

Classrooms alone don't create leaders — students also need community and hands-on experience. Our project-based student teams and organizations teach our students valuable technical, leadership and research skills while preparing them to become the next generation of Texas Engineers.

Learn more about our 2020-21 student projects: *bit.ly/student-orgs-20*
Support student projects: *bit.ly/support-ug-projects*

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