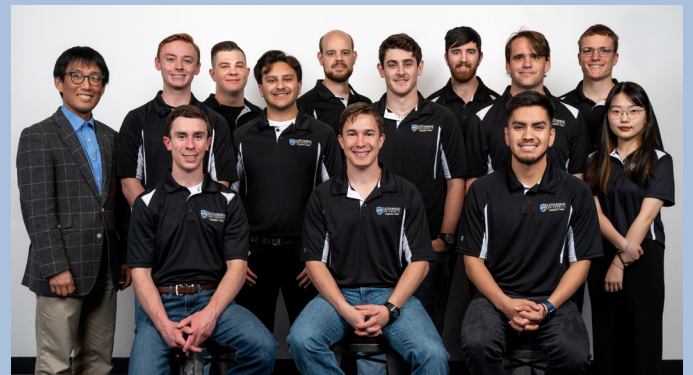




**ACME: Additive Construction Materials  
Experimentation**

The purpose of this project is for the Senior Design team under Dr. Kraig Warnemuende to be able to characterize and predict the material properties of 3D printed concrete. This technology is relatively new; therefore the concrete construction industry has recognized the need for consensus standards for 3D printed concrete which are based on empirical material behavior. The A.C.M.E. 2021-2022 team has refined our large-scale 3D printer by upgrading the extrusion system with a new pump and other improvements to reliability and operational effectiveness, in order to efficiently implement our proposed experimentation program. To date, we have successfully printed several simple shaped specimens with a 1 ½” diameter extruder.

**FACULTY ADVISOR: Dr. Kraig Warnemuende**



**BADGER Reloaded:  
Big Autonomous  
Durable Goose  
Remover**

BADGER Reloaded is the third and final year of a partnership between LeTourneau University and an industry client, A&K Systems. BADGER (Big Autonomous Durable Goose Remover) is an autonomous robot designed for installation on golf courses to autonomously chase Canadian Geese away. Using the ideas and lessons learned from the previous two years, the BADGER Reloaded team seeks to build a fully functional and manufacturable robot.

**FACULTY ADVISOR: Dr. Hoo Kim**

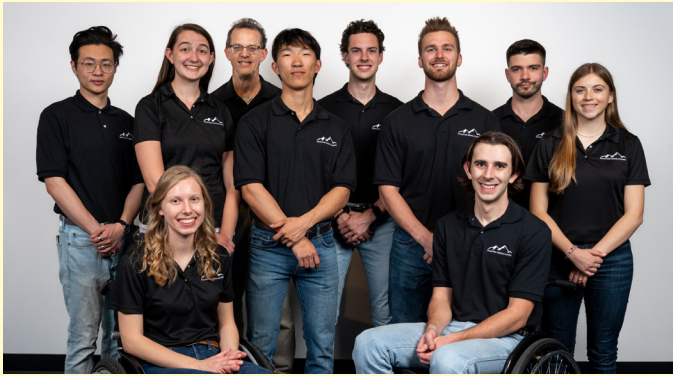


**FLOW: Evaluating the Drainage  
Efficiency of LETU Campus**

The FLOW senior design team are civil engineering students studying the drainage characteristics of the watershed on LeTourneau University’s campus. The team is installing monitoring equipment and gathering data to help evaluate its post-construction hydrologic performance. This project helps students apply foundational concepts in hydraulics, hydrology, and stormwater management. The results will be published to help inform other stormwater researchers, campus facilities, and city officials about how land use changes affect empirical runoff coefficients in similar-sized watersheds.



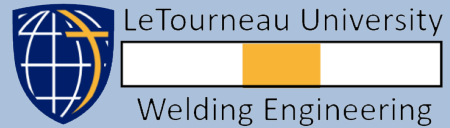
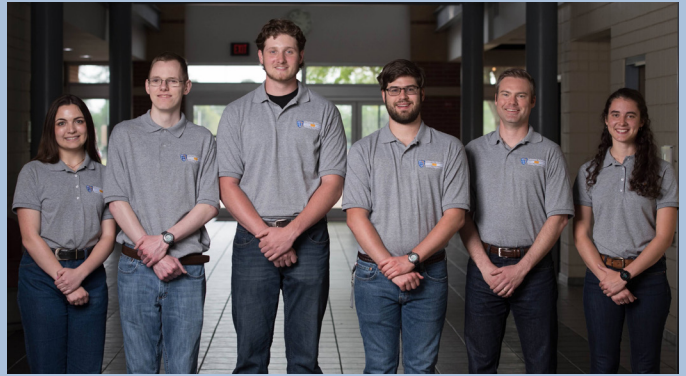
**FACULTY ADVISOR: Dr. Yunus Salami**



### Frontier Wheelchairs: Powering Wheelchairs in Developing Nations

In the developing world, powered wheelchairs are too expensive for most people who need them. Meanwhile, battery-powered wheels are decreasing in cost due to their prevalence in powered scooters and bicycles. Beeline Wheelchairs, an organization in Guatemala, has asked LeTourneau engineering students to design an attachment using an electric wheel that can help wheelchair riders travel up to 12 miles over semi-rugged roads at 10 mph. In this application, the device needs to require little maintenance and cost less than \$300. This year, the students plan to design, build, and test this device.

**FACULTY ADVISOR: Prof. Norman Reese**



### HAZtoughness

**Overview:** Validate a Testing Protocol to Establish the Maximum Heat Input for Welding S-1 Series Carbon Steels with Toughness Requirements

**Objective:** The objective of this work is to develop a reliable, repeatable and relatively low-cost simulative method for testing carbon steels with toughness requirements to determine the maximum heat input limits for each of these S-1 Series grouped materials. If adopted by the Navy, the method can thereafter be used to establish universal heat input limits for these steels.

**FACULTY ADVISOR: Dr. Richard Baumer**



### LEGRange: LeTourneau Emulated GPS Range

LEGRange is a 3-year GPS-centered project being funded by Sandia National Labs. The goal of the project is to create a GPS constellation and place it on campus for the purpose of running over-the-air testing and evaluation of adversarial signals. The GPS constellation will consist of six pseudolites (ISM transmitters acting as satellites) and one receiver. The pseudolites will receive authentic GPS signal for timing and transmit over the ISM band. The receiver will receive the authentic GPS signal and the emulated signals from the pseudolites over the ISM band. Each device will leverage mature code provided through UT Austin's Radionavigation Lab in order to process signals. LEGRange is a highly anticipated project that will advance research efforts in the field of defense.



**FACULTY ADVISOR: Dr. Nathan Green**



## LETREP: LeTourneau Rehabilitation Engineering Project

Project LETREP2 aims to design and develop a medical-grade rehabilitation device for individuals with motor impairment due to neurological disorders (e.g., stroke and spinal-cord injured patients). Rehabilitation using this device is to reduce leg-muscle spasticity in the patients through a method called the operant conditioning of the spinal reflex. The device builds on the prototype developed in the previous year by LETREP1 to improve the following:

• Ensured safety and adjustability for different patients  
 • Modular system for easy transport  
 • Compact motor-pulley-footplate mechanism to elicit stretch reflex in the calf muscle  
 • Robust electromyography measurements of the calf muscle in response to the stretch  
 • Streamlined data collection and analysis system  
 • Improved user interface

**FACULTY ADVISOR: Dr. Ko Sasaki**



## Low Heat SS: Tandem Submerged ARC Welding (SAW) Productivity Optimization in 1" Plate

The 2021/2022 Low Heat Input Welding senior design team is evaluating three different controlled short circuit welding processes on stainless steel. The goal is to understand how these processes work and to evaluate the heat input, stability, and deposition rate capabilities of these processes along with conventional short circuit. This information will be compared with an existing GTAW process for a potential increase in welding productivity.

**FACULTY ADVISOR: Dr. Ezequiel Pessoa**



# LETOURNEAU UNIVERSITY

ENGINEERING & ENGINEERING  
TECHNOLOGY



## LEVI: LeTourneau Engineering Venture Initiative

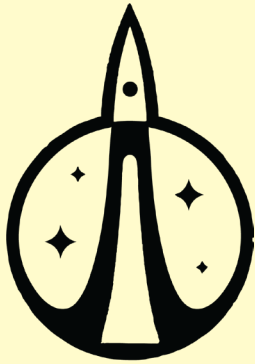
The LeTourneau Engineering Venture Initiative (LEVI) team is developing a device to non-invasively measure and monitor respiratory rate in an ER setting. Additionally, the LEVI team is patenting their work, creating an LLC, and participating in various business competitions for venture capital.

**FACULTY ADVISOR: Dr. Joonwan Kim**





## LUNAR: LeTourneau University Nexus for Amateur Rocketry



**LUNAR**

For the past 60 years, space has relentlessly proven to be the final frontier of our universe and the undiscovered country that continues to challenge and amaze scientists. While few space missions are attempted today, most rocket projects are maintained by civilian rocket enthusiasts aiming to study the upper regions of our atmosphere and to gain experience in amateur rocketry. This year LeTourneau University joins thousands of others across the country to study, design, and construct their own high-powered rocket. This project will need to consider structural and fluid mechanics, aerodynamics, and the culmination of these fields pertaining to a launch vehicle system and a payload system.

**FACULTY ADVISOR: Dr. Chad File**



**FACULTY ADVISOR: Dr. Gitogo Churu**



## Sweet Shop

Sweet Shop USA, in Mount Pleasant TX, is a leading manufacturer of handmade and specialty chocolates. In a process for packaging mint sticks for a certain client, the packaging fails for a certain number of chocolates. They have been able to improve the process to minimize losses, but are left with a large – and still growing – inventory of failed packages containing usable chocolate. The owner of the Sweet Shop has reached out to LETU SEET to assist with a solution (after failing to obtain a successful solution from several engineering firms). Research and development has been conducted last year on two possible solutions with prototype development. This year's project is developing both prototypes into functioning mint stick recovery systems. The project has applications in process engineering and instrumentation and controls. The outcome will be two working solutions to be deployed at the Sweet Shop that will recover chocolate product from the growing inventory and possibly be implemented into the current real-time process.

**FACULTY ADVISOR: Prof. John Tixier**

# TAT &

## TATO: Vehicle Mobility Assist Device

Persons with physical disabilities often find it difficult to get in and out of vehicles. The main objective of this Senior Design Project is to design, build and test a device that can effectively help a person with a disability to get in and out of the vehicle safely and with ease. The device must be safe to operate and inexpensive to mass produce.