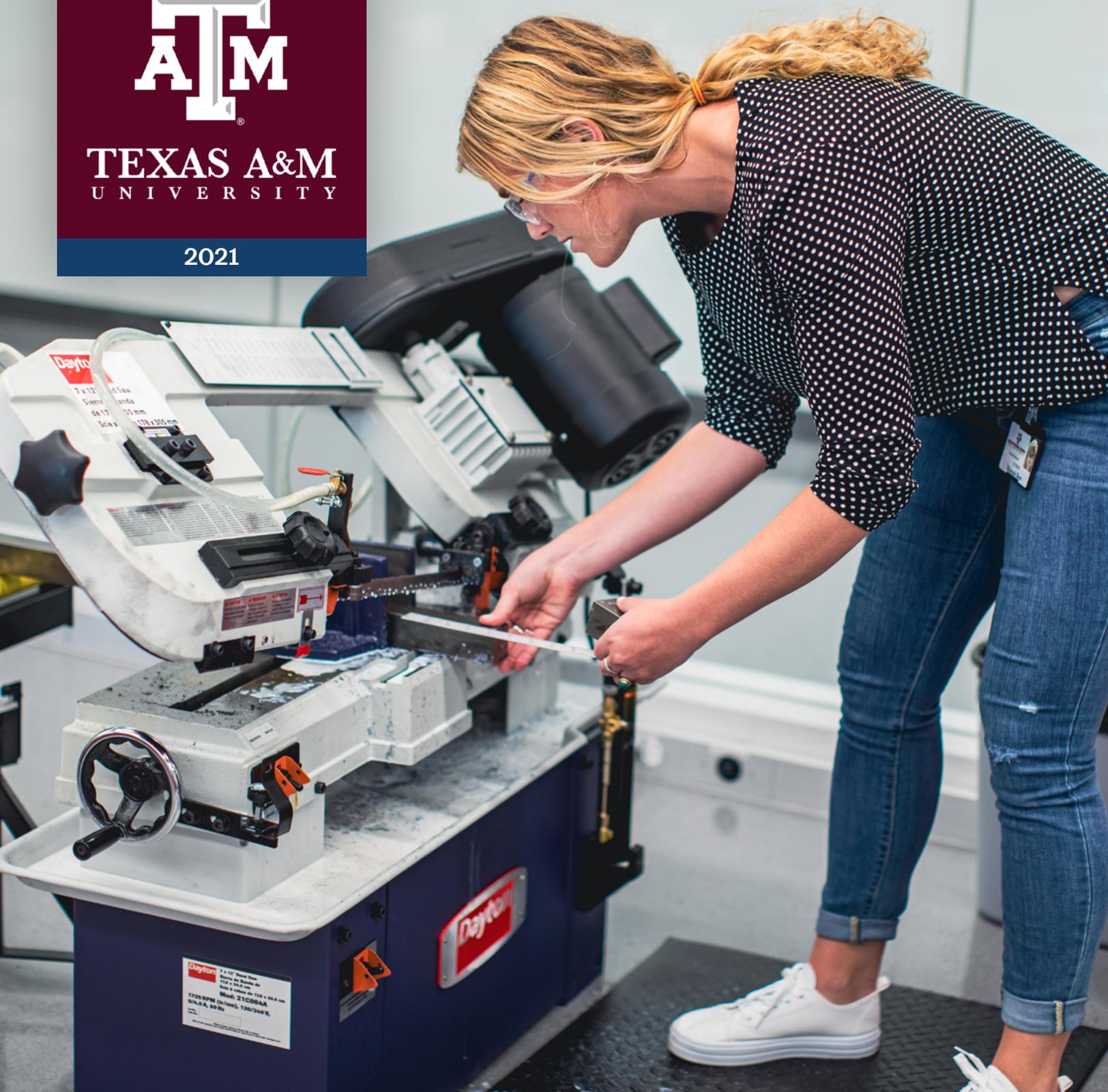




TEXAS A&M  
UNIVERSITY

2021



DEPARTMENT OF

**MULTIDISCIPLINARY ENGINEERING**

# LETTER FROM THE DEPARTMENT HEAD



It is an honor to be named the first department head of the Department of Multidisciplinary Engineering. Our year was remarkable in many ways, and the future holds great promise.

One word that describes this year in particular is growth. We increased our student enrollment, our faculty and our staff. Students show interest in the department as we offer curricula that prepare future engineers for multidisciplinary careers: architectural engineering, subsea engineering and project management; and professions where skillsets are ever-emerging: cybersecurity, engineering medicine, engineering entrepreneurship and the newest offering, engineering law. We also offer online degrees, such as our Doctor of Engineering, which draws tremendous attention from prospective students.

This past year, we graduated our second cohort of students participating in the Bachelor of Science in Interdisciplinary Engineering. The degree is flexible, meaning students can customize their engineering degree based on their interests. I'm excited for the opportunities that will present themselves for students who partake in this program.

As we push forward, I am thankful for the faculty, staff and students who are paving the way toward excellence. I look forward to guiding multidisciplinary engineering to new heights as department head and cultivating continual improvement.

Thanks and Gig 'em!

A handwritten signature in black ink that reads "Timothy J. Jacobs". The signature is fluid and cursive.

**Timothy J. Jacobs, Ph.D.**

Department Head, Multidisciplinary Engineering  
Professor, J. Mike Walker '66 Department of Mechanical Engineering  
Steve Brauer, Jr. '02 Faculty Fellow

# START YOUR AUTONOMOUS ENGINES



It's Oct. 23, 2021, and tensions are high at the Indianapolis Motor Speedway. Engines are roaring, the crowd is cheering and racecars are lining up without a driver in sight. The green flag waves to start the race that's taking hands-free to a whole different level.

Autonomous racecars programmed by teams across the world — including the Texas A&M Indy Autonomous Challenge team led by doctoral student Lance Decker — will go head-to-head in the first-ever Indy Autonomous Challenge in pursuit of \$1.5 million in rewards.

"There are cars that have some autonomy, such as lane-keeping cars that can recognize the left and right side of the lane and steer the wheel," said Decker. "The difference is that autonomous cars on the road are going 30 miles per hour with the help of a driver, and we'll be going 200 miles per hour without human intervention."

The teams were provided with software and tools capable of communicating with a modified Dallara IL-15 racecar. The team is responsible for developing code that propels the racecar around the track while avoiding other cars in the fastest time possible.

"We are writing code that is transportable to the car," said Decker. "Then we will make adjustments to create connectivity between the virtual world and reality."

If the team wins, they plan to use the prize money to endow a scholarship at Texas A&M.

"Right now, this is a one-off event," said Decker. "Our goal is to turn it into something perpetual where other students can come along, take the same car and continue to compete. It would be amazing to help provide this opportunity to others who share this interest." ▼



# ADVANCING RESEARCH ON ENVIRONMENTALLY FRIENDLY, HYDROGEN-ENRICHED FUEL

Dr. Muzammil Arshad and two multidisciplinary students from the Higher Education Center at McAllen, Jonathan Rodriguez and Miriam Alanis, conducted a study to analyze the performance of hydrogen-enriched fuel on spark engine performance and efficiency. This solution could make significant contributions to helping automobiles become more environmentally friendly.

“Due to climate change, as well as a focus on reduced emissions and deprivation of fossil fuel reserves, there has been immense research to reduce emissions,” said Arshad. “This has led to investigating effects of dual fuels on the emissions as well as engine performance parameters because we don’t want to lose the combustion characteristics by injecting a secondary fuel.”

The goal is that by adding hydrogen, cars will be more fuel-efficient and produce less emissions. The researchers also analyzed whether significant changes would be required to current spark ignition engines to account for the addition of hydrogen.

“Our findings show a reduction in the in-cylinder peak pressure, insinuating that we do not need major modifications to the engine to use this dual fuel,” said Rodriguez.

Their research was accepted into the 12th U.S. Annual Combustion Meeting hosted in College Station, where they presented their findings. This study was also recently published in the *Petroleum and Chemical Industry International journal*.

“These accolades establish our research and give it credibility,” said Rodriguez. “I believe we are part of the first student research projects conducted on the McAllen campus. As an undergraduate, I didn’t believe it was an experience I would achieve until Dr. Arshad developed the project.” ▼



## FEATURED RESEARCHER

**Dr. Muzammil Arshad**

Instructional Assistant Professor,  
College of Engineering



# ALTERNATE CAMPUSES

## HIGHER EDUCATION CENTER AT MCALLEN

Students at the Higher Education Center at McAllen have a unique opportunity to earn an engineering degree from Texas A&M University while living in the Rio Grande Valley. Through the multidisciplinary engineering department, students at the Higher Education Center can pursue a Bachelor of Science in Interdisciplinary Engineering.

## ENGINEERING AT GALVESTON

The Engineering for Marine Environments track is a specialized interdisciplinary degree that focuses on engineering in marine environments — from shore to ocean floor. By pursuing this degree, students gain an understanding of the geohazards present in and around the ocean by taking courses in ocean engineering, project management and safety engineering. Here, students will enjoy the scenic Texas A&M University at Galveston located on the Gulf Coast. ▽

## CLOSING THE GAP BETWEEN ENGINEERING AND MEDICINE

Dr. Andrew Robbins is helping health care professionals develop their ideas to assist patients from conception to production by teaching students about the overlap between engineering and health care through his work at Engineering Medicine (EnMed).

“While all medical schools train physicians to be great doctors, some doctors want to create technologies to fix problems in health care,” said Robbins. “EnMed provides a hands-on education program preparing students to become medical innovators.”

Students learn how to diagnose patients while simultaneously studying how to develop influential medical technologies. Rooted in its collaboration with Houston Methodist hospital, it prioritizes research and experimentation.

“EnMed is an excellent opportunity for anyone interested in translating research into products that make a difference in the clinic,” said Robbins. “I love working with students in EnMed that want to solve the biggest problems in health care.” ▽



### Dr. Andrew Robbins

Research Assistant Professor, EnMed Program and Mechanical Engineering

Adjunct Assistant Professor of Biomedical Engineering, Cardiovascular Sciences, Houston Methodist Research Institute

Deputy Director, Biomechanical Environments Laboratories



# UNDERSTANDING CYBERSECURITY IN THE DIGITAL AGE

The field of cybersecurity is exponentially growing as society moves through the digital age. Brian Uzuegbunam, an interdisciplinary engineering major, is jumping ahead of the curve by working toward a minor in cybersecurity.

“As we find more ways to progress technologically, there needs to be safeguards and regulations put in place to ensure they’re not being used maliciously,” said Uzuegbunam. “This minor has equipped me to understand technology’s effects on our everyday lives.”

From cyber ethics to networking fundamentals, the program offers an array of knowledge to students interested in gaining a basic understanding of cybersecurity.

“I learned about the real-world applications of cybersecurity and about the risks we take while existing in the digital age,” said Uzuegbunam. “We are attached to the feeling of privacy, but innovations like facial recognition and fingerprint scanning seem to go against that belief.”

The cybersecurity minor is designed to appeal to all undergraduate students across multiple departments and in numerous colleges. It is available to all students pursuing a bachelor’s degree. ▀



# OFFSHORE VIBRATORY-INSTALLED WIND TURBINES

Texas A&M researchers have theorized a way to float a 15-megawatt wind turbine in offshore environments and install the structure using vibratory hammers. Funded by the National Offshore Wind Research and Development Consortium, they will determine the practicality of this idea.

“Cranes are expensive, and in the offshore business, they charge about a half-million dollars per day for use,” said Dr. Saadat Mirza, professor in the subsea engineering program offered through the department. “We are proposing that we assemble the whole structure onshore and float the structure out. This idea is completely new to industry.”

Other contributors include Dr. Charles Aubeny in the civil and environmental engineering department and Dr. Moo-Hyun Kim from the ocean engineering department.

The team has proposed to insert wind turbines into the seabed through vibratory hammers capable of quickly puncturing and temporarily loosening the seabed, to install a bucket foundation.

“When the hammer vibrates, it temporarily liquefies the soil and will allow the turbine to enter the soil very rapidly,” said Aubeny. “As opposed to impact installation, which uses one large hammer, multiple vibratory hammers may be used simultaneously. This means no strict limit on the foundation size.”

By using vibratory hammering, the foundation can be more compact. This feature allows for construction of the wind turbine on land then floating it to the offshore location. This method is also less time-consuming, taking only 10-15 minutes, as opposed to the 8-10 hours it currently takes. In addition, noise pollution and financial costs are immensely decreased. ▽



## FEATURED RESEARCHERS

**Dr. Charles Aubeny**

Professor, Civil & Environmental Engineering



**Dr. Saadat Mirza**

Professor of Practice, Subsea Engineering



**Dr. Moo-Hyun Kim**

Professor, Ocean Engineering  
Bauer Professor II  
Director, Ocean System Simulation and Control Lab



TEXAS A&M UNIVERSITY  
Department of  
Multidisciplinary Engineering

[engineering.tamu.edu/mtde](http://engineering.tamu.edu/mtde)

DEPARTMENT OF MULTIDISCIPLINARY ENGINEERING

# BY THE NUMBERS

## ENROLLMENT\*

(FALL 2021)

**241** Total

**171** Undergraduates

**70** Graduates

**257** Total Graduated Students

## FACULTY

**64** Total Faculty

**21** Primary Faculty

**3** Courtesy/Director Level Faculty

**40** Affiliate Faculty

*\*preliminary,  
5th class day*