

Engineering **Senior Design** **2026**



FAMU-FSU
College of
Engineering

Team 117: Carbon Capture with NaOH in Packed Bed Reactor (from left): Aiden Laurie and Mo Tehassee in the chemical lab.



SUVRANU DE, SC.D.
GOOGLE ENDOWED DEAN,
FAMU-FSU COLLEGE OF ENGINEERING

Engineering Senior Design is always one of our most anticipated events of the year.

Our engineering seniors have worked on these projects—from concept to prototype or plan—for the past two semesters. The capstone project is the fulfillment of what seems like a long and arduous journey in the life of an engineering undergrad. But oh, is it worth it!

This book is filled with projects that will inspire you for their imagination and technical savvy.

As a mechanical engineer myself, I'm especially delighted by the mechanical engineering projects that are close to my heart. (I know I'm supposed to be unbiased.) But then I read about civil engineering projects that juggle so many important factors, like client budgets and the environment, and I'm awed. The industrial engineering teams that can see a way to improve efficiency in just about any scenario and electrical and computer engineering teams that are improving health and safety...these are truly inspiring students who have put their education and creativity to work. The chemical and biomedical team projects lead me to believe our world problems will, indeed, be solved by these enterprising young minds.

I hope you enjoy reading through this book and learning about what challenges our sponsors brought to the table and the solutions our students provided. They worked in largely mixed teams with colleagues who learn, think and work differently than they do. We don't identify the students' universities in this book because we usually don't know (without asking) which student "belongs" to FAMU or FSU. Ours is a unique college, and these career-ready engineering graduates are well positioned to infuse their new companies with enthusiasm, drive, and the critical "soft" skills (which are actually hard to master) they honed on our campus.

A special thank you to the faculty who have mentored these teams over the past two semesters. Without these important educators and researchers, our college—and our students—would not be where they are today. Most have known these students for many years now. I hope we will continue to know them as engaged alumni and future project sponsors/mentors.

I'm so proud of the accomplishments this book represents.



Chemical Engineering Team 117: Carbon Capture with NaOH in Packed Bed Reactor (L-R) Madisyn Wiggins, Sofia Disilvestri, and Sebastian Duarte in the chemical lab.

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**Multidisciplinary Team*

CHEMICAL & BIOMEDICAL ENGINEERING



Biomedical Engineering Team 111: Endostella (from left) Matthew Hutchins, Abigail Huber, Nikole Gaydos, Destry Nix, and Anthony Rodriguez.

Team 101: Bioreactor



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ADVISOR:
Stephen Hugo Arce, Ph.D.

SPONSOR:
DOW

Soft tissue reconstruction faces persistent challenges: autologous fat transfer produces variable resorption requiring repeat interventions, while permanent synthetic implants carry long-term foreign material risks. Current approaches lack consistency and outcome predictability.

We developed a polycaprolactone (PCL) mesh scaffold with a collagen coating to support guided tissue growth and remodeling while avoiding permanent implant material. PCL was selected for its tunable mechanical properties, biodegradability, and biocompatibility. The collagen coating promotes cell adhesion, while the scaffold architecture facilitates cell infiltration, nutrient transport, and extracellular matrix deposition during early tissue formation.

Scaffold performance was evaluated by culturing tissue constructs in a bioreactor system providing controlled physiological conditions, including nutrient perfusion and mechanical support. This platform enabled systematic assessment of tissue maturation, structural stability, and reproducibility, offering greater predictability than traditional fat grafting methods. Bioreactor conditioning was designed to enhance tissue viability and construct consistency.

This approach offers a durable, customizable alternative for soft tissue regeneration that reduces long-term implant-associated risks while improving outcome predictability. PCL mesh scaffolds, prioritizing natural tissue integration and patient-centered outcomes, represent a clinically relevant platform for next-generation regenerative therapies.

Team 102: Kyphoplasty Device



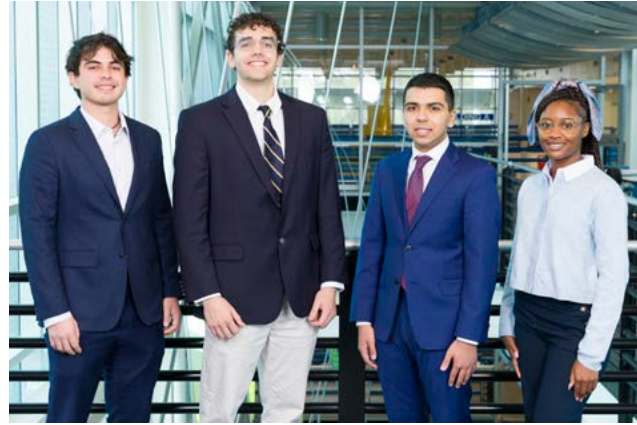
TEAM MEMBERS:
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ADVISOR:
Dr. Gupta

SPONSOR:
Mayo Clinic Jacksonville

We developed Vertifix through a joint venture between the FAMU-FSU College of Engineering and Mayo Clinic Convergence Science Internship Program to address issues surrounding kyphoplasty procedures performed at Mayo Clinic Jacksonville and in hospitals across the world. Current kyphoplasty procedures repair vertebral compression fractures (VCFs) but often leak cement into the body, hurting patient outcomes. We aimed to produce a device that reduced cement leakage and improved patient quality of life. We designed Vertifix to be inserted into a patient's vertebrae and expanded to restore normal shape. PMMA bone cement was pumped through the device and hardened inside the vertebrae to solidify the damaged bone.

Team 103: Drop-Foot



TEAM MEMBERS:

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Department of Chemical & Biomedical Engineering

We addressed foot drop, a common gait impairment caused by dysfunction of the deep peroneal nerve, resulting in inadequate ankle dorsiflexion during walking. This condition increases the risk of tripping and falling and contributes to abnormal gait mechanics. Current non-invasive treatments primarily include ankle-foot orthoses (AFOs) and functional electrical stimulation (FES) devices. While FES systems directly stimulate the deep peroneal nerve and promote a more natural gait pattern, existing commercial devices are often prohibitively expensive and are not consistently covered by insurance.

We presented NeuroStep, a wearable functional electrical stimulation device designed to provide an affordable, accessible, and effective alternative for individuals with foot drop. NeuroStep targeted the deep peroneal nerve to actively assist dorsiflexion during the swing phase of gait, improving foot clearance and fall risk. We integrated wearable sensors, a microcontroller, and a custom stimulation circuit capable of delivering safe, charge-balanced biphasic current pulses. Our design considerations focused on usability, comfort, battery longevity, and minimal user adjustment, with an intended consumer cost below \$1,000.

We evaluated device performance using objective gait metrics, including walking speed, step and stride length, dorsiflexion angle, and muscle activation measured via wearable sensors. By prioritizing affordability without sacrificing functionality, NeuroStep aimed to expand access to FES technology, enhance gait mechanics, and improve quality of life for individuals affected by foot drop.

Team 104: Targeted Drug Delivery



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ADVISOR:

Dr. Al Hashash

SPONSOR:

Mayo Clinic, Jacksonville

We addressed Crohn's disease, a chronic inflammatory condition that can affect any part of the gastrointestinal tract but most commonly involves the small bowel. In a substantial subset of patients, ongoing inflammation progresses to fibrostenotic or penetrating complications that ultimately require surgical intervention. Current treatment relies on systemic medications that suppress immune activity, yet these approaches often fail to achieve remission. These limitations underscored the need for a safe, targeted approach for localized treatment of limited small bowel Crohn's disease (LSBCD).

We developed IleoBond™, a mucoadhesive biomaterial patch engineered for site specific delivery of the corticosteroid budesonide to the ileocecal region. We designed the patch to actively leverage the body's mucus layer as a biological anchor, using a chitosan-based adhesive interface to promote prolonged retention at the diseased site. We coupled this layer to a diffusion modulated drug reservoir and an impermeable backing that enforced unidirectional transport into the intestinal wall. This design enabled sustained, localized corticosteroid delivery while minimizing systemic exposure.

We characterized the mucoadhesive layer using UV-Vis spectroscopy to confirm bond formation, with ex vivo adhesion testing on porcine intestinal tissue validating functional stickiness and retention behavior. We characterized the core polymer matrix through rheological analysis to define its mechanical properties. We conducted a complete study of the patch's swelling to evaluate fluid interactions and their effects on dissolvability, while we assessed toxicity using fibroblast co-culture and XTT assays to evaluate cytocompatibility. Together, these results supported the platform's potential for precision, site-specific therapy in inflammatory bowel disease.

Team 105: Biosense Webster



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ADVISOR:

Madison Burke

SPONSOR:

Biosense Webster

We addressed arrhythmias—abnormalities in what is considered a normal heartbeat—that can appear harmless at first but can be indicators or even increase the risk of more serious heart-related problems such as cardiac arrest and stroke. With the constant rise in heart disease and heart-related deaths, the afflicted age range lowering, and medical costs rising, a change was needed within the healthcare system to find more effective and affordable ways to detect arrhythmia within patients. We recognized that creating a convenient, wearable at-home heart monitoring device that provided constant detection of heart signals would aid tremendously in combating this pressing issue.

We developed an ambulatory, long-term cardiac monitoring (LTCM) device with the ability to detect heart signals, identify arrhythmias that occurred, including atrial fibrillation (AFib), and notify the patient and physician when these irregularities were occurring, allowing both an easier and more convenient way to diagnose, treat, and prevent heart related injuries or deaths. By reading heart signals, notifying patients and physicians when there were spikes or episodes of abnormal heart behavior, and recording these abnormalities for later analysis, this device could save patients from facing more dire consequences or invasive procedures.

While challenges arose due to numerous competitors of at-home heart monitoring devices already existing, our device stood out by being wearable for constant monitoring, small and convenient so that the patient hardly noticed they had it on, and sending data straight to the physician so that immediate action could be taken when necessary. Additionally, our device targeted a different range of arrhythmias that were not currently able to be detected by devices in market and was wearable for longer periods of time than current competitors.

Team 106: MRI to CT *multidisciplinary team*



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ADVISOR:

Brett Berry

SPONSOR:

VySpine

We explored the feasibility and impact of an MRI-only imaging pipeline using deep learning models to synthesize CT-like images from conventional MRI scans. CT imaging is a cornerstone of modern diagnostics, widely used for bone assessment, radiation therapy planning, and surgical preparation. Despite its clinical value, CT exposes patients to ionizing radiation, posing cumulative health risks when repeated scans are required. MRI, by contrast, provides excellent soft tissue contrast without radiation exposure but lacks the ability to accurately capture bone density and fine structural detail—historically preventing it from fully replacing CT in many clinical workflows.

By producing synthetic CT images that preserved clinically relevant bone information, our approach has the potential to significantly reduce patient radiation exposure while maintaining diagnostic accuracy. Beyond image generation, we integrated AI-based diagnostic tools to assist in image interpretation. These tools can automatically highlight regions of interest, flag potential abnormalities, and provide decision support to radiologists as a secondary review layer, improving diagnostic confidence and efficiency.

The integration of synthetic CT generation and AI-assisted diagnostics offers substantial benefits across multiple stakeholders. Patients benefit from reduced radiation exposure, clinicians gain enhanced diagnostic tools, and healthcare systems could see improved efficiency and reduced costs. Ultimately, this MRI-only, AI-driven approach has the potential to transform medical imaging workflows, improve patient safety, and redefine standards of care across a wide range of clinical applications.

Team 107: Hearing Aid



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ADVISOR:

Sophia Judge

SPONSOR:

Materialize Mimics

Hearing loss affects over 5.1 million children in the US and properly fitted hearing aids are critical for successful language development and preventing long-term educational and social difficulties. Behind-the-ear hearing aid models are the most common intervention for children with moderate hearing loss, but current devices face limitations in comfort, durability, and adaptability to rapid ear growth. These challenges result in frequent device refitting, inconsistent auditory input, and financial strain for families.

We designed and developed PediaPrints, a pediatric hearing aid system that separated electronic components from growth-dependent earmolds. Our system paired a conventional behind-the-ear hearing aid with patient-specific, 3D-printed earmolds generated through digital modeling using Materialise Mimics software. We utilized 3D scanners and segmentation of ear regions to create digital models, then applied a growth-prediction algorithm based on pediatric ear development to enable earmolds to be digitally re-sized and reprinted as children grow. We manufactured the earmolds using FormLabs biocompatible, flexible medical-grade resin for rapid, low-cost production. The team conducted bench testing to evaluate dimensional accuracy, material properties, durability, and adaptability to different brands of behind-the-ear electronics. Our design accounted for ISO 10993 biocompatibility standards and FDA 510(k) regulations.

By integrating digital modeling, 3D printing, and biocompatible materials, our PediaPrints earmolds aimed to reduce long-term costs, minimize clinic visits, and support auditory development during critical periods. This approach had the potential to improve equity, accessibility, and clinical outcomes in pediatric hearing care.

Team 109: Malaria Diagnosis *multidisciplinary team*



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SPONSOR:

Medtronic

Malaria remains a devastating global crisis, claiming over 608,000 lives annually, primarily children in sub-Saharan Africa. Current diagnostics are unreliable and incapable of measuring infection severity, leading to antimalarial overuse and increased drug resistance. We aimed to provide low-cost, automated, and accurate diagnostics in resource-limited settings by overcoming the accuracy limitations of Rapid Diagnostic Tests and the accessibility barriers of traditional microscopy.

We developed the Hem.AI system, a compact battery-powered device that combined microfluidic sample preparation with AI-driven diagnostics. Our device automates the entire workflow by utilizing a computer-driven imaging array and a Convolutional Neural Network to identify Plasmodium parasites. This approach eliminates the need for trained pathologists and reduces the time-to-result from two to four hours to under ten minutes.

Team 108: Prosthetic Volume Management



TEAM MEMBERS:

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ADVISOR:

Tim Larson

SPONSOR:

Hanger Clinic

We designed a below-the-knee prosthetic socket with integrated pressure sensors to address volume fluctuation challenges faced by transtibial amputees. Around 150,000 people undergo lower limb amputation annually in the United States, with below-the-knee amputations representing the majority. Diabetes, peripheral arterial diseases, and trauma are the main causes, with diabetes showing increasing prevalence among aging populations. Diabetic amputees often experience neuropathy, causing pain and sensory issues in the remaining limb.

Below-the-knee amputees experience residual limb volume fluctuations of around 5% throughout the day due to daily activity, significantly affecting prosthetic socket fit. Patients must recognize when socket fit changes, as ill-fitting sockets cause discomfort, pain, skin irritation, and tissue damage. However, neuropathy impairs patients' ability to detect these fit changes.

We developed a portable prosthetic socket with real-time pressure monitoring to alert users when socket fit deteriorates. We implemented eight piezoresistive sensor arrays throughout the socket interior and utilized an Arduino to process all signals. The system related voltage changes caused by pressure variations to residual limb volume changes and socket fit quality.

Our device aids patients with residual limb volume management, limiting adverse effects of ill-fitting prosthetics while promoting patient autonomy and increasing overall quality of life. The system potentially reduces or eliminates the need for prosthetist visits for recurring fitting issues.

Team 110: JRs Heroes



TEAM MEMBERS:

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JR Harding, Ph.D.

SPONSOR:

Department of Chemical & Biomedical Engineering

Millions of individuals with limited grip strength, arthritis, neurological impairments, or upper-limb mobility challenges cannot fully participate in recreational golf due to difficulty maintaining a stable wrist-to-club connection during putting. Conventional golf equipment relies heavily on hand strength and fine motor control, creating accessibility barriers that reduce independence in adaptive sports. We developed an Adaptive Forearm-Mounted Golf Putter Attachment designed to stabilize the putter using forearm motion rather than grip strength alone, enabling controlled, repeatable putting for users with limited hand function.

We integrated a commercial forearm brace with a custom 3D-printed PLA+ structural clip that securely interfaces with a standard putter shaft. This semi-rigid clip mechanically couples the club to the forearm, limiting shaft rotation, maintaining consistent wrist alignment, and reducing reliance on finger strength. An open ergonomic finger-rest feature provides a tactile alignment cue while preserving natural hand movement. The system is lightweight, strap-adjustable, and may be donned in under one minute.

Iterative prototyping and stakeholder feedback guided refinements that improved comfort, ease of use, and alignment support while eliminating the need for screws, tools, or significant assistance. Our key design goals included high grip stability, safe surface pressures, durability over repeated use, and low-cost manufacturability.

Our device addresses a significant gap in adaptive golf equipment by providing an affordable, portable, and user-centered solution that preserved traditional putting mechanics. By enhancing independence and accessibility, this project supports inclusive participation in recreational golf for individuals with upper-limb impairments.

Team 111: Endostella



TEAM MEMBERS:

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ADVISOR:

Dr. Michael Snabes

SPONSOR:

Abbvie

We designed and developed a novel subdermal implant for controlled, long-term delivery of leuprolide acetate to treat endometriosis. Current therapies rely on systemic hormone suppressants and oral medications that prioritize symptom management over disease control, requiring daily compliance and producing significant side effects. These limitations highlighted a critical need for sustained-release alternatives that reduce patient burden.

Our implant utilizes a polymer-based delivery system optimized to achieve sustained and predictable release profiles, enabling continuous drug administration over extended durations. By delivering leuprolide acetate subdermally, we eliminated frequent dosing requirements and improved treatment adherence while maintaining therapeutic hormone suppression levels. Inspired by the Nexplanon contraceptive platform but fundamentally redesigned for endometriosis-specific therapy, our design transformed conventional daily or monthly treatments into a single, long-acting intervention.

We addressed key design considerations including implant geometry, polymer membrane properties, drug loading, and diffusion-driven release kinetics to ensure precise control over dosage and duration. We used computational modeling and design optimization to guide parameter selection for achieving clinically relevant release rates.

Beyond endometriosis, our subdermal implant platform represents a scalable and adaptable drug delivery strategy for women's health. By shifting treatment paradigms from temporary symptom management toward precision-controlled, long-term therapy, we established a foundation for next-generation implants capable of delivering therapeutics with patient-specific dosing and duration. This work aims to redefine chronic disease management in women's health through innovative implantable drug delivery systems.

Team 113: Vein Locator



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ADVISOR:

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SPONSOR:

Department of Chemical & Biomedical Engineering

Venipuncture procedures commonly involve palpating veins on the inner arm. Despite its routine nature, the procedure remains a clinical challenge, especially for individuals with higher BMI values or darker skin tones who often do not have accessible veins due to poor visibility. Repeated failed needle insertion attempts cause vein rolling, bruising, risk of infections, and ultimately leads to fear or decreased trust in healthcare providers. This issue raised the need for a device that provided guidance for accurate vein location. Current vein visualization devices improve success rates, but were expensive, limited in imaging depth, and not consistent across all populations.

To address this need, we developed the Doppler Vein Locator as a non-invasive, ultrasound-based medical device designed to support medical personnel in locating veins for venipuncture. Utilizing doppler ultrasound, a method that applies the doppler effect to characterize blood flow velocity within blood vessels as a sound signal, the device sorts between venous and arterial sounds and determines the location with the highest amplitude venous signal strength to pinpoint the proper injection point. The Doppler Vein Locator aims to provide cost-effective yet reliable vein detection that rivals current industry standards of infrared-based detection with no patient discrimination.

Team 112: Cerebral Palsy Assistive Stretch



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SPONSOR:

Department of Chemical & Biomedical Engineering

Lower-limb impairment from neuromuscular disorders, stroke, or prolonged immobilization often causes spasticity, pain, reduced range of motion, muscle weakness, and delayed functional recovery. Effective rehabilitation requires consistent, guided therapy that supported pain relief, promoted muscle re-education, and safely maintained joint mobility. However, many existing rehabilitation options rely on expensive, clinic-based equipment that was difficult to access consistently and often fail to deliver coordinated mechanical movement and neuromuscular stimulation. These limitations reduce therapy adherence and hinder patient progress, particularly for individuals requiring long-term or home-based rehabilitation.

To address this need, we developed ExoPulseS as an integrated motor-assisted stretching and transcutaneous electrical nerve stimulation (TENS) system designed to support lower-limb rehabilitation in both clinical and at-home settings. The device synchronizes controlled mechanical stretching with charge-balanced electrical stimulation to reduce spasticity, alleviate pain, improve circulation, promote neuromuscular re-education, and maintain joint range of motion. ExoPulseS incorporates a motorized linear actuator, adjustable leg brace, biocompatible surface electrodes, and an embedded control system that coordinates stimulation delivery with joint movement while enforcing predefined safety limits.

Overall, ExoPulseS demonstrates a novel and accessible approach to lower-limb rehabilitation by integrating motorized stretching and neuromuscular electrical stimulation into a single synchronized platform. By addressing pain management, mobility preservation, and therapy accessibility, the device offers a more effective, comfortable, and consistent treatment option that expanded therapy options beyond traditional clinic-only solutions.

Team 114: Firefighter Team



TEAM MEMBERS:

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ADVISOR:

Stephen Hugo Arce, Ph.D.

SPONSOR:

Department of Chemical & Biomedical Engineering

Firefighters during post-fire overhaul are exposed to elevated levels of airborne particulates, toxic gases, and carcinogenic byproducts that persist after active flames are extinguished. Repeated exposure is associated with increased long-term health risks, including respiratory disease and occupational cancer. While self-contained breathing apparatuses provide protection during active suppression, their prolonged use during overhaul contributes to physical fatigue and physiological strain.

To address this, we developed the Canary Air Purification Unit—a respirator cartridge designed to integrate directly with existing firefighter face masks and PPE. The device aims to reduce inhalation of harmful contaminants during overhaul while minimizing the physical burden of traditional respiratory protection. The final design features a dual-filter system combining a high-efficiency particulate air (HEPA) filter and a cellulose nanofiber (CNF) filter, enclosed in a lightweight thermoset epoxy casing. This configuration enables effective removal of larger particulates and fine carcinogenic particles while maintaining compatibility with standard firefighter PPE.

Design development followed a structured engineering approach driven by clearly defined performance and usability requirements. Key priorities included filtration efficiency, contaminant removal accuracy, durability under harsh conditions, and ease of adoption. These requirements were translated into quantitative engineering specifications using a House of Quality analysis, with concept selection performed via a Pugh chart. Overall, the Canary Air Purification Unit enhances firefighter safety during overhaul by reducing airborne contaminant exposure while maintaining usability and long-term applicability.

Team 115: AIChE ChemE Car Competition



TEAM MEMBERS:

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Pia Dinamarca
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ADVISORS:

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Robert Wandell, Ph.D.

SPONSOR:

FAMU-FSU AIChE Student
Chapter and DOW

We designed and optimized a shoebox-sized autonomous vehicle for the American Institute of Chemical Engineers (AIChE) ChemE Car Competition, where cars must travel a specified distance and stop precisely using only chemical reactions for propulsion and control. Our project integrated reaction kinetics, heat and mass transfer, process design, electrical systems, and programming while meeting safety, environmental, and competition constraints.

We utilized thermoelectric generators (TEGs) operating via the Seebeck effect for propulsion. We created a temperature gradient between an exothermic acid-base reaction on the hot side and a cold reactor containing frozen aqueous ethylene glycol mixture. We performed energy and mass balances to predict heat transfer and electrical output, ensuring sufficient voltage to drive the motor.

Our stopping mechanism relied on an iodine clock reaction, where a distinct color change occurred once thiosulfate was depleted. A photosensor connected to an Arduino detected this color change and immediately ceased power to the motor, stopping the vehicle. By varying reactant concentrations, we altered reaction time and precisely controlled stopping distance. We developed calibration curves correlating reaction time with reactant concentrations, enabling accurate distance prediction on competition day.

Through extensive testing and documentation, we identified the most consistent operating conditions. Our project resulted in a fully autonomous ChemE Car capable of operating without external intervention, demonstrating practical application of chemical engineering concepts and competing at the AIChE Regional Student Conference.

Team 116: Injection Molding



TEAM MEMBERS:

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SPONSOR:

DOW

Plastic waste poses a significant environmental challenge globally, with roughly 300 million tons generated annually and only 5% of that amount recycled. We investigated the manufacturing feasibility of repurposing recycled plastic into a small functional consumer product through injection molding, using high-density polyethylene (HDPE) and a simplified manual injection molding system suited for small-scale manufacturing.

We compared virgin and recycled HDPE using tensile-strength and durability tests. Recycled material was sourced from post-consumer containers and processed under controlled conditions to evaluate mechanical performance. We used COMSOL Multiphysics to model polymer flow behavior and support mold design, and developed prototype molds through CAD. Product selection was informed by a student survey, which identified a keychain-sized bottle opener as the optimal design based on desirability, usability, and compatibility with our system's constraints. We also conducted a preliminary techno-economic analysis to estimate production and material costs and assess profitability within a small-scale manufacturing model.

Our results indicate that recycled HDPE can be successfully processed into reusable products while maintaining acceptable mechanical integrity, and that small-scale production of recycled plastic goods may be economically viable. Our simplified injection molding system demonstrates a scalable framework for sustainable product development and local recycling initiatives.

Team 117: Carbon Capture with NaOH in Packed Bed Reactor



TEAM MEMBERS:

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Sebastian Duarte
Richard (Mo) Tehassee
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ADVISOR:

Richard Crisler

SPONSOR:

Chemical Engineering Unit
Operations Teaching Laboratory

We designed a packed bed reactor (PBR) experiment for the Unit Operations Laboratory course to expand reactor-based instruction beyond existing batch and CSTR configurations, addressing limited student exposure to gas-liquid mass transfer and plug-flow behavior.

We selected a reactive absorption system using CO₂ and NaOH for its low-cost reactants, familiar laboratory handling, and fast, well-studied kinetics suitable for repeated student trials. The design treated CO₂ removal as a coupled absorption-reaction process in which CO₂ dissolves into the liquid phase and reacts with hydroxide to form bicarbonate/carbonate species—making overall performance dependent on gas-liquid mass transfer and hydrodynamics.

We specified countercurrent gas-liquid operation, instrument locations, and key control points via a draft process flow diagram, including temperature, pressure drop, and inlet/outlet composition monitoring to support future conversion and mass-transfer calculations. Equipment scope covered column sizing, packing, pumps, flow meters, piping, and planned integration of temperature probes, pH meters, and CO₂ analyzers.

MATLAB and Aspen Plus supported sizing, sensitivity checks, and consistency verification across key operating variables: gas flow rate, liquid circulation rate, NaOH concentration, and temperature. Experimental operation over 25–65°C and CO₂ flow rates of 250–1000 L/min showed improved removal at higher temperatures, with best performance near 500 L/min. Predictive models for outlet pH, CO₂ concentration, and temperature effects matched experimental results within 5–20% error.

Team 118: Chocolate 3D Printing



TEAM MEMBERS:

Hannah Maken
Esther Perceval
Humberto Romero

ADVISOR:

Robert Wandell, Ph.D.
Subramanian Ramakrishnan,
Ph.D.

SPONSOR:

NSF CREST

Additive manufacturing with chocolate presents unique challenges rooted in heat transfer, phase transitions, and rheology. Chocolate behaves as a shear-thinning, viscoelastic material whose flow and solidification depend sensitively on temperature. Previous teams successfully produced 2D chocolate patterns but were unable to achieve stable multi-layer structures without a dry ice batch cooling system, revealing the need for controlled cooling that could rapidly extract heat from deposited layers without disrupting extrusion.

We developed a thermoelectric-cooled print bed designed to stabilize the build zone and enable reliable 3D chocolate printing. The system integrated a Peltier (TEC) cold plate with Arduino-based PID control to maintain ideal cooling conditions. This configuration applied core chemical engineering principles of conduction and transient heat transfer to maintain the print bed between 5–15°C, a temperature range that promoted controlled crystallization of cocoa-butter without water condensation. By providing consistent conductive cooling, the print bed accelerated solidification of early layers, prevented sagging, and minimized heat accumulation during printing. We implemented a phased build-test approach beginning with chocolate tempering and 2D patterning, followed by low-profile 3D structures, and culminating in full-scale structures. This work demonstrated that precise thermal management at the print surface was an enabling factor for multi-layer chocolate printing and established a reproducible foundation for future teams working with temperature-sensitive materials.

Team 119: Recycled 3D Printing Filament



TEAM MEMBERS:

Aliza Hutley
Quenton Quarterman
Jordyn Riley
John-Paul Garzon

ADVISOR:

Robert Wandell, Ph.D.

SPONSOR:

DOW

We investigated the enhancement of interfacial compatibility between polylactide (PLA) and high-density polyethylene (HDPE) for 3D-printing filament production to address the growing plastic waste crisis. Although HDPE is readily available and exhibits favorable mechanical properties, several studies have reported poor miscibility between traditional polyolefins and PLA. This incompatibility often results in phase separation, warping, and reduced mechanical performance in fused deposition modeling (FDM) applications.

We explored two primary mechanisms to improve compatibility: the incorporation of lignin as a biomaterial additive and surface modification of HDPE via ultraviolet (UV) irradiation. We utilized a desktop extrusion system to produce filaments and employed comprehensive material characterization techniques, including differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and tensile testing to evaluate the blends.

Our results indicated that low-HDPE-content filament blends, when fortified with UV treatment or additives, exhibited improved interlayer adhesion and structural stability compared to untreated controls. Overall, our work contributed to the advancement of sustainable additive manufacturing by demonstrating a feasible method for upcycling HDPE waste into functional 3D-printing filaments and engineering materials.

Team 121: 3D Printing Waste Easy Bake Oven



TEAM MEMBERS:

Guillermo Penela
Meadow Limoncello
Madelaine Burrows
Ivana Barahona
Carmen Perez Sosa

ADVISOR:

Robert Wandell, Ph.D.

SPONSOR:

DOW

PLA waste from failed 3D prints and excess filament has outpaced current disposal and recycling capabilities in academic, laboratory, and small-scale manufacturing environments. Existing recycling solutions are either designed for industrial scale or are prohibitively expensive and inefficient for desktop applications, limiting accessibility for small users.

Our goal was to design a compact, cost-effective, all-in-one PLA recycling system integrating shredding, drying, melting, extrusion, and spooling into a single machine. We evaluated existing desktop recycling technologies—including Filabot, Felfil, and ReDeTec systems—assessing cost, functionality, footprint, and filament quality to inform design decisions targeting improved affordability, safety, and ease of use.

To quantify material degradation across recycling cycles, we 3D printed virgin PLA dog-bone specimens and subjected them to ASTM tensile testing to establish baseline mechanical properties. We then shredded, reprocessed, and reprinted the specimens, repeating tensile testing across multiple cycles to identify practical reuse limits while preserving printability. We systematically varied extrusion temperature, airflow, and spooler speed to determine operating conditions yielding consistent filament diameter and acceptable mechanical performance.

Our project demonstrates the feasibility of small-scale, closed-loop PLA recycling and establishes a foundational framework for fabrication, testing, and optimization of an accessible desktop recycling solution.

Team 120: Fermentation Process Modeling



TEAM MEMBERS:

Alberto Baumeister
Thomas Lockhart
Alex Chiramonte
Hannah Oppgard

ADVISOR:

Robert Wandell, Ph.D.
Ian Slauch, Ph.D.
Jeff Jenkins

SPONSOR:

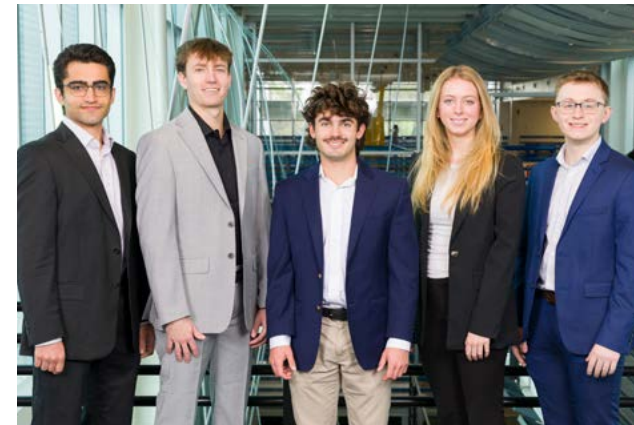
Department of Chemical and Biomedical Engineering

We developed a comprehensive process model of beer production using Aspen Plus® to evaluate the technical and economic feasibility of a small-scale, grassroots brewing operation. The brewing process was represented as an integrated sequence of unit operations, from malted barley through mashing, lautering, wort boiling with hop addition, fermentation, conditioning, and packaging. Each stage was modeled using appropriate reactor, separator, and heat-transfer blocks to capture mass and energy balances, phase behavior, and simplified reaction kinetics, with particular emphasis on starch conversion during mashing, solid-liquid separation during lautering, and biochemical fermentation of sugars to ethanol and carbon dioxide.

We used the simulation to estimate utility requirements, material flows, and equipment duties at industrially relevant production scale, incorporating these outputs into a preliminary economic analysis of capital investment, operating costs, and revenue streams. Equipment sizing, utility consumption, labor, and raw material costs were evaluated under conservative pricing assumptions. The analysis also considered value recovery from byproducts, including spent grain and carbon dioxide, and the influence of energy and water usage on operating expenses.

Malted barley was selected as the primary feedstock for its established brewing performance and well-characterized enzymatic sugar generation. Our combined simulation and financial assessment demonstrated that Aspen Plus is a suitable platform for modeling complex biochemical food and beverage processes, providing meaningful insight into scalability and profitability, and illustrating how process simulation can bridge chemical engineering fundamentals with practical business considerations in brewing facility design.

Team 122: Thermoelectric Cooler



TEAM MEMBERS:

Keian Bahmani
Nicolas Walker
Cole Patrick
Brooke Gilbert
Colin Waldie

ADVISOR:

Robert Wandell, Ph.D.

SPONSOR:

DOW

We developed a consumer-oriented, solar-powered portable cooler using thermoelectric cooling (TEC) technology and the Peltier effect to actively cool contents without ice or external power. Our design addressed the need for a self-sufficient, portable refrigeration solution by integrating thermoelectric modules against insulated interior walls, with heat-dissipating fins and cooling fans on the hot side of the TEC plates to maintain optimal temperature gradients. Solar panels mounted on the lid charged an internal battery, enabling continuous cooling independent of direct sunlight.

Our prototype incorporated a user-facing temperature control panel and foam insulation to minimize energy demands while maintaining portability comparable to premium coolers. We used COMSOL Multiphysics to simulate heat transfer across candidate casing and insulation materials, then 3D-printed and assembled the final model to balance cooling capacity, user-focused design, and manufacturability. Although conventional refrigeration systems remain five times more efficient at large scales, thermoelectric cooling achieves competitive performance in miniaturized applications due to its simplicity, elimination of refrigerants, and minimal maintenance requirements.

We conducted performance testing against traditional ice-based coolers to evaluate cooling duration, temperature control, and cost-effective construction. Our proof of concept demonstrates commercial viability and represented a promising pathway toward sustainable refrigeration that combines active cooling with renewable energy, offering consumers an environmentally friendlier alternative with minimal recurring costs.

CIVIL & ENVIRONMENTAL ENGINEERING



Team 212: Church of Latter-Day Saints Temple (from left) Eric Kempisty, Dougherty Shoenfelt, Veronika Li, and Kane Meyer in Tallahassee.

Team 201: Enlisted Unaccompanied Personnel Housing



TEAM MEMBERS:

Katy Borders
Selin Gelgen
Taylor Palahunik
Halley Torres

ADVISORS:

O. Sean Martin, Ph.D., P.E., and
Michael Elwardany, Ph.D., P.E.

SPONSOR:

Stantec - Chad Mason, P.E.,
Olivia O'Bryan E.I.T., and
Chandler Hatcher, P.E.

We collaborated with Stantec to design an expanded Enlisted Unaccompanied Personnel Housing (EUPH) site at Camp Bull Simons, a military installation south of Crestview, Florida, serving as a key training site for Green Berets and paratroopers. Our goal was to improve living conditions and quality of life for the growing number of enlisted personnel stationed at the base by adding two new EUPH buildings to the existing site.

Our design incorporated two housing buildings, a courtyard, pickleball and basketball courts, a picnic pavilion, landscaped green spaces, and additional parking. A primary technical challenge involved stormwater management: we evaluated the existing detention pond to confirm it could handle runoff from the new development and designed the site to safely direct all stormwater to the pond, preventing flooding and erosion.

We developed the design in compliance with standards from the American Society of Civil Engineers (ASCE), the Unified Facilities Criteria (UFC), and the Architectural Barriers Act (ABA), ensuring the facility met safety and accessibility requirements for Department of Defense installations. The completed site design delivered a practical, regulation-compliant layout that expanded housing capacity and recreational opportunities for service members.

Team 202: Green Acres at Pedrick Road



TEAM MEMBERS:

Christian Gullett
Damian Morales
Cassidy Peters
Lily Rodgers

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Magnolia Engineering -
Scott Kell, P.E.

We designed Green Acres at Pedrick Road, a residential subdivision balancing efficient land use, environmental protection and compliance with local zoning regulations. Our site plan includes 18 residential lots, served by an internal road network that provides safe access for residents and visitors.

Stormwater management presented a key design challenge, as the site sits within a closed basin requiring additional storage capacity. We addressed this with a pond, bypass swales and a pipe-and-drain collection system meeting Leon County and Northwest Florida Water Management District requirements. Water, sewer and electrical utilities were tied into existing city infrastructure.

Environmental stewardship shaped several design decisions. We preserved a 3.15-acre conservation area to protect existing trees and wildlife habitat, and limited floodplain disturbance to no more than five percent of the total area. Tree impacts were managed through Leon County's debit and credit system, which required replanting in green spaces and nearby parks. We added a 20-foot landscape buffer along the western entrance to minimize tree loss and improve site aesthetics. A walking path around the pond and a conservation easement connected the neighborhood to the park to the north.

The finished subdivision integrates proper setbacks, utility corridors and green spaces to balance function, appearance and community needs, resulting in a safe, environmentally responsible and community-oriented neighborhood.

Team 203: Jim Godwin Road Flood Mitigation and Resurfacing Project



TEAM MEMBERS:

Jack Crabhill
Trett Phillips
Aiden Reed
Frank Roberts

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Phillips Precision Engineering, Inc. - Natacha Phillips, P.E.

We addressed long-standing flooding problems on Jim Godwin Road in Calhoun County, Florida, where storm events repeatedly cut off residential access and blocked the Chipola Community Church Food Distribution Center from emergency services. Our goal was to improve drainage, raise the roadway and resurface it to enhance safety, structural longevity and storm resilience.

Our drainage redesign replaced four side drains and one main drain to improve stormwater conveyance, removing three damaged 5-foot culverts and replacing them with box culverts. Using HY-8 software for drainage modeling, we determined that two 9-foot-by-4-foot box culverts optimally handled runoff from 5-, 10- and 25-year storm events while minimizing changes to road elevation. We designed the box culverts in AutoCAD and used OpenRoads Designer for roadway layout. Raising the road by less than two feet preserved cost efficiency and limited environmental impact, while widening the travel surface from 18 to 22 feet brought the road into compliance with Florida Department of Transportation (FDOT) standards.

We coordinated permitting with the Northwest Florida Water Management District (NWFWM) and incorporated erosion control measures to protect adjacent wetlands and Stafford Creek. Our construction plan maintained one open lane for local traffic throughout the estimated 115-day build schedule.

The completed design improves safety, structural resilience and cost efficiency for the corridor. By mitigating flood risk and preserving access during major storm events, we delivered a durable infrastructure solution for the Jim Godwin Road community.

Team 205: Intersection Safety & Operational Improvements



TEAM MEMBERS:

Kennedy Jackson
Leah Toney
Sanai Virachitvein

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

RK&K - Stuart Samberg, P.E.

We converted a historically unsafe two-way stop-controlled intersection into a single-lane roundabout to address a long history of crashes and near-miss events. The original configuration required drivers on the side street to stop while main-road traffic continued at speed, causing repeated misjudgments of vehicle approach rates and resulting in angle crashes. Roundabouts reduce right-angle collisions, typically the most severe crash type, by slowing all vehicles and channeling traffic unidirectionally, so entering drivers need only yield to traffic from one direction. This simplified decision environment improved both safety and operational efficiency during peak hours.

We also addressed chronic stormwater drainage deficiencies alongside the geometric redesign. Standing water had accumulated along the roadway during heavy rainfall events, increasing hydroplaning risk and accelerating pavement deterioration. Our solution incorporates upgraded pipes, inlets and swales to remove stormwater from the roadway more effectively, reducing flood potential and extending the service life of the new pavement.

Together, these two interventions, roundabout conversion and drainage system upgrades, resolve the intersection's primary safety and infrastructure deficiencies, producing a more reliable and resilient roadway for the surrounding community.

Team 204: Rainey Cawthon Bulk Plant



TEAM MEMBERS:

Jimmy George
Blake Jozsa
Ben Williams

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Half Engineering - Shane Watson, P.E.

Rainey Cawthon Distribution (RCD) needed to expand its fuel distribution capacity in the Big Bend area while strengthening regional fuel supply resilience during hurricanes and other emergencies. To meet this need, we designed a new bulk fuel storage facility on a 5.51-acre site at 4305 Shelfer Road in Tallahassee, Florida, zoned C-2 General Commercial and M-1 Light Industrial.

We developed the grading, drainage, stormwater and building systems for the project. Because the site sits within a closed basin, we designed a grading plan that directs runoff to a stormwater pond fed by Type C inlets connected to mitered end sections. The sidewalk adjacent to the 1,950-square-foot office building was graded to a slope below 2% to satisfy ADA requirements, and parking was sized at one space per 250 square feet of office area, per City of Tallahassee code. Truck circulation was laid out to support safe, efficient movement while preserving space for future expansion. We minimized environmental disturbance by maintaining natural drainage patterns and limiting unnecessary site clearing.

Through close coordination with RCD, our final design met all applicable city codes, stayed within budget and added 45,000 gallons of fuel storage capacity. The completed facility improves truck access, supports RCD's operational and long-term maintenance goals and strengthens Tallahassee's fuel supply infrastructure.

Team 206: West Alabama Highway Gallion Bypass



TEAM MEMBERS:

Kennedy Carper
Ashlyn O'Connor
Charles Rackley
Elam Richardson
Avante Rivers

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Alabama DOT - Martin Clark, P.E.

We addressed increasing collision reports and traffic congestion along AL-69 and through the city of Gallion, Alabama, caused by a three-maneuver routing sequence that forces drivers off AL-69 onto US Route 80, traveling roughly 1,100 feet southeast before returning via a divided highway. This inefficient configuration exceeded the designed traffic volumes and densities, contributing to nighttime collisions, lane congestion, and air and noise pollution for neighboring residents.

Our goal was to design a seamless connecting span that bypasses the city of Gallion and restores direct north-south continuity along AL-69. A key technical constraint we addressed was a section of the new alignment that passes over an intersecting railroad track, requiring a minimum vertical clearance of 26 feet.

Our proposed design draws heavier, higher-speed traffic away from Gallion's residential areas while improving the efficiency and safety of the AL-69 corridor. The solution reduces congestion, improves travel times and enhances safety for both motorists and city residents.

Team 207: Resurfacing, Rehabilitation & Restoration of SR- 30



TEAM MEMBERS:

Ryan Bertran
Ty Ficklin
Oliver Romanach

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Chipola Engineering Group -
Nick Grosso, P.E.
Grant Groom, P.E., and
Todd French

We addressed recurring safety failures at the intersection of U.S. Highway 98 and South Bay Shore Drive in Eastpoint, Florida. The intersection had a history of serious crashes involving both drivers and pedestrians. Its role as a hurricane evacuation route demanded a design capable of handling both daily and emergency traffic volumes. To identify root causes, we conducted traffic counts, speed studies, crash record reviews, turning movement analyses and site visits.

Using this data, we developed two alternative designs: a signalized intersection and a modern single-lane roundabout. Both alternatives incorporated ADA-compliant curb ramps, improved pedestrian crossings and extended sidewalk infrastructure.

Several constraints shaped our design process. Narrow right-of-way limited roadway widening, and existing utilities restricted the placement of signs, poles and drainage infrastructure. Adjacent bay and wetlands required us to minimize earthwork to avoid environmental impact. The absence of viable detour routes also required us to maintain U.S. 98 operations during peak construction hours.

After evaluating both alternatives against safety performance, traffic operations, cost, and public acceptance criteria, we determined that the modern roundabout delivered the greatest long-term benefit. It reduces the frequency of severe crashes, moderates vehicle speeds and maintains traffic flow without signal-induced delay. We completed the project with a formal recommendation to advance the roundabout design, supported by engineering drawings, preliminary cost estimates and a community-impact-conscious construction phasing plan.

Team 208: Amenity Campus, Atwell LLC



TEAM MEMBERS:

Kristoffer Durham
Thaddeus Flagge
John Parios
Jack Poulson

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Atwell LLC - Nik Kasten, P.E.

We completed the Amenity Campus project for Atwell LLC, designing a recreation site for a new community in Naples, Florida. The site includes a clubhouse, bathhouse, pool deck, tennis courts, pickleball courts, a garden area, planters and a mail kiosk, supported by roads, parking and utilities. Our goal was to produce a safe, functional layout that met Collier County requirements and Florida design standards.

We prepared two site layout alternatives and evaluated each for access and traffic flow. We selected Alternative 1 for its improved circulation and clearly defined pedestrian paths. The final design provided 74 parking spaces, including 3 ADA-compliant stalls, with drives and sidewalks meeting all required slopes and setbacks. We designed the parking lane at 30 feet wide to accommodate larger vehicles and the community's older population.

We graded the site to ensure proper drainage and eliminate standing water, using minimum and maximum control elevations to maintain safe vertical separation between structures and the stormwater system. Slopes were held between 1% and 4% to direct runoff toward inlets and an existing pond. Water and sewer lines were routed to satisfy county requirements and connect to nearby service points. We used AutoCAD Civil 3D to model the site and verify slopes, drainage flow and utility placement. Structural design followed ASCE 7-22 and Florida Building Code requirements, including a design wind speed of 176 mph for this region.

The final plan satisfies the client's requirements, complies with all applicable codes and produces a complete, buildable design for the community.

Team 209: FPSI Emergency Response Vehicle Staging Area



TEAM MEMBERS:

Olivia Fawcett
Austin Holmes
JaKeyvan Jones

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Florida Public Safety Institute
(FPSI) - Longan Lane

We designed a ten-acre emergency vehicle staging area for the Florida Public Safety Institute (FPSI) to replace uneven, inadequate storage conditions for firetrucks, ambulances, patrol cars and armored units. Our goal was to deliver a fully paved facility with safe traffic circulation and a code-compliant stormwater system.

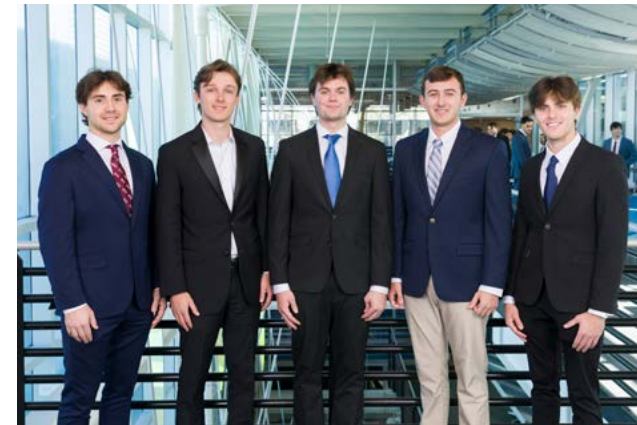
We began with a thorough site analysis covering ground elevations, soil types and drainage patterns, then verified compliance with the Florida Administrative Code for stormwater management and Florida Department of Transportation geometric standards. The facility needed to accommodate more than 300 emergency vehicles of varying sizes, so we designed two large, paved areas connected by wide roadways that allowed heavy vehicles to maneuver without conflict.

Stormwater management was our primary technical challenge. The site required retention of approximately 3.5 acre-feet of runoff. We sited a retention pond in the remaining open space after laying out the paved areas, sizing it to meet the volume requirement and satisfy regional regulations, thereby reducing on-site and adjacent flood risk.

A portion of the site also required a grade raise of approximately 20 feet. To support the resulting 3.5-acre elevated paved surface, we designed three retaining walls engineered to resist a combined soil and concrete load of roughly 11,400 tons, with additional capacity to maintain long-term stability.

Our final design improves vehicle storage, traffic flow and stormwater drainage, providing FPSI with infrastructure suited to support current operations and future growth.

Team 210: Olsen Road Multi-Family Subdivision Development



TEAM MEMBERS:

Ethan Katz
Patrick Long
Max Myhill
Cole Piccarreto
Tripp Weston

ADVISORS:

O. Sean Martin, Ph.D., P.E. and
Kamal Tawfiq, Ph.D., P.E.

SPONSOR:

Urban Catalyst Consultants –
Sean Marston, P.E.

We addressed the challenge of developing multi-family housing on a sloped, undeveloped 9.82-acre site in Tallahassee, Florida. Our goal was to create a subdivision design that balanced housing demand, environmental protection, and Leon County regulations. The site's steep slope, natural drainage paths, and limited access created significant constraints that required careful planning to ensure safe slopes, proper stormwater drainage, and vehicle accessibility.

We developed a complete civil layout that included roadways, utilities, stormwater systems, and slope support. We placed a detention pond at the site's lowest point to facilitate downhill stormwater flow and reduce flooding risk. We designed a reinforced retaining wall to support home foundations, backyard loads, and roadway use while reducing unsafe slopes. Our roadway design accommodated low-speed vehicle travel and included pedestrian space. We connected water, sewer, and storm utility layouts to existing infrastructure while meeting required slopes and spacing standards.

We evaluated three design alternatives to compare density, cost, and community impact. Our selected alternative used the land efficiently while remaining practical to build and maintain. The final design complied with city, county, and state regulations, including zoning, environmental, roadway, and stormwater codes. We used engineering software to demonstrate how grading, drainage, and utilities would function on the site.

This project demonstrated how civil engineering design can transform a challenging site into a safe and functional residential development.

Team 211: Gulf Winds Credit Union Building



TEAM MEMBERS:

Jacob Akel
Clay Christiansen
Luke Gareiss
Richard Hanft
Alexander Sobol

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Kever Mckee - Barry V. Pujol

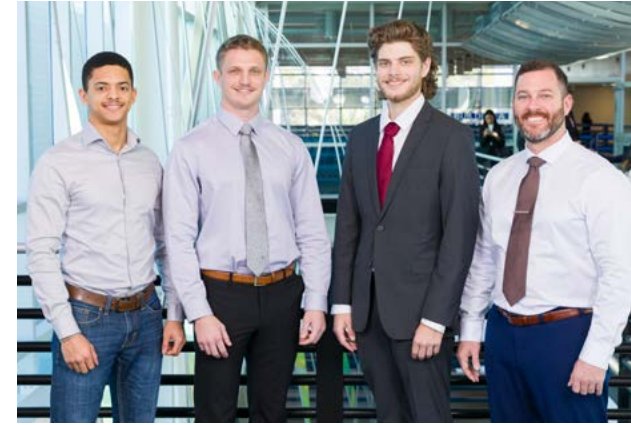
We addressed the need for a safe and sturdy office facility for Gulf Winds Credit Union in Pensacola, Florida. The project confronted significant challenges including moisture-sensitive soils and limited natural drainage, which could have caused unplanned settlement and construction delays. We developed coordinated site, geotechnical, and structural designs for proper execution of the four-story office building.

Our final design included a four-story steel-framed structure supported by shallow spread footings bearing on compacted sandy soil. We placed the footings four to six feet below grade and sized them to safely support column loads ranging around 500 kips, with some reaching up to 700 kips. We provided strength and stability through reinforced concrete stairs, steel braced frames, elevator cores, and composite concrete floor slabs. We selected this structural system to reduce material weight while ensuring proper long-term performance.

Controlling groundwater and stormwater flow presented a major challenge due to near-surface silty sands that drain slowly and retain moisture. We implemented moisture-conditioned fill and strict compaction guidelines to address this issue. We designed a stormwater retention pond with a sand chimney drainage system to provide a designated discharge location. The pond contained soils that allowed drainage and acted as a vertical filter.

Our design decisions and strategies reduced construction risk, controlled settlement, and ensured long-term performance. The final design delivered a safe, sturdy, and efficient solution for the proposed development.

Team 213: ServisFirst Bank



TEAM MEMBERS:

Zacharie Ayotte
Zane Banachowski
Jackson Powers
Kenneth Williams

ADVISORS:

Sean Martin, Ph.D., P.E. and
Kamal Tawfiq, Ph. D., P.E.

SPONSOR:

Moore Bass Consulting -
Travis Dorn, P.E. and
Kipp Kirkland, P.E.

We designed a new facility for ServisFirst Bank on a parcel with only half the area available for development. Working with Moore Bass Consulting, our site design provided a new location for underserved customers in a growing area, supporting ServisFirst's continued expansion in Tallahassee.

We designed the site to be functional, sustainable, and inclusive while meeting ServisFirst's requirements. Our final design included an open-air retention pond and a wrap-around drive-through, with the building centrally located on the site. A major challenge was an electrical easement that prevented half the site from being used, requiring several design revisions to meet client needs. Our completed design reduced erosion, controlled runoff, and ensured water quality.

We guided our design using local, state, and federal standards, including the Tallahassee Land Development Code, Florida Building Code, American Society of Civil Engineers (ASCE) standards, the Clean Water Act, and the National Society of Professional Engineers Code of Ethics (NSPE). We verified that our site design was legal and code compliant.

Our final design met all client needs and sponsor requirements. It provided a functional bank location that complied with all state and local regulations while preserving the natural appearance of the area and improving customer access.

Team 212: Church of Latter-Day Saints Temple



TEAM MEMBERS:

Eric Kempisty
Veronika Li
Kane Meyer
Dougherty Shoenfelt

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Half Associates -
Shane Watson, P.E.

We focused on the challenge of building a religious site on land with steep slopes, dense woods, and heavy stormwater runoff. Our goal was to design a safe, buildable, and environmentally responsible site for the Church of Jesus Christ of Latter-day Saints Temple in Tallahassee. Without careful engineering, the site's steep topography and flooding risks would have prevented construction.

We created a comprehensive design that included grading, drainage, parking, and utility layouts. Because the site is near a main road, we followed Florida Department of Transportation (FDOT) regulations to secure proper permits. Managing stormwater was a top priority due to frequent heavy rainfall in the area. Our final design used a stormwater pond, underground pipes, and natural flow paths to control runoff. This system prevented soil erosion and protected nearby properties by treating and attenuating water before discharge.

Preserving existing trees while meeting city building codes presented another major challenge. We clustered buildings and parking areas to reduce tree removal and provide natural landscaping buffers. This approach maintained the temple grounds' peaceful character while benefiting the environment. We ensured all paths and parking areas met ADA standards, providing safe access for all visitors.

Our final solution balanced engineering requirements, environmental stewardship, and community values. The design met all City of Tallahassee requirements as well as state and federal regulations. This project demonstrated how thoughtful site planning can transform difficult terrain into functional and respectful public space.



Team 214: SR 196 (Bayfront Parkway) SUNTrail Extension



TEAM MEMBERS:

Samuel Davidson
Jackson Landis
Devin Rainey
David Ramos
James Waller

ADVISORS:

O. Sean Martin, Ph.D., P.E.,
Primus V. Mtenga, Ph.D., P.E. and
Kamal Tawfiq, Ph.D., P.E.

SPONSOR:

Michael Baker International
(MBI) - Terra Parrish, P.E. and
Jeff Roberts, P.E.

We designed a trail from downtown Pensacola along the coast to the Pensacola Bay Bridge, which connects to Gulf Breeze. This project was funded by the State of Florida through their Shared-Use Non-motorized Trail program, or SUNTrail, which exists to create more pedestrian trails throughout the state.

The existing sidewalk was old, cracked, and needed replacement. We removed the 6-foot-wide sidewalk and replaced it with a 12-foot-wide concrete path along the bay. Our planned trail was approximately one mile long. Nearly one-third of its length lacked sufficient space for the 12-foot path due to coastal erosion-control rocks. For these portions, we designed a boardwalk to build above the rock. We also considered reducing lane width and shifting the road at some points to create the necessary space for the 12-foot path.

One challenge arose where our trail would pass through a missing children memorial across from Veteran's Memorial Park in Pensacola. We created crosswalks at the park ends and extended the existing park trail width to 12 feet. This allowed us to seamlessly connect our new construction with the local landmark without disturbing the memorial. Through these solutions, we successfully created an addition to the SUNTrail system.

Team 216: Great Burger Site Redevelopment



TEAM MEMBERS:

Benjamin Golomb
Caco Grundler
Amir Kraishan
Mason Roddenberry
Jeffrey Williams

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Kimley Horn -
Dillan Clarke, P.E.,
Reid Thomas, P.E.,
Dylan Johnson, E.I. and
Alexander Thornberg, E.I.

We designed the Great Burger Site Redevelopment to serve the community's need for a quality fast-food restaurant on a 2.6-acre property containing an existing development. Our team developed a full site plan for the western half of the site, including building placement, parking, stormwater design, utility connections, and transportation improvements, while the eastern half remained open for future development.

We began by confirming the zoning as an Activity Zone and used the City of Tallahassee Land Development Code to identify design requirements including building setbacks, landscaping rules, impervious surface limits, and minimum parking ratios. Since the site included a drive-through, internal vehicle circulation was a major focus. We checked that the drive-through stacking distance was adequate and developed sight distance triangles using sponsor-provided data and Florida Department of Transportation (FDOT) standards. We chose driveway locations to optimize safety and access.

We designed an on-site stormwater system using the FDOT Drainage Manual and the TR-55 method. We created a grading plan to direct runoff to the proposed inlets and maintained ADA-compliant routes across the site. We extended water, sewer, and fire lines from nearby utilities and included a grease trap to handle restaurant waste.

The biggest challenges were parking demand, stormwater pond placement, and internal traffic flow. We reviewed multiple layout options during design and adjusted the building orientation and parking layout to improve efficiency. The final design met the required standards and supported redevelopment along the Apalachee Parkway corridor.

Team 215: St Margaret's Wastewater Treatment Facility Rehabilitation



TEAM MEMBERS:

Morgan De La Garza
Shelby Harrell
Jadon Morini
Raphael Ruiz

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Hydro-Dyne Engineering -
Cullen LeClair

As Florida's population rises, the demand for clean water and proper waste disposal continues to increase, requiring many wastewater treatment facilities to operate across the state. We visited an aging wastewater treatment facility in Lake City, Florida, and addressed rehabilitation-based needs and hydraulic improvements. Our project added a new 2-foot-by-6-foot channel in the facility's headworks, where a screening system designed by Hydro-Dyne was installed.

To complete the project, we took the system offline, which disrupted daily activities and raised estimated costs. These raised costs came from bypass pumping, which re-routed water away from the construction area. We met system wash requirements during bypass pumping of 26 gallons per minute at a pressure of 60 pounds per square inch.

To prepare for the additional channel, we removed damaged piping and made concrete repairs. The new fine screening system we installed handles a peak flow of 7.5 million gallons of water per day. Adding another screening system in the headworks provided a more consistent flow, ensuring more water is treated for the surrounding area. It also ensured waste is captured and removed in accordance with the Clean Water Act and the Florida Department of Environmental Protection Senate Bill 64.

Despite challenges such as a rural environment, aging infrastructure, and system downtime, our project illustrated how small municipalities provide clean drinking water for their surrounding areas.

Team 217: Champ's Chance Site Design



TEAM MEMBERS:

Rameen Ahmad
Kassandre Azar Moise
Abigail Eno
Hailey Wolfenden

ADVISORS:

O. Sean Martin, Ph.D., P.E.,
Scott Wasman, Ph.D.,
Kamal Tawfiq, Ph.D., P.E. and
Primus Mtenga, Ph.D.

SPONSOR:

FAMU-FSU College of
Engineering

We designed a new dog adoption facility for Champ's Chance, a nonprofit in Monticello, Florida, caring for more than 150 dogs. The existing shelter was overcrowded and faced pest problems, necessitating relocation to a new site. Our project addressed the need for adequate space while maintaining dog comfort and operational efficiency for staff and volunteers.

We developed a comprehensive site plan for the 21-acre property in Jefferson County. The site's topography significantly influenced our placement of buildings, access roads, and stormwater management systems. We reclassified the site to enable construction while preserving the existing house, and designed parking for the approximately 8,000-square-foot facility to include 14 to 35 spaces, one meeting accessibility requirements, per local building codes.

Because the original entrance utilized a privately owned neighboring road, we designed a new access road complying with Florida Department of Transportation and American Association of State Highway and Transportation Officials standards. We positioned a retention pond at the site's lowest elevation in the southeast area to manage stormwater runoff and protect nearby wetlands.

Our primary solution uses repurposed shipping containers for dog kennels, mounted on concrete pads and covered with shed and gabled roofs. We selected the shed design to follow the natural slope and reduce construction costs. The facility incorporates various container sizes to create dedicated spaces for healthy dogs, birthing cottages, and puppies, providing the adoption center, kennels, and training areas needed to support Champ's Chance's mission while addressing the organization's spatial and operational challenges.

Team 218: I-10 Widening



TEAM MEMBERS:
Olivia Buxton
Kendall Goad
Alejandra Rojas
Victoria Rojas

ADVISOR:
O. Sean Martin, Ph.D., P.E.

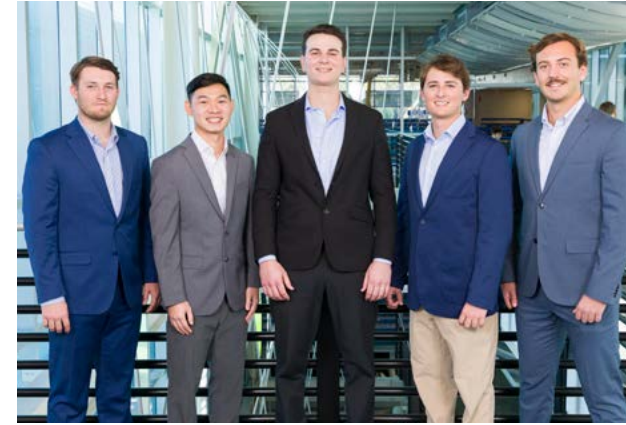
SPONSOR:
HNTB - David Crombie, P.E.

We studied the widening of approximately five miles of Interstate 10 in Okaloosa County, Florida, from east of the Yellow River to east of State Road 85. This segment serves as a critical east-west corridor for freight traffic, regional and national connectivity, and hurricane evacuation for the Panhandle. The existing four-lane configuration produced heavy congestion, safety concerns from high freight truck volumes, and insufficient capacity for rapid population growth.

Our objective was to expand the highway from four to six lanes by adding one lane in each direction to accommodate current and projected traffic demand, improve flow, and enhance safety. We analyzed existing and future traffic patterns, reviewed environmental impacts, designed roadway geometry, and evaluated drainage systems. Using FDOT standards, we developed two design alternatives differing primarily in lane placement and cross-slope configuration.

After comparing both options, we selected the alternative that adds new lanes to the inside of the highway with a downward cross-slope opposite to the existing configuration. This design minimizes impacts to adjacent properties, maintains existing bridge clearances, reduces construction costs, and lessens environmental impacts. The expansion improves daily commuter travel, strengthens regional connectivity, enhances economic reliability for freight transportation, and preserves the corridor's function as a primary hurricane evacuation route. By increasing roadway capacity and optimizing geometric design, our project reduces traffic congestion, improves safety, and prepares the corridor for future growth in Northwest Florida.

Team 220: Welaunee Blvd. Extension/Low-Level Bridge Pre-Design



TEAM MEMBERS:
Zachary Allen
Trevor Nguyen
Jake Orsi
Elijah Oshins
James Simkins

ADVISOR:
O. Sean Martin, Ph.D., P.E.

SPONSOR:
Kimley-Horn –
Dwight Dempsey, P.E. and
Donald Matthews

We designed a complete bridge solution for a growing roadway corridor facing traffic congestion and safety concerns. The project addressed the need for a strong, cost-effective structure to support future development while prioritizing safety, constructability, and long-term performance.

Our multidisciplinary civil engineering team approached the project using professional consulting practices. We evaluated site limitations, traffic demands, environmental factors, and construction impacts throughout the design process. We faced significant challenges working within environmental constraints of a wildlife area while also addressing soil conditions, drainage requirements, and current design standards.

We selected a Florida I-beam concrete bridge system capable of safely supporting large vehicle loads. We sized structural components to withstand gravity loads, wind forces, and vehicle braking forces while ensuring long-term durability. The design emphasized constructability through simple member layouts and standard materials.

We produced professional-quality deliverables including construction drawings, engineering calculations, and a comprehensive final report suitable for client review. Effective teamwork, communication, and coordination proved essential to meeting project deadlines.

This project demonstrated how engineering solutions can enhance public safety and mobility while accommodating future growth. The completed design reflected real-world engineering practices and prepared our team for professional careers in structural and transportation engineering.

Team 219: City of Tallahassee Southside Sustainable Transit Center



TEAM MEMBERS:
Lynwood Busby
Winston Chadwick
Holly Denig
Jewel LaCross
Clayton Moore

ADVISORS:
O. Sean Martin, Ph.D., P.E.,
Pedro L. Fernández-Cabán,
Ph.D., and
Kamal Tawfiq, Ph.D., P.E.

SPONSOR:
City of Tallahassee –
John Powell, Esq., P.E.

A large portion of Tallahassee residents lack sufficient public transportation options. The Southside Sustainable Transit Center, a bus hub located on Orange Avenue, was designed to address this need by providing bus route access to Tallahassee's southside community.

We focused on designing the main building on the site: a two-story, multi-use structure arranged as three small buildings in a line, separated by approximately 50 feet of concrete pads and connected on the second floor by a continuous floor. The first story served passengers and bus drivers, while the second story provided office space for City of Tallahassee workers. Our scope also included a traffic analysis to ensure adequate bus turning movements.

We began by developing a conceptual drawing encompassing the foundation, columns, beams, walls, roof, and their connections, then estimated structural loads to design components capable of supporting them. We modeled all components in Revit to produce the final building plans. For the traffic analysis, we collected intersection volume data from existing databases and compiled our findings into a formal report.

Our design process incorporates special sustainability considerations. Rather than optimizing purely for cost, we evaluated environmental and community impacts alongside structural and functional requirements, reflecting our commitment to responsible engineering in an underserved community.

Team 221: Edward Ball Wakulla Springs State Park New Interpretive Center



TEAM MEMBERS:
Lyn Chin
Benjamin Gatz
Henry Katz
Lillian Keller
Rene Marcil

ADVISORS:
O. Sean Martin, Ph.D., P.E., and
Vern Danforth, P.E.

SPONSOR:
George & Associates
Consulting Engineers, Inc. –
Jay Peterson, P.E.,
Signe Ulsamer, P.E. and
Dominic Rodio

Our team prepared the site design for a new center to interpret the history and culture of Wakulla Springs State Park. We aimed to improve visitor education, access, and sustainability for the Florida Department of Environmental Protection, with George & Associates sponsoring the work. Our team designed a large site to accommodate park meetings and reformed the nearby parking lot to improve traffic flow. We also designed a storm water pond to manage runoff and prepared geotechnical recommendations for the structural design.

We used survey data, soil reports, permit guidelines, and cultural studies to guide the layout. Our design software included Civil 3D for site work and Bentley Open Roads for storm water and parking lot design. The team coordinated with state and local agencies to ensure compliance with the Northwest Florida Water Management District's Environmental Resource Permit, Wakulla County codes, the Florida Building Code, and other environmental protection standards.

We managed several challenges throughout the project. The building area constraints affected permit applications, and we had to develop the site while protecting the park's ecological health, including a large spring and cultural resources. The team worked through software issues, coordinated permit timelines with multiple agencies, and maintained communication with stakeholders to ensure the design met park needs and requests.

The final design provided a functional, accessible, and sustainable plan that supports visitor interpretation while preserving the natural and historic aspects of Wakulla Springs State Park.

Team 222: Drinking Water System Project for San Isidro de Puñín, Ecuador



TEAM MEMBERS:

Krystal Fajardo
Rudy Santayana
Katherine Short
Maeve Storm

ADVISORS:

O. Sean Martin, Ph.D., P.E.,
Kamal Tawfiq, Ph.D., P.E.,
Tarek Abichou, Ph.D., P.E., and
Sol Park, Ph.D.

SPONSOR:

FAMU-FSU Engineers Without
Borders USA Chapter

We addressed the challenge of unsafe and unreliable drinking water in the rural community of San Isidro de Puñín, Ecuador. The existing system, constructed approximately 40 years ago, suffered from two critical problems: sediment accumulation in the spring chamber requiring frequent cleaning, and inconsistent water disinfection leading to unreliable access to potable water.

Our objective was to design improvements to the spring catchment, reduce sediment buildup, and upgrade the chlorination and storage tank systems in accordance with Ecuadorian water standards. We based our designs on data from previous site visits and input from Ecuadorian partners, as we could not conduct new site assessments prior to Fall 2026. Where information was unavailable, we made engineering assumptions that future teams will refine with updated field data.

We developed construction drawings for a new French trench catchment, an improved spring chamber, and storage tank upgrades. We performed comprehensive hydraulic calculations including flow estimation, pipe sizing, and chlorine demand analysis. Using these calculations, we designed a gravity-fed chlorination system that operates without electricity and minimizes overflow.

Our deliverables included complete construction documents and a cost estimate of \$6,765 for system implementation. Despite site access limitations, we successfully created practical engineering solutions that provide future Engineers Without Borders teams with actionable designs to improve access to clean, reliable drinking water for the San Isidro de Puñín community.

Team 224: Stone's Home Center



TEAM MEMBERS:

Frank Anzalone
Colin Krieger
Alexander Lotz
William Pfeiffer
Taggart Williams

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

DHM Engineering -
Mary Farris, E.I.

Stone's Home Center, a hardware store with nine locations throughout Southwest Georgia and Northwest Florida specializing in hardware, building materials, agriculture, and animal feed, required engineering work for a new location in Quincy County off Blue Star Highway. We provided structural, roadway, and site development design for their new property consisting of three buildings on an 8.3-acre lot.

Each building was a pre-engineered metal building that required foundation and slab design. The single-story pre-engineered metal buildings presented specific challenges due to their extremely lightweight construction. We designed the foundations to withstand strong winds that cause positive uplift forces on the buildings.

We also designed the site layout for the parking lot and entrance road. The site design posed challenges because the property was located directly off a state highway, requiring special considerations for turning radius, conflict points, and separation of traffic streams throughout the property. Additionally, we designed the site to avoid interfering with a wetland located to the west of the property.

The design work for Stone's Home Center allowed us to apply multiple specialties of civil engineering. Designing a property to accommodate multiple types of customers and an up-to-code roadway that provides safety for everyone who enters was a rewarding challenge.

Team 223: Temple Terrace Smart Pond Retrofit



TEAM MEMBERS:

Blake Jagger
Owen Noyes
Marco Suarez
Uriel Trejo
Sean Turner

ADVISORS:

O. Sean Martin, Ph.D., P.E. and
Gideon Nnaji, Ph.D.

SPONSOR:

National Stormwater Trust -
Mark Thomasson, P.E. and
Russ Freeman, E.I.

We addressed flooding and water quality problems at an unpermitted borrow pit in Temple Terrace, Florida. The site frequently overflowed during heavy rain, threatening nearby homes, roads, and natural areas. Our goal was to transform the borrow pit into a permitted stormwater pond that reduced flooding, treated stormwater, and protected people and the environment.

The borrow pit was located within a Federal Emergency Management Agency (FEMA) flood zone and lacked a legal outlet for safe water release during large storms. We analyzed site hydrology and runoff patterns, calculating runoff volumes for small and large storms, including 100-year events. We also assessed how future development would increase runoff and ensured our design complied with all local and state stormwater regulations.

We redesigned the borrow pit into a controlled stormwater pond with a smart water management system that lowered water levels before predicted storms to create storage capacity for incoming rainfall. This prevented flooding during heavy rainfall events. Extended detention times allowed sediments and pollutants to settle naturally, improving water quality. We redesigned a swale to convey treated water to a nearby wetland while minimizing soil erosion. Our final design met all stormwater and flood safety requirements. This project demonstrated that intelligent stormwater systems can effectively reduce flooding, enhance water quality, and protect adjacent communities and natural areas.

Team 225: City of Bonifay WWTP Surface Water Discharge



TEAM MEMBERS:

Michael Berg
Sydney Bowles
Mikalya Skinner
Ava Stallard

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Florida Rural Water Association
Peyton Piotrowski, P.E.

Florida Senate Bill 64 eliminates treated wastewater discharge into lakes and streams. We focused on helping City B Wastewater Treatment Plant stop sending treated wastewater into Camp Creek to protect rivers and streams from excess nutrients and pollution. Meeting this requirement was important for supporting cleaner water and long-term environmental health in the community.

We began by analyzing how the wastewater plant operated, treated water quality, site soil characteristics, and available land. We met with our sponsor to confirm project goals and discuss designs and permits. We compared three alternatives: Rapid Infiltration Basins (RIBs), water reuse at the city cemetery, and deep-well injection. RIBs required more land but offered lower construction costs and simpler operation. Deep-well injection required expensive drilling and strict permitting. Water reuse needed new pipes, pumps, and storage infrastructure. Based on these factors, we selected RIBs as the optimal solution.

We then completed preliminary design steps. We estimated site soil properties, calculated the area needed for multiple basins, and determined appropriate rest periods between infiltration cycles. We also developed initial layout concepts and identified required data, including soil tests and groundwater levels. These steps enabled us to prepare design calculations and drawings. By selecting the Rapid Infiltration Basin system, we supported groundwater recharge, reduced nutrient loading to surface water, and provided a long-term, sustainable solution for City B Wastewater Treatment Plant.

Team 226: Bonifay Park Flood Mitigation



TEAM MEMBERS:
Ethan Dunnigan
Ryan Preisendorf
Ema Vandembush
Barrett Waldrop

ADVISOR:
O. Sean Martin, Ph.D., P.E.

SPONSOR:
DHM Melvin Engineering -
Brent Melvin, P.E.

The town of Bonifay, Florida, faces frequent flooding in its downtown area that caused property damage and disrupted daily activities for residents and businesses. We were asked to design a solution to reduce flooding while creating a usable community space. Our final design included a stormwater detention pond that also functioned as a public park.

We designed the detention pond to handle stormwater intake for a 100-year storm. We built it 118 feet above sea level, above the FEMA flood plain. The natural bank of the pond sat at the groundwater level, two to three feet below the surface. Due to high inflow from the northern end, the pond occupied much of the parcel. We primarily controlled outflow using a rectangular suppressed weir that output into an existing canal at the south end of the lot. The outflow matched the previous allowable outflow in tandem with another output weir from the southern side of the pond. We lined the pond with native plant species to filter harmful compounds such as nitrates and nitrites from the stormwater.

For community use as a public park, we added a concrete trail around the detention pond. We installed a simple truss pedestrian bridge made of FRP with an epoxy-coated wooden deck along the narrowest length of the pond. We also installed amenities including restrooms, benches, lighting, and picnic tables. We selected amenities based on longevity and durability due to low post-project maintenance funding.

Team 228: College of Engineering Pedestrian Accessibility Improvement Project



TEAM MEMBERS:
James Dockstader
Phoebe Jean-Baptiste
Carlantz Maurice
Alexander Nunez

ADVISOR:
O. Sean Martin, Ph.D., P.E.

SPONSOR:
FAMU-FSU College of
Engineering

We improved pedestrian safety and accessibility around the Florida A&M University–Florida State University College of Engineering campus by redesigning sidewalks and crossings to meet Americans with Disabilities Act (ADA) standards. High daily foot traffic made these upgrades essential. A major problem was the absence of a safe route between the engineering campus and the nearby AME and IRC buildings, with no marked crosswalk across Engineering Way. Many crossings at vehicular entry and exit points also lacked detectable warning pads or clear walkways, making it harder for students, staff, and visitors to navigate campus safely.

Our goal was to identify all areas that did not meet ADA requirements and redesign them to create a safer, more accessible pathway network. We surveyed the campus and documented each location where sidewalks, ramps, or crossings were missing or substandard. One critical site was a crossing between two parking lot driveways where vehicles moved in and out from both sides, requiring careful design to protect pedestrians.

We used AutoCAD to redesign each problem area, adding missing sidewalk connections, placing detectable warning pads, and marking crosswalks to clearly indicate pedestrian right-of-way. The main challenge involved working around existing roads, curbs, and utilities, which constrained where new sidewalks and ramps could be installed.

Our final design created a safer and clearer walking environment, improved access for people with disabilities, and reduced conflict points between vehicles and pedestrians. The project made daily travel around the engineering campus safer, smoother, and more inclusive for all users.

Team 227: City of Tallahassee Southside Transit Center



TEAM MEMBERS:
Samuel Alonso
Carlos Escobar
Sara Hanzl
Derkya Stanley
Antonio Taneda

ADVISOR:
O. Sean Martin, Ph.D., P.E.

SPONSOR:
City of Tallahassee/StarMetro -
John Powell, Esq., P.E.

We designed a second transit hub for Tallahassee's south side to address critical transportation gaps affecting residents' access to work, school, and healthcare. The existing single bus transfer center creates long wait times, confusing routes, and daily challenges for riders. Our project aimed to improve bus service, enhance rider experience, reduce environmental impact, and support Tallahassee's clean energy goals.

We selected a site at 400 East Orange Avenue in Tallahassee, Florida. Our team reviewed surveys, existing utilities, and available space to develop a comprehensive plan that included demolishing old structures, grading, and designing layouts for bus roadways, utilities, and stormwater management. The final design incorporated a main transit building, eight electric bus bays, pedestrian walkways, and a maintenance building. We ensured all elements met Americans with Disabilities Act parameters and provided safe bus turning movements.

The project faced several technical challenges. The site consisted of mostly flat Albany loamy sand, and federal funding requirements mandated materials made in the United States. The limited space had to accommodate bus traffic, a multi-story transit building, and pedestrian accessibility simultaneously. We evaluated two stormwater management options: an on-site pond and a connection to an existing City of Tallahassee pond across Orange Avenue. We ultimately selected the off-site connection because it reduced maintenance requirements and created additional space for parking, landscaping, and safer pedestrian areas.

Our team delivered a practical design that balanced cost, sustainability, and community needs, making public transportation more accessible for south Tallahassee residents.

Team 229: Wave Student Living



TEAM MEMBERS:
Rafael Bruzzi Spekla
Joshua Malgalhaes
Zachary Santoro
Liam Shutte

ADVISOR:
O. Sean Martin, Ph.D., P.E.

SPONSOR:
BCEI - Doug Barkley, P.E.

We designed a four-story mixed-use building to compare steel and timber construction methods, evaluating structural design approaches, material applications, and construction logistics. We selected this common building typology—retail on the first floor with residential units above—because loft-style construction is widely used in the industry and its scale enables comparisons applicable to similar projects.

We used the Lofts on 833 Gaines Street in Tallahassee, Florida, as our design site, leveraging available architectural drawings, soil data, and geotechnical reports to develop original structural designs for both systems. The two structural approaches differed in gravity and lateral load resistance strategies, fire performance requirements, material costs, and construction sequencing. To isolate the structural comparison, we held site layout, stormwater management, and utility systems constant across both alternatives.

The final designs produce two complete structural alternatives for the same building program. This parallel approach allows direct comparison of performance characteristics and construction considerations for steel versus timber framing. Both designs meet applicable structural codes and environmental standards while providing the required retail and residential space. Our work demonstrates that both structural systems can successfully serve identical programmatic requirements while offering distinct advantages in design and construction.

Team 230: Site Design & Permitting for Secure Laboratory Facility at Eglin AFB



TEAM MEMBERS:

Ryleigh Carr
Ethan Rodriguez
Olivia Seely
Bryanna Valencia

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

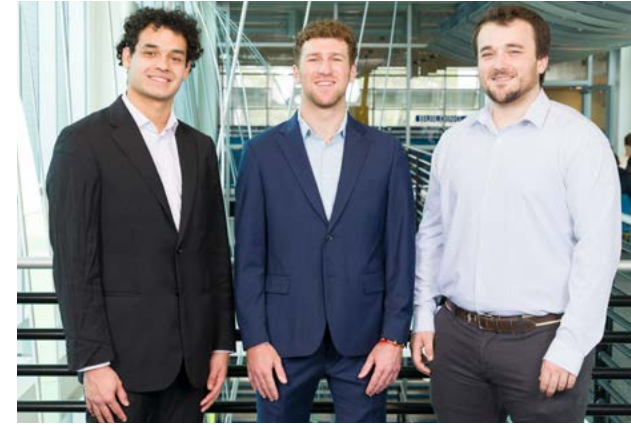
Stantec - Olivia O'Bryan, P.E.
and Chad Mason, P.E.

We partnered with Stantec to design the site layout and secure necessary permits for a new cyberwarfare laboratory at Eglin Air Force Base, the largest Air Force Base in the United States. The base required this facility to expand its research and testing capabilities in cyberwarfare technology. Our design included the laboratory building, employee parking, semi-truck and antenna trailer docking areas, dumpster placement, and stormwater drainage infrastructure, all compliant with the Okaloosa Land Development Code, Urban Hydrology for Small Watersheds (TR-55), and military design guides.

We faced strict regulatory requirements throughout the design process. We created a 33-ft. offset line around the proposed building where the line of sight could not be obscured, designed parking spaces to 9-ft. by 18.5-ft. dimensions, and developed stormwater systems to handle 2-year and 10-year, 24-hour storms. The primary challenge was fitting all design features within the site boundary while working around existing buried utilities from the site's previous use as living space. We ensured proper roadway access for truck routing and dumpster service vehicles.

We applied for and coordinated permits with the Northwest Florida Water Management District and the United States Army Corps of Engineers. This project demonstrated how civil engineers support military mission research by addressing environmental, logistical, and infrastructure requirements through secure and compliant site design.

Team 232: Gamble Rogers State Park Seawall and Drainage



TEAM MEMBERS:

Armando Cardona
Blake Fagen
David Kraus
Kelby Weber (not pictured)

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Hydra Engineering and
Construction, LLC -
Dylan Jones, E.I.

We addressed the failing infrastructure at Gamble Rogers State Park, where a deteriorating seawall along the Matanzas River and recurring flooding had caused campground closures, unsafe road conditions, and structural damage. The existing seawall exhibited cracking, settlement, and failing anchors that accelerated erosion, while ponding issues persisted across the site.

We reviewed existing site conditions and identified critical constraints including shallow groundwater, sandy soils, size restrictions, and the sensitive coastal environment. A significant challenge involved the asbestos-containing materials in the existing seawall, which required careful removal in compliance with federal and state regulations.

To prevent further soil loss, we designed a replacement seawall system using vinyl wall panels secured with horizontally screwed anchor rods. This design provided adequate strength for the calm water conditions while offering extended service life. We demolished the existing seawall and constructed the new system in its place.

To resolve the flooding problem, we designed detention ponds at low points throughout the site, connected by a network of underground pipes. This interconnected system enabled even water distribution between ponds, preventing uncontrolled flooding at any single location. The pipe network allowed us to reduce individual pond sizes since all ponds functioned collectively, creating a more efficient solution.

The completed restorations improved site drainage, restored safe access, increased seawall strength, and reduced future maintenance requirements. Our project delivered simple and durable solutions that balanced cost, safety, and environmental stewardship while supporting long-term park operations.

Team 231: Resilient Site and Infrastructure Design for a Municipal Fire Station



TEAM MEMBERS:

Johnny Fitz
Jeremiah Hopkins
Khia Norman

ADVISOR:

O. Sean Martin, Ph.D., P.E.

SPONSOR:

Chen Moore and Associates -
Bailey Leider

Flooding and heavy rain place growing pressure on fire stations across Florida, requiring improvements to ensure stations remained operational during storms to protect lives and property. We prepared a civil engineering site design to improve flood readiness for a municipal fire station in Lakeland, Florida. Our team examined grading, surface water flow, soil type, and emergency vehicle access routes. We reviewed rainfall history and flood maps to identify areas vulnerable to flooding during large storm events. One major challenge was reducing flood risk while maintaining safe emergency vehicle access.

We designed a site plan that improved water flow and reduced flooding. Our final design included new grading and a stormwater system sized for a 100-year storm. We installed flood barriers in low areas to limit water movement toward the building and redesigned driveways to allow fire trucks and ambulances to enter and exit during storms. We routed utility lines to reduce water damage and limit service outages, and we added soil protection measures to prevent erosion and support long-term site use.

All design work complied with local land-use rules and state road standards. We balanced safety, cost, and ease of construction throughout the design process. Our project demonstrated how effective site planning protected emergency services during severe weather. The final design improved access, reduced flood risk, and helped ensure continued service to the surrounding community.



ELECTRICAL & COMPUTER ENGINEERING



Team 304: Wireless Wearable Controller for Robotic Hand (from left) Julius Walls, Jonah Goldberg, Aaron Smith, Kwajo Burrs and Charlie Masterson.

Team 301/302: 2026 IEEE Southeastcon Hardware Competition



TEAM MEMBERS:

Thomas Buretz
Alejandro Caro
Henry Forero
Nathan Gibbs
Alex Harris
Tyler Morgan
Josue Villarreal

ADVISORS:

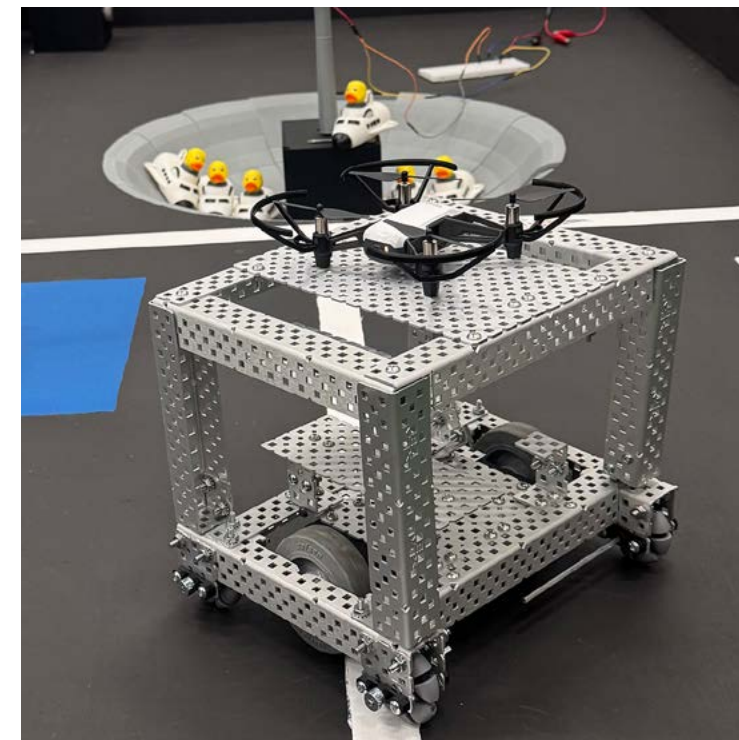
Linda DeBrunner, Ph.D. and
Bruce Harvey, Ph.D.

SPONSOR:

Department of Electrical and
Computer Engineering

We designed a self-operating robot and drone system for the 2026 IEEE SoutheastCon Hardware Competition. The competition required teams to build an autonomous system that completed physical tasks in an arena within a strict time limit using a point-based scoring system. Teams earned points by completing tasks accurately and quickly without human control.

Our robot completed four tasks to power antennas, which turned on LED lights. The drone then viewed and identified the LED colors and sent this information to a receiver to earn points. Six rubber ducks scattered around the arena needed to be collected into a specific region for extra points. Since the competition awarded the most points to antenna-powering tasks, our robot prioritized completing these first.



The robot navigated the arena autonomously, powered the antennas, transported rubber ducks, and traversed uneven terrain. It sensed its environment through sensors that determined its position and movement. We worked with mechanical and aerospace engineering Team 527 who designed who designed the robot's structure, while our team handled control and sensing.

After assembling all robot parts, the system underwent repeated testing and tuning to improve reliability. We used test runs to refine movement, task completion, and coordination between the robot and drone. Once the robot consistently succeeded in testing, it was ready for competition. **Note: This team won first place in the 2026 IEEE SoutheastCon competition!**

Team 303: Autonomous Navigation/Surveillance Land Vehicle



TEAM MEMBERS:

Garrison Gralike
Allen Jones
Paul Mallas
Jeremia Nunez
Aaron Robinson
Dallas Zimmer

ADVISOR:

Zhixin Pan, Ph.D.

SPONSOR:

L3 Harris

We collaborated with mechanical and aerospace engineering Team 515 to design and build an autonomous ground vehicle capable of independent navigation, wireless communication, and manual operator control when needed. The vehicle's capabilities addressed the growing interest in self-driving technology by creating a versatile platform that could operate safely without constant human supervision.

We equipped the vehicle with GPS tracking for navigation and mapping, multiple cameras for obstacle detection, and two-way radio communication for remote instruction. The vehicle successfully navigated autonomously, avoiding obstacles without human input while transmitting a live video feed of its surroundings. We implemented a manual override feature that allowed operators to assume direct control when necessary, which proved essential given the vehicle's speed of 20+ miles per hour.

The vehicle demonstrated robust performance across diverse terrain including grass, sidewalks, curbs, and roads, proving its flexibility beyond controlled indoor environments. This capability, combined with its autonomous navigation and real-time communication systems, created what we characterized as a rugged yet technologically sophisticated platform capable of handling rough conditions.

Our completed vehicle successfully meets all project goals, demonstrating effective autonomous movement, wireless communication capabilities, and seamless operator interaction in real-world environments. The integration of GPS navigation, computer vision for obstacle avoidance, radio communication, and manual override functionality results in a functional autonomous vehicle platform that improves operational safety by reducing the need for direct human presence during exploration tasks.

Team 304: Wireless Wearable Controller for Robotic Hand



TEAM MEMBERS:

Tyler Anderson
Kwajo Burrs
Jonah Goldberg
Charlie Masterson
Aaron Smith
Julius Walls

ADVISOR:

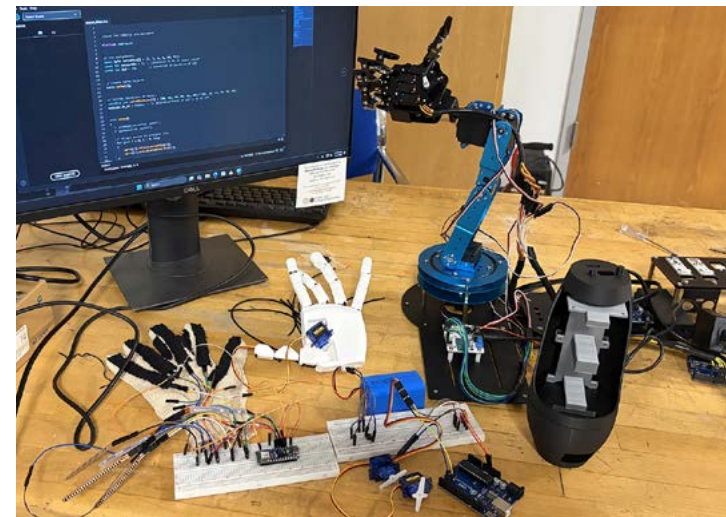
Migara Amarasinghe, Ph.D.

SPONSOR:

Department of Electrical and Computer Engineering

We designed a robotic hand that communicates in American Sign Language, alongside a wearable glove controller that operates it wirelessly. The glove integrates a microcontroller to process information, sensors to capture hand positions, and a battery to power all functions. The robotic hand incorporates multiple motors to control each finger individually and receives commands from the glove through Bluetooth connection. We implemented a vibration feedback system in the glove that notified users when the robotic hand interacted with objects.

The project successfully creates a wireless wearable device capable of controlling a robotic hand. The system signs various ASL numbers and letters at an appropriate speed and with accuracy comparable to the user's signing. The glove is simple enough for anyone to use and effectively capture users' hand movements.



Team 305: Signal Tracking and Recognition of Emotional Stress State (STRESS)



TEAM MEMBERS:

Sebastian Cox
Ryan Driscoll
William Lucky, III
Grace Parnas
Ashlynn Quintana
Joshua Romeo

ADVISOR:

Victor DeBrunner, Ph.D.

SPONSOR:

Department of Electrical and Computer Engineering

Since the COVID-19 pandemic, college students have experienced notable changes in academic performance, social connection, and personal well-being closely tied to stress. We set out to develop a more accurate method for measuring student stress levels by creating a system that collected brain signals using wearable sensors and utilized artificial intelligence to analyze these signals and classify stress levels and causes in users.

We used a headset to read electrical brain activity and blood oxygen signals from test subjects. These signals, electroencephalogram (EEG) and functional near-infrared spectroscopy (fNIRS), provided valuable insight into subjects' mental states. We cleaned the raw signals to remove excess noise and errors, then analyzed the resulting signals and used them as inputs for our machine learning model, which classified users as either stressed or relaxed.

Our system correctly identified stress in most test cases, allowing for quick assessment of someone's current mental state. This project demonstrates how signal processing and machine learning could be combined to create an effective classification system. Our final design allows for future expansion to support real-time usage and wearable health applications, and the project could serve as a test bed for further research in student stress.

Team 306: Language Translator Badge



TEAM MEMBERS:

Donovan Bond
Ignacio De Leon
Zyon Gomez
Cristian Klatt
Kenil Patel
Keila Souriac

ADVISORS:

Shonda Bernadin, Ph.D. and
Lisa Wakamiya, Ph.D.

SPONSOR:

Department of Electrical and Computer Engineering

We designed a portable language translation device that uses artificial intelligence to facilitate real-time communication in settings such as international airports, business meetings, and conferences. The device captures spoken language through an integrated microphone, converts speech to text using AI, and translates the text into a target language displayed on a touchscreen interface similar to movie subtitles.

Our team selected components prioritizing portability and functionality. We integrated a minicomputer that enables Wi-Fi connectivity for internet-based translation services, a compact battery providing full-day operation, a circuit board designed for safe recharging, and a microphone for speech capture. We housed these components in a 3D-printed case that provided durability and heat resistance while maintaining a lightweight form factor.

The device operation requires users to select both their source language and target language during setup. The battery capacity supports all-day use without recharging, addressing the mobility needs of international travelers and business professionals. The touchscreen interface provides intuitive operation similar to smartphone interactions.

Our solution reduces language barriers by enabling real-time communication between speakers of different languages. The combination of AI-powered translation, portable hardware design, and user-friendly interface makes cross-language collaboration more accessible in global interactions.

Team 307: Dual-Channel High-Q RF Circuit for NMR Research



We designed and built an improved radio frequency (RF) system for Nuclear Magnetic Resonance (NMR) spectroscopy that enables simultaneous study of two distinct atomic nuclei. NMR is a technique that uses magnetic fields and radio waves to analyze molecular structure by observing how atoms respond to these signals. The challenge we addressed was the limitation of conventional NMR devices, which typically study only one atom type at a time, requiring multiple experiments to gather comprehensive data.

Our goal was to strengthen the data collection capability of NMR instruments so researchers could extract more information from each experiment. We developed an RF system capable of dual-nucleus detection, allowing the collection of more data from a single experiment without additional testing. The completed system demonstrates that NMR technology could be developed to be more economical, effective, and replicable. Our final design may prove useful for researchers in chemistry, physics, medicine, and engineering who require dependable and accessible NMR instruments.



TEAM MEMBERS:

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Dylan Joerder
Raquel Marriott

ADVISORS:

Thierry Dubroca, Ph.D. and
Jerris Hooker, Ph.D.

SPONSOR:

National High Magnetic Field
Laboratory

Team 309: RFID Lab Access



We developed an access control system for dangerous equipment in the FAMU-FSU College of Engineering's planned maker spaces. The new building will house equipment requiring protection against unauthorized use, creating the need for a secure, trackable access solution.

Our team designed a swipe-based foundation system that restricts equipment operation to authorized users only. The system records user identity, usage timestamps, and equipment runtime duration. We created three core components: a digital log storing user information, a web interface for lab instructors to manage access permissions, and integrated hardware connecting machines to the database. Each user's card contains their information and serves as the machine's on/off control. When swiped, the machine verifies authorization through the digital log before enabling operation.

Lab instructors can activate or revoke individual access permissions for specific machines through the web interface, providing granular control over equipment access. This protects both equipment and users from misuse and danger while maintaining detailed usage records for facility management.

The final design integrates seamlessly with the existing university network, allowing for scalable deployment across multiple maker spaces with minimal system modification. We built the system as an expandable foundation that either our team or the client can develop further to accommodate additional equipment stations and features as the maker spaces grow.

TEAM MEMBERS:

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Taylor Gooden
Patrick Laciuga
Calvin Reinert
Jadalynn Truong

ADVISOR:

Robert Wandell, Ph.D.

SPONSOR:

Department of Electrical and
Computer Engineering

Team 308: Automated Blood Pressure Cuff



We designed a portable device to measure blood pressure and heart rate, addressing the need for affordable health monitoring. High or low blood pressure and irregular heart rate often indicate underlying health problems, yet current monitoring devices are bulky and expensive. Our goal was to create a smaller, lighter, and more affordable alternative that enables users to take control of their health through accessible vital sign tracking.

We developed a device that captured and measured cuff pressure and arterial vibrations as blood flowed through the artery. We used a pressure sensor to convert the cuff pressure and vibrations into analog voltage signals. The microcontroller read these analog signals and calculated the user's blood pressure and heart rate, then displayed the results on a liquid crystal display (LCD) screen.

Through these efforts, we created a wearable medical device that complies with global safety standards. The device accurately measures and displays blood pressure in an easily readable format. These results demonstrate promise in this technology. With further research, this technology could provide greater accessibility to those unable to meet with a care provider due to various reasons.

TEAM MEMBERS:

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Jae Garland
Jaimison Marcelin
Cody Rodgers
Chris Wacker

ADVISOR:

Babak Noroozi, Ph.D.

SPONSOR:

Department of Electrical and
Computer Engineering

Team 310: Jamming Resistant Camera System



Wireless security cameras are widely used for monitoring homes, businesses, and public spaces, but many systems fail when wireless signals are disrupted by jamming. Wi-Fi jamming occurs when strong interfering signals block normal communication, causing cameras to disconnect or stop recording, creating serious security risks where continuous monitoring is needed. We designed and built a jamming-resistant Wi-Fi camera system that could detect interference and continue operating during an attack.

We used embedded software to control camera system operations. During testing, we used a small device to create wireless interference simulating a jamming attack. The system monitored the wireless connection for changes such as weak signals or dropped connections to identify possible jamming. When we detected interference, the camera automatically switched to a safe mode and saved video footage locally so no important data was lost.

We developed software to manage detection, system response, and data logging. Testing showed that the camera continued recording and saved video footage during multiple jamming scenarios. Logged data allowed us to review system performance after each test.

This project demonstrates that Wi-Fi camera systems could be made more reliable through intelligent detection and response techniques. The final design shows potential for use in security applications where uninterrupted surveillance is important.

TEAM MEMBERS:

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Austin Onyebueke
Zuberi Sobers
Mark Yearwood

ADVISOR:

Abdulrahman Takiddin, Ph.D.

SPONSOR:

Department of Electrical and
Computer Engineering

Team 311: Autonomous Go-Kart *multidisciplinary team*



We upgraded a go-kart to achieve autonomous driving capabilities in a simple environment, advancing self-driving vehicle research for our sponsors. Our primary objective was to establish reliable vehicle mobility on a standardized chassis while performing autonomous driving operations. We also designed the system to accommodate future research upgrades.

We attached electrical and mechanical components to the chassis, including sensors, cameras, motors, and modified body parts. The sensors and cameras collect environmental data, allowing the go-kart to perceive and react to its surroundings. We route all data to the vehicle's main computer, which processes the information to determine appropriate actions. For example, when the go-kart approaches obstructions such as cones or walls, the system recognizes the obstacles and commands the kart to slow down or steer around them to maintain its intended path.

We established a new electrical powertrain and control firmware system to ensure reliable operation of all electrical components. In its finished state, our design operates as intended. The go-kart successfully detects its environment, recreates it virtually, and plans effective navigation paths through the environment.

TEAM MEMBERS:
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Spencer Gangwer (MAE)
Aaron Jacobs (ECE)
Ryan Jacobs (ECE)
William Nealy (MAE)

ADVISORS:
Olugbenga Anubi, Ph.D.
Ravikumar Gelli, Ph.D.

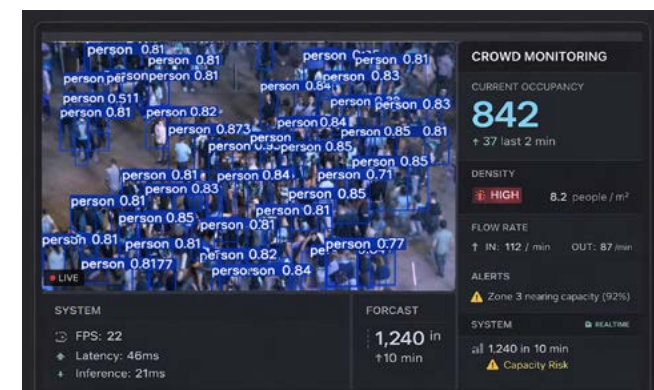
SPONSOR:
Resilient and Autonomous
Systems Lab

Team 312: AI Crowd Counter



Large gatherings often create safety and management challenges for schools, events, and public spaces. Existing crowd counting methods rely on manual observation, which prove slow, inaccurate, and difficult to use in real time. We developed a reliable system that automatically counted people and estimated crowd density using video footage to improve situational awareness and support better decision-making without requiring expensive or complex equipment.

We designed and built an artificial intelligence-based crowd counting system that uses standard cameras. The system analyzes video frames to detect individuals and estimate how many people occupied a given area. We trained and tested the model using sample crowd images and videos to improve accuracy across different lighting conditions and camera angles. The system processes videos in real time and displayed crowd counts and density levels through a simple user interface. Our design emphasizes ease of use, low cost, and compatibility with existing camera systems.



The completed system demonstrates that artificial intelligence can deliver accurate and consistent crowd estimates without human involvement. Compared with manual counting methods, our system reduces errors and produced results more quickly. The project shows that automated crowd monitoring can help prevent overcrowding, improve space management, and enhance public safety. This work provides a practical solution for organizations seeking to better understand and manage crowd conditions in real-world environments.

TEAM MEMBERS:
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Dimitri Jaksic
Lynn Pierre Etienne
Jayla Russell

ADVISOR:
Marcos Vasconcelos, Ph.D.

SPONSOR:
Department of Electrical and
Computer Engineering

Team 313: Aerial Target Intercepting System



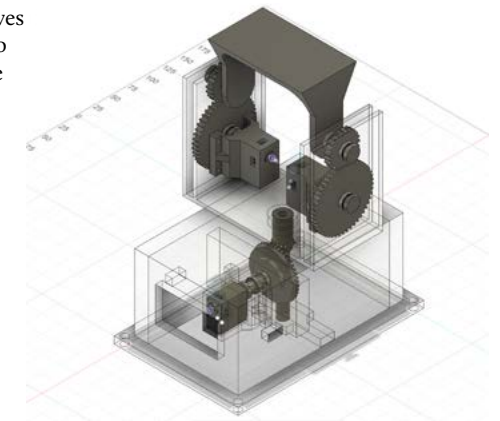
We designed and built an autonomous system that demonstrates the fundamental principles of moving target interception used in modern defense technologies. Our project addresses the engineering challenge of combining speed and precision to intercept objects in motion, a problem that spans applications from industrial automation to missile defense systems.

We divided our system into three integrated modules: acquisition, control, and actuation. The acquisition module fuses data from a high-speed camera and radar sensor to estimate a moving target's position and motion in three dimensions in real time. We process this information to generate predictions of the target's future location.

Our control module receives state-based control loop to determine the appropriate response. This loop continuously monitors system state and coordinates communication between the acquisition and actuation modules to ensure accurate tracking and timely response.

The actuation module consists of a custom 3D-printed mechanical platform with two-axis motion controlled by servo motors. This design allows the system to adjust its orientation and aim based on control commands. Once we detect a target, the system automatically calculates an interception trajectory and executes the response without human intervention.

We successfully demonstrate key concepts used in modern interception and missile defense systems, including sensor fusion, predictive algorithms, closed-loop control, and autonomous operation. Our prototype provides a simplified but effective model for understanding complex real-world defense technologies in an academic setting.



TEAM MEMBERS:
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Carolina Dominguez
Justin Hu
Ian MacDonald
Aaryan Patel

ADVISOR:
Jerris Hooker, Ph.D.

SPONSOR:
Department of Electrical and
Computer Engineering

Team 314: Biometric Smartwatch



We developed a wrist-worn smartwatch that reads and displays health and wellness data in real time. The device integrates sensors to measure heart rate, blood oxygen level, blood alcohol content, and motion, with all information displayed on a small screen attached to the watch. Users control smartwatch operations manually through buttons on the device, which also displays date and time. The watch is powered using rechargeable batteries.

To make the design portable and validate our work, we created a custom printed circuit board and tested our design. We then assembled the components into a custom case to house the watch parts. The smartwatch we developed is intended as a personal health awareness tool rather than a medical device, allowing users to monitor their health information in real time.

TEAM MEMBERS:
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Thomas Wedding

ADVISOR:
Bayaner Arigong, Ph.D.

SPONSOR:
Department of Electrical and
Computer Engineering

Team 315: New Musical Instrument *multidisciplinary team*



We were tasked with creating a musical instrument with no restrictions. We strived to develop a unique instrument with a distinct analog sound, standard amplifier compatibility, and a novel way to intuitively control multiple notes.

Inspired by tap guitar technique, our final design combines the dual-handed freedom of the piano with the intimate finger control of a violin. We used long metal strips as keys. The true innovation was curling the ends of the keys into a resonant chamber for acoustic capabilities and compact design, which produces a unique metallic sound when tapped. We implemented amplification piezoelectrically from the body and inductively from each key's vibrations. The built-in filter and pedal system provides tone control.

We successfully created a unique instrument with physical audible appeal. Its physical properties allow the instrument to sound good both acoustically and electronically with the use of filters or effects. The keys give users great control over the pitch and expression of each note.

TEAM MEMBERS:
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Peter Fasano (MAE)
Nidal Khalil (MAE)
Nicholas Vermillion (ECE)

ADVISOR:
Shayne McConomy, Ph.D.

SPONSOR:
Department of Electrical and
Computer Engineering

Team 316: Pedal Powered Generator



We designed and built a human-powered demonstration system to teach students and the public about electricity generation through interactive outreach events. The project aimed to combine physical activity with hands-on learning by allowing participants to ride a stationary bike to generate electricity that directly powers a slot car on a modified track.

We tested multiple components to ensure compatibility, reliability, and safety throughout the design process. The final system integrates a bike-mounted generator, power control electronics, and a modified slot-car track that operated entirely on rider-generated power. We added an LCD display to provide real-time feedback on power output and system status, helping users visualize the relationship between their pedaling effort and electrical energy production.

The system performed successfully during outreach events, where participants observed immediate cause-and-effect relationships between pedaling speed and car velocity. This direct feedback effectively illustrated fundamental concepts including energy conversion, electricity generation, and mechanical-to-electrical power transfer. We prioritized accessible materials and intuitive operation to minimize intimidation factors for diverse audiences.

The project achieved its educational objectives by delivering an engaging, experiential learning platform that demonstrated practical engineering principles. User responses indicate increased interest in engineering and technology following interaction with the system. The demonstration proved effective across age groups, showing that engineering education can be made accessible and exciting through tangible, interactive experiences that connect physical effort to measurable electrical outcomes.

TEAM MEMBERS:
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Joshua Nable
Jeffery Thomas Jr.

ADVISOR:
Peter Cheetham, Ph.D.

SPONSOR:
Department of Electrical and
Computer Engineering

Team 317: Autonomous Camera System for Combat Sports



We developed an automated camera system to address the challenge of filming MMA grappling matches, where athletes move rapidly and remain in close contact through rolls, turns, and frequent position changes. Traditional filming requires multiple camera operators to capture the action without missing critical moments, creating a significant operational burden.

Our team designed a three-camera system mounted on motorized tripods controlled by a central processing unit. Each camera operates on battery power, eliminating cable requirements, and consists of a camera module, microcontroller, and automated pan-tilt mount. We implemented AI-based athlete detection and tracking algorithms that directs the cameras to follow competitors autonomously. The central device aggregates video feeds from all three cameras and selects the optimal view for recording and display in real time.

We tested the system during live training sessions with the FSU Brazilian Jiu-Jitsu club. The cameras successfully tracked rapid movements and ground fighting while maintaining stable, centered framing of the athletes. The system avoided abrupt camera movements and frame instability, producing clear video that captured important moments without gaps in coverage.

Our results demonstrate that AI-driven camera systems can effectively automate combat sports filming, reducing the need for multiple human operators while maintaining video quality. The system keeps athletes properly framed and visible throughout matches, producing footage suitable for viewing and analysis.

TEAM MEMBERS:
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Miles Henry
Ruth Massock
Devin Peebles
Billy White

ADVISOR:
Rodney Roberts, Ph.D.

SPONSOR:
Department of Electrical and
Computer Engineering



INDUSTRIAL & MANUFACTURING ENGINEERING



Team 408: Improvement of Knee and Hip Surgical Process T1 (L-R) Helen Chung, Valeria Teruel, Sapphire Slawsky, and Victoria Shewan with their advisor, Emilie Miley, Ph.D., at TOC Now.

Team 401: HPMI Composites Development for Aerospace Applications



TEAM MEMBERS:
Daniel Andrews
Ana Correa
Devan Perry
Azaria Moore

ADVISORS:
Chelsea Armbrister, Ph.D.,
Tarik Dickens, Ph.D., and
Ernesto Garcia, Ph.D.

SPONSOR:
Los Alamos/Sandia

We explored the effects of controlled irradiation on EPON 862/W epoxy resin in collaboration with Prairie View A&M University, with sponsorship from Sandia National Laboratories and Los Alamos National Laboratory. This resin system is widely utilized in the aerospace industry for its ability to withstand harsh environments, including radiation, thermal cycling, and mechanical stress.

Our primary objective was to evaluate the material's performance for use in aerospace composites, with specific focus on its stability under X-ray irradiation. We aimed to replicate the extreme conditions encountered in aerospace environments and assess the resulting structural and thermal degradation.

We characterized the EPON 862/W epoxy system using Dynamic Mechanical Analysis (DMA), Differential Scanning Calorimetry (DSC), Laser Flash Analysis (LFA), Micro-CT Scanning, and 3-Point Bending tests. These methods enabled us to evaluate material properties both before and after irradiation, which we conducted at Prairie View A&M University.

Team 402: HPMI Stainless Steel for Aerospace Applications *multidisciplinary team*



TEAM MEMBERS:
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Christian Kennedy (IME)
Sunshine McDonald (IME)
Nicolas Rossi (IME)

ADVISORS:
Chelsea Armbrister, Ph.D.,
Tarik Dickens, Ph.D.,
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Ernesto Garcia, Ph.D.

SPONSOR:
Sandia National Laboratories

Sandia National Laboratories faces critical inefficiencies in procuring specialized 316L stainless steel components, with traditional casting and forging workflows requiring lead times up to eighteen months and occasionally producing parts that fail to meet quality standards. We evaluated the integration of Additive Manufacturing (AM) to augment Sandia's existing supply chain and reduce these bottlenecks.

While AM enables production of complex geometries in hours rather than months, we recognized that the layer-by-layer fabrication process differed fundamentally from traditional monolithic casting and could introduce unique material defects. We investigated how these manufacturing variances impacted mechanical integrity through comprehensive testing of AM-fabricated specimens. We performed tensile testing to determine ultimate strength and torsional testing to evaluate shear properties.

Following mechanical failure, we utilized spectroscopy and fractography to examine the microstructure at fracture points, while Computed Tomography scans characterized internal pore distribution and structural defects. We then conducted a technoeconomic analysis to assess AM integration viability, comparing operational costs, material waste, and lead-time reductions against traditional methods. Our study determined whether the performance-to-cost ratio of additive manufacturing met Sandia National Laboratories' rigorous strategic requirements.

Team 403: HPMI Nano Gauges *multidisciplinary team*



TEAM MEMBERS:
Diego Anguizola (IME)
Reece Morris (IME)
Xavier Pellot (IME)
Elias Silvera (IME)
Lesly Nazaire (ECE)
Summer Rains (ECE)

ADVISORS:
Joshua Degraff, Ph.D. and
Ernesto Garcia, Ph.D.

SPONSOR:
HPMI

We designed and prototyped a low-cost, flexible forearm wearable device utilizing Carbon Nanotube (CNT) Buckypaper sensors to detect user gestures—such as taps, holds, and squeezes—for human-device interaction. Our primary objective was to create a sensor-based wearable capable of translating physical actions into digital input with high accuracy, low power consumption, and real-time responsiveness.

We built upon prior CNT studies conducted at the High-Performance Materials Institute (HPMI), which demonstrated the feasibility of CNT sensors for micro-strain detection. Our interdisciplinary team of industrial, manufacturing, and computer engineers focused on sensor integration, data acquisition via the Dewesoft system, and the development of classification algorithms in Python and Arduino for both offline and live testing.

Throughout the project, we defined design parameters through data collection, calibration testing, and ergonomic studies to identify optimal sensor placement on the forearm. We emphasized comfort, durability, washability, and simplicity while ensuring the device remained affordable to manufacture (under \$25) and scalable for commercial applications.

We delivered a functional prototype that demonstrated accurate gesture recognition, supported by comprehensive documentation, testing data, and a feasibility analysis for future development phases.

Team 404: Recovery of Waste Material



TEAM MEMBERS:
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Alexa Saade
Molly Sonn
Adriana Szurnicki

ADVISORS:
Robert Markum, Ph.D.,
Ernesto Garcia, Ph.D.,
Michael Elwardany, Ph.D.,
Youneng Tang, Ph.D.,
Naser Tibi, Ph.D. and
Chukwunike Okwuenu

SPONSOR:
City of Tallahassee

The City of Tallahassee Waste Management Department disposes of an annual average of 980 tons of grit waste from the Thomas P. Smith Water Reclamation Facility and 1,740 tons of zero-liquid-discharge filter-pressed solids from the Sam O. Purdom Generating Station. Recent state regulations and moisture content limitations restrict continued landfilling of these materials, necessitating alternative solutions.

We performed extensive research on the physical characteristics and regulatory constraints of these waste streams to identify sustainable reuse pathways. Based on this analysis, we developed a feasibility and recommendation report for the City of Tallahassee that outlined potential reuse and commercialization opportunities aimed at reducing disposal costs and diverting material from landfills.

Our project equips the City of Tallahassee with actionable recommendations to reduce landfill dependency, lower long-term disposal costs, and improve operational resilience against tightening regulatory constraints.

Team 405: Improvement of Equipment Repair Process



TEAM MEMBERS:
Ryan Chambre
Faith D'Alessandro
James McGovern
Jamil Racho

ADVISOR:
Ernesto Garcia, Ph.D.

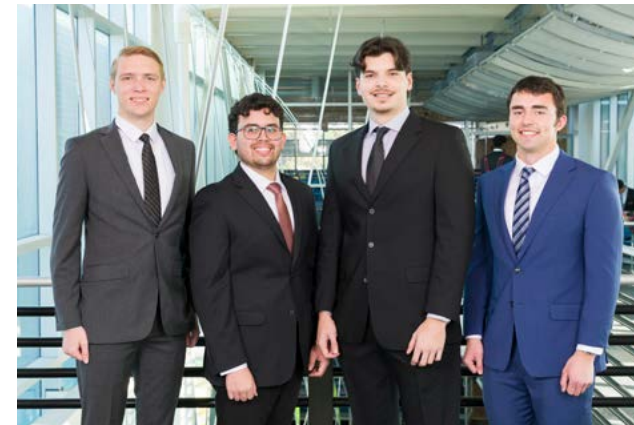
SPONSOR:
TMH

We conducted an operational improvement project at Tallahassee Memorial Healthcare (TMH), a private, not-for-profit community healthcare system serving the Big Bend region. Our project focused on improving the efficiency of TMH's stretcher storage and repair process to reduce equipment downtime and increase stretcher availability across clinical units.

Through direct observation, stakeholder interviews, and process mapping, we identified key sources of waste, including inconsistent damage tagging, disorganized storage areas, unclear ownership, and communication breakdowns between departments. We applied Lean Six Sigma tools to evaluate the existing workflow and isolate the primary contributors to delays and operational inefficiencies.

We streamlined communication, standardized reporting procedures, and enhanced the organization of the repair and storage system. These interventions reduce non-value-added activities and enhanced operational efficiency. The improvements support more reliable equipment availability and strengthened patient care delivery by ensuring that critical mobility assets are accessible to clinical staff when needed.

Team 406: Improvement of Facilities Layout and Control System of Inventories



TEAM MEMBERS:
Caleb Daniels
Juan Diego Velarde
Joseph Leyva
Rep Martin

ADVISOR:
Ernesto Garcia, Ph.D.

SPONSOR:
Robins AFB

We partnered with civilian contractors at Robins Air Force Base to redesign their inventory management system for consumable items like bolts and screws, as well as specialized fixtures used in first-article and engineering testing. The project also included evaluating the warehouse floor plan to optimize the shelving layout. These improvements addressed critical needs to enhance time management, streamline workflow, and prevent redundant procurement or fabrication of existing parts.

We conducted an on-site assessment at Robins AFB to analyze the current layout and identify operational bottlenecks. Department of the Air Force software restrictions required us to work within the Microsoft ecosystem to ensure compliance and security. The engineering team at Robins AFB provided a substantial budget that enabled high-scale solution implementation. We developed a tracking system for inventory specifications and locations using standardized labeling and QR code integration.

To optimize the warehouse layout, we implemented Integer Linear Programming via Python to determine the most efficient material placement. We built the final tracking system using Microsoft SharePoint and Power-Apps. While this solution effectively managed fixture tracking, the high volume and complexity of consumables led us to conclude that an automated point-of-use solution, such as an AutoCrib parts vending machine, offered the most efficient management strategy. Collectively, these recommendations provide a scalable framework to reduce redundant ordering and significantly improve the speed of part retrieval and overall workflow at Robins AFB.

Team 407: Improvement of College Bus Routes



TEAM MEMBERS:
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Nigel Brown
Congguang Chen
Robert Stephens

ADVISORS:
Ernesto Garcia, Ph.D.,
Veronica White, Ph.D., and
Michelle Rambo-Roddenberry,
Ph.D., P.E.

SPONSOR:
FAMU-FSU College of
Engineering

We evaluated the performance of the bus system serving the College of Engineering and developed data-driven recommendations to improve reliability, efficiency, and user experience. Increasing enrollment and new academic facilities prompted our study, as these changes were projected to generate higher passenger demand on the Innovation route.

We applied a DMAIC methodology to define the problem, measure performance, analyze root causes, and design improvements. We conducted field Gemba observations on each route to collect operational data, including arrival times, dwell durations, headways, passenger counts, and schedule adherence. We also analyzed StarMetro data and rider feedback to estimate demand patterns and identify peak congestion periods.

Using these data, we developed a discrete-event simulation model in Simio to represent operations, accounting for class rush surges, vehicle capacities, and operator breaks. We tested several scenarios, including bus additions, headway adjustments, break relocations, and modified stop sequences. We compared performance metrics—specifically average wait time, cycle time, and hourly capacity, to determine feasible improvements within existing resource constraints.

Our analysis revealed gaps in schedule consistency and underutilization during off-peak periods, whereas peak periods exhibited crowding and uneven vehicle spacing. We produced an optimization framework that matched student travel demand to available trips and validated solutions through simulation. These results inform proposed route and scheduling changes aimed at reducing commute times while maintaining cost efficiency. Our findings provide StarMetro and the College of Engineering with actionable recommendations to support future growth and dependable transportation services.

Team 408: Improvement of Knee and Hip Surgical Process T1



TEAM MEMBERS:
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LibbyAnn Ling
Victoria Shewan
Sapphire Slawsky

ADVISORS:
Emilie Miley, Ph.D. and
Ernesto Garcia, Ph.D.

SPONSOR:
Tallahassee Orthopedic Center

We analyzed perioperative workflow efficiency within the Tallahassee Orthopedic Clinic ambulatory surgical center to increase daily surgical throughput while maintaining patient safety. Our team employed a DMAIC-based framework to define the current-state surgical process, identify bottlenecks through direct observation and time-study data, and quantify performance gaps relative to operational targets.

We conducted detailed process mapping and value stream analysis to characterize patient flow from preoperative intake through postoperative recovery. We cleaned, validated, and analyzed data from surgical schedules and time-tracking forms to establish baseline metrics, including average daily surgeries, cycle times, and resource utilization. To test interventions, we developed a discrete-event simulation model that replicated operations and evaluated proposed improvements under varying demand and staffing scenarios.

Our results demonstrate significant potential for increased surgical throughput and reduced idle time through targeted process changes. We delivered a validated simulation model and data-driven recommendations designed to support evidence-based decision-making and sustainable operational improvements within the surgical center.

Team 409: Improvement of Knee and Hip Surgical Process T2



TEAM MEMBERS:
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Patricia Jimenez
Valeria Teruel
Jenna Lowenthal

ADVISORS:
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SPONSOR:
Tallahassee Orthopedic Center

We analyzed perioperative workflow efficiency within the Tallahassee Orthopedic Clinic ambulatory surgical center to increase daily surgical throughput while maintaining patient safety. Using a DMAIC-based framework, we defined the current-state surgical process, identified bottlenecks through direct observation and time-study data, and quantified performance gaps relative to operational targets.

We conducted detailed process mapping and value stream analysis to characterize patient flow from preoperative intake through postoperative recovery. We cleaned, validated, and analyzed data from surgical schedules and time-tracking forms to establish baseline metrics, including average daily surgeries, cycle times, and resource utilization. To test interventions, we developed a discrete-event simulation model to replicate operations and evaluate proposed improvements under varying demand and staffing scenarios.

Our results demonstrate significant potential for increased surgical throughput and reduced idle time through targeted process changes. Our final deliverables included a validated simulation model and data-driven recommendations designed to support evidence-based decision-making and sustainable operational improvements within the surgical center.



MECHANICAL & AEROSPACE ENGINEERING



Team 506: Automated 3D Mapping of Rotor Magnetic Field (from left) Trey Gilland, Tahj Reed, Taylor Joseph, Juan Gonzalez, Andrew Colon, and Nicolas Wigington with their project at Danfoss in Tallahassee.

Team 501: NASA Psyche Mission: Sample Acquisition from Hypothesized Surfaces



TEAM MEMBERS:

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Conner Holmes
Claudia Irausquin
Jake Marcus
Janna Rhodes
Jerry Richardson

ADVISOR:

Shreyas Balachandran, Ph.D.

SPONSOR:

ASU

We designed a system to collect metal and rock samples from the surface of asteroid Psyche, supporting NASA's Psyche mission to study a rare, metal-rich asteroid that may be the exposed core of an early planetesimal. Learning about Psyche helps scientists understand how planets form and evolve. Our goal was to gather useful samples from different surfaces and keep them clean and secure. We worked with Senior Design Team 502, which focused on returning the samples to Earth, so our system needed to pass each sample safely and reliably to the return system.

Our system collects samples, stores them, and prepares them for transfer. The design had to function in space conditions including microgravity, extreme cold, and vacuum. To meet these challenges, we studied past missions such as OSIRIS-REx and Mars rover sampling systems, then adapted their methods to a metal-rich surface.

We built and tested a prototype on Earth using materials and setups that matched what we expected to find on Psyche. The prototype combines drilling with a short gas release to collect both loose dust and solid pieces. This method limits sample loss and reduced mixing between sites. The design stores several samples, keeps each one sealed, and measures how much material was collected.

The project demonstrates a small, automated system that can support future missions to metal-rich asteroids. The system provides a clear path for collecting clean, well-preserved samples that help scientists learn how planets form and change over time.

Team 502: NASA Psyche Mission: Sample Return from Hypothesized Surfaces



TEAM MEMBERS:

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Jeremiah Jones
Jensen Kubina
Ryan Kunz
Adam Lyn
Zachary Schurr

ADVISOR:

Simone Hruza, Ph.D.

SPONSOR:

ASU

NASA's Psyche mission studies the metal-rich asteroid 16-Psyche to understand planetary formation. Because damaged or contaminated samples limit scientific analysis, safe sample transfer and containment are critical for future space missions.

We developed a sample transfer and containment system to move collected material into a return capsule while maintaining contamination-free conditions. Our design limits exposure to external dust, protects samples from temperature fluctuations, and reduces damage from debris during transfer and storage. We built a working prototype and test plan that demonstrated controlled, repeatable transfer operations. Our testing focused on alignment accuracy, repeatability, and non-contact transfer capability to verify the system could scale to future mission requirements.

We implemented an open-source robotic arm equipped with a camera and end effector to capture samples. The camera identifies visual markers, similar to QR codes, placed on sample containers. These markers enable the arm to locate targets, align the end effector, and confirm placement during transfer. This approach improves accuracy and simplifies testing by making each step measurable and repeatable. We based our capsule concept on proven designs from NASA sample return missions including Stardust and OSIRIS-REx, which used sealed containers to protect material during handling and return. By combining vision-guided robotic transfer with a sealed capsule design, we created a system that supported safe and reliable sample handling for future Psyche mission applications.

Team 503: Quick Trim Notcher Upgrade

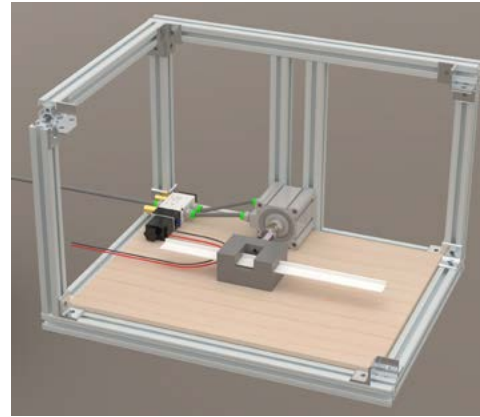


TEAM MEMBERS:
Ivan Buktenica
Ulysses Ellis
Morgan Horesh
Tyler Leroy-Khoury
Alexander Wampler

ADVISOR:
Keith Larson

SPONSOR:
CLN South Florida

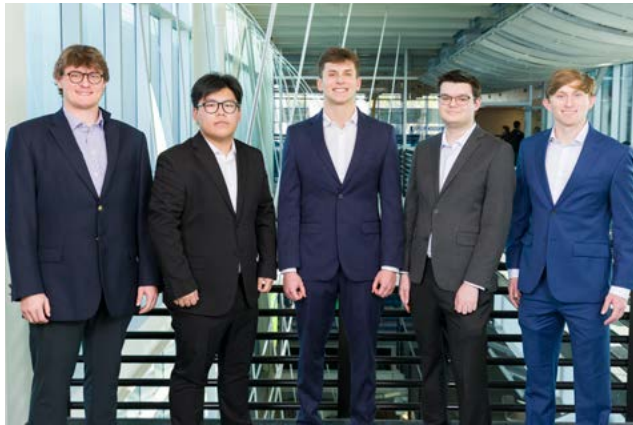
We designed a simplified notching machine for CLN of South Florida to create V-shaped notches in trim cap material used on commercial signs. The trim cap, composed of flexible plastic with an aluminum core, requires precise notches to bend smoothly around curved surfaces and raised lettering. CLN's existing tool, while functional, uses an overly complex mechanism featuring a large rotating blade that descends vertically, contacts the material, and rocks back and forth to cut each notch. This design incorporates excessive moving parts, increasing manufacturing costs, setup time, maintenance requirements, and susceptibility to mechanical failure.



Our objective was to develop a simpler, more affordable solution that maintained the same notch quality while improving operational speed and preserving cutting accuracy. We designed and built a mechanism using a sharpened V-shaped steel blade that presses straight down through the plastic to form each notch, then retracts to allow material repositioning for the next cut. This approach eliminates unnecessary motion and significantly reduces the total part count.

We conducted testing focused on notch quality, consistency, and ease of use. Results demonstrate that our design produces clean and consistent notches while lowering both manufacturing costs and maintenance demands. The final design provides CLN of South Florida with a reliable, cost-effective tool that improves production efficiency without sacrificing performance.

Team 504: Cement Drying in Ceramic Particulate Filters



TEAM MEMBERS:
Macauley Bacon
Jiabai Gao
John Holley
Noah Hughes
Justin White

ADVISOR:
Huixuan Wu, Ph.D.

SPONSOR:
Corning

We designed a new drying system for Corning to address inefficiencies in Diesel Particulate Filter (DPF) production. DPFs are ceramic filters that trap harmful pollutants from diesel engine exhaust. These cylindrical components contain numerous small channels plugged in a checkerboard pattern with cement, allowing air to pass while capturing soot and unburnt fuel. Before packaging, the cement plugs required drying to prevent mold growth. Corning's existing conveyor-based pizza-style oven limits production to approximately 60 parts per hour, creating a bottleneck in their manufacturing process.

We developed a system that uses heating and suction fans to push and pull warm air through the DPFs. As filters move along the conveyor belt, they stop at set positions that align with heating and suction fan funnels, enabling uniform drying across each part. Halfway through the process, the heating and suction fans switch sides to ensure even drying on both sides of each filter.

We designed the system to be adjustable to accommodate different sized DPFs. By shortening the drying time, our system aims to increase production from 60 parts per hour to at least 140 parts per hour, improving overall process efficiency. The solution is also scalable, allowing Corning to expand capacity to dry larger volumes of parts as production demands increase.

Team 505: Multiphase to Pure Vapor: Designing a Compressor Inlet Solution



TEAM MEMBERS:
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Clayton Fusco
Landon Kelly
Nathan Norman

ADVISOR:
Kourosh Shoele, Ph.D.

SPONSOR:
Danfoss Turbocor

We designed and installed a refrigerant mixing device for Danfoss's compressor testing setup to improve safety and reliability during operation. A critical risk in compressor testing occurs when liquid refrigerant enters the compressor. Since liquids cannot be compressed, this can cause serious mechanical damage. Our goal was to mitigate this risk while integrating seamlessly with Danfoss's existing system for evaluating cooling and refrigeration compressors.

Over two semesters, we researched refrigerant behavior, reviewed existing solutions and evaluated multiple design concepts before selecting a final approach. We used design software to model and refine device geometry, and ran computer simulations to predict refrigerant flow and mixing behavior prior to physical testing. Key design targets included reliable operation across a range of conditions, a total cost of approximately \$2,000 and straightforward manufacturing and assembly to simplify integration with the existing test setup.

We selected a device with a spiral interior geometry, which continuously mixes refrigerant as it flows through, preventing liquid accumulation and improving flow consistency. The absence of moving parts reduces maintenance requirements and minimizes failure risk. After building and testing a prototype, we installed the final device on Danfoss's testing system. The design meets all performance requirements while remaining affordable and easy to manufacture. By preventing liquid refrigerant from reaching the compressor, our device improves operational safety, protects valuable equipment and helps ensure the accuracy of compressor test results.

Team 506: Automated 3D Mapping of Rotor Magnetic Field



TEAM MEMBERS:
Andrew Colon
Trey Gilland
Juan Gonzalez
Taylor Joseph
Tahj Reed
Nicolas Wigington

ADVISOR:
Eric Hellstrom, Ph.D.

SPONSOR:
Danfoss Turbocor

We worked with Danfoss, a manufacturer of magnetic bearing compressors that offer extended machine life and improved efficiency, to develop an automated magnetic field measurement system for quality assurance testing. Danfoss compressors rely on precisely controlled magnetic fields, but their existing manual measurement process is time-consuming, inaccurate, and makes it difficult to verify consistent shaft manufacturing standards.

We designed an automated system that measured magnetic flux distributions and generated 3D visual maps of the magnetic field around each shaft. Our design incorporates three coordinated motion systems: a linear actuator that moves a magnetic field sensor along the shaft's length, a rotational stage that turns the shaft through 360 degrees to capture complete circumferential data, and a radial positioning system that moves the sensor away from the shaft to map how magnetic flux varied with distance from the center. The sensor collects readings throughout the scanning volume, and our software processes this data to create 3D models that make flaws and inconsistencies readily detectable.

Our automated method significantly reduces human error by limiting operator involvement to shaft loading and test initiation. The system improves measurement accuracy compared to manual testing while decreasing training requirements and labor costs for magnetized shaft inspection. The project delivers faster, more accurate, and more reliable testing that ensures each shaft meets Danfoss performance standards before installation in compressors.

Team 507: Automated Recycling



TEAM MEMBERS:
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Bomine Jayasinghe
Kamara Manzie
David Russ
Juliana Youngman

ADVISOR:
Dorr Campbell, Ph.D.

SPONSOR:
DOW

Recycling centers face significant inefficiencies due to improper material sorting, which increases waste and slows processing. We designed an automated recycling device to improve sorting accuracy and reduce manual labor in recycling plants.

We built a machine that sorts common recyclable items including shredded cardboard, small soda cans, mini water bottles, and small glass bottles. Items enter through a hopper and travel on a conveyor belt where the system weighs each object and captures an image to estimate its size. We calculate density using weight and size measurements while simultaneously sending images to an artificial intelligence program for material prediction. The system combines density calculations with AI predictions to identify material types, then uses paddles to direct items into designated bins. Each bin measures the total weight of collected materials and alerts workers when full.

Our testing demonstrated that the machine sorted plastic, aluminum, glass, and cardboard with at least 80 percent accuracy. The system also separated unidentifiable items into a separate bin. Results showed that combining AI analysis with density calculations improves sorting performance compared to using either method alone. We designed the system with emphasis on safety, reliability, and ease of operation for recycling facility workers.

This project demonstrates how automation can enhance recycling operations by reducing waste, saving processing time, and improving material recovery rates through more accurate sorting.

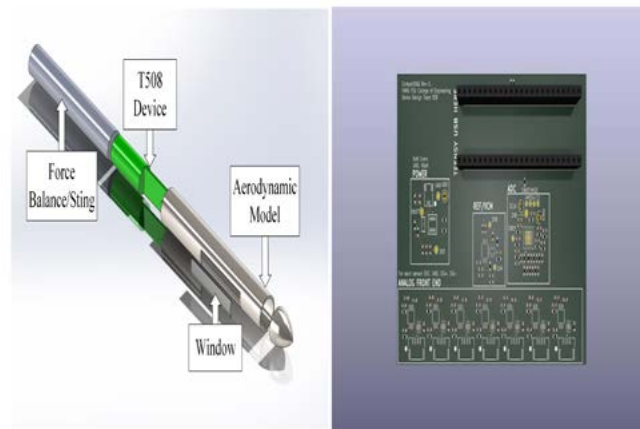
Team 508: Wireless Sensing in Hypersonic Wind Tunnel



TEAM MEMBERS:
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Jack Fillenwarth
Belen Melendez Parrales
Gavin Pufahl
Mikayla Schuller

ADVISORS:
Rajan Kumar, Ph.D. and
Jonas Gustavsson, Ph.D.

SPONSOR:
FCAAP



Wind tunnel testing enables researchers to study airflow around models before constructing full-scale designs. Traditional rear mounting supports hold models in place but have limited internal space, preventing pressure sensors and force-measuring systems from operating simultaneously. We designed a compact wireless data transmission device to solve this problem, allowing both systems to run concurrently and improving overall testing efficiency.

We evaluated multiple wireless communication methods, including Wi-Fi and Bluetooth, ultimately selecting a laser-based system for our final design. The aluminum model construction blocked most wireless signals, preventing data transmission through the walls. We addressed this challenge by adding a small window to the model, enabling the laser signal to transmit data without interference.

We integrated the device to fit inside the wind tunnel model, using an internal power source to operate the electronics. The device collects data from the pressure sensors and transmits it through the laser to a receiver, which stores the information on a computer for analysis.

We conducted tests to verify the data transmission reliability. Our results confirmed that the laser-based system successfully transmitted pressure sensor data, with stored device data verifying the outcomes. The adaptable design allows researchers to create smaller-scale versions for use with reduced-size wind tunnel models. This device enables researchers to conduct wind tunnel testing more efficiently and flexibly by eliminating the previous constraint of running only one measurement system at a time.

Team 509: Automatic Conductor Hoist *multidisciplinary team*



TEAM MEMBERS:
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Harrison Moore (ECE)
Melissa Oestreich (MAE)
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Gabriela Zurheide (MAE)

ADVISOR:
Pat Hollis, Ph.D.

SPONSOR:
Florida Power & Light

All power line workplaces heavy physical strain on linemen, with one of the most demanding tasks being pulling power lines to the correct tension. These lines can weigh thousands of pounds, increasing the risk of injury. We designed a portable, battery-powered hoist system to make power line work safer and easier by replacing the manual pulling process. The device mounts directly onto a power line and pulls it to a set tension, eliminating the need for constant manual force.

We worked with Florida Power & Light to establish clear design goals. The system is light enough for one person to carry and use while still producing up to 4,000 pounds of pulling force. An electric motor generates the necessary force, which is amplified through a gear system to keep the device compact and user-friendly.

We integrated sensors to measure line tension during operation, ensuring accurate and repeatable results. A temperature sensor prevents the device from overheating and protects the equipment from damage. Safety features include an emergency stop button and audio-visual warnings to quickly alert linemen about any issues. Testing demonstrates that the device reduces physical strain while maintaining steady performance. The final design meets our strength, accuracy, and portability goals and shows strong potential to improve safety and reduce setup time for power line work.

Team 510: NASA Student Launch Rocket



TEAM MEMBERS:
Alex Hamberg
Connor Hull
Alexander Kunstmann
Hunter Litt
Lexi Rodriguez
Efe Yeseren

ADVISOR:
Alexandre Berger, Ph.D.

SPONSOR:
Florida Space Grant Consortium

We designed and launched a high-power rocket for the 2026 NASA Student Launch Competition that reached a target altitude of 4,900 feet. The competition follows NASA's design process, including test launches and iterations, teaching us how to design for safety and functionality.

Our rocket, Anomaly, was built to meet the competition's unique challenges. Flight performance is scored on multiple criteria: altitude accuracy, with points deducted for every foot above or below our declared height; descent time under 90 seconds for bonus points; and landing proximity to the launch pad. We will achieve success by landing without damage, ensuring the rocket fully reusable. We collaborated with Team 511, whose payload will deploy upon landing to complete its mission.

We constructed the rocket from strong, lightweight materials. The design features a specialized nose cone and fins, with carbon fiber components used in high-stress areas such as the tail cone and nose tip. We designed major sections to separate easily, enabling safe transport, inspection, and repair. An onboard camera provides real-time flight observation. We implemented a dual-parachute recovery system: a drogue chute deployed at apogee for initial deceleration, followed by a main parachute at lower altitude to ensure a controlled landing within the required descent parameters.

Team 511: NASA Student Launch Payload *multidisciplinary team*

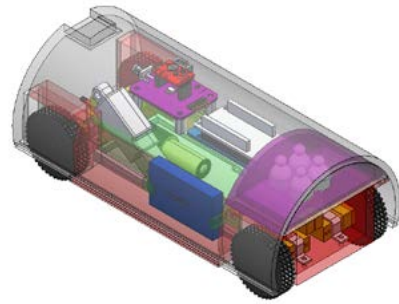


We designed a rover-style payload for the NASA Student Launch mission that collects soil and measures its pH level within 15 minutes after landing. The system operates autonomously, though we could send a signal to begin collection.

Our payload is a compact rover that exits the rocket and lands safely on the ground. Once deployed, the rover drives away from its capsule using a four-wheel system that provides steady motion on uneven soil. The vehicle carries onboard power, control electronics, and sensors that allow it to move without outside assistance. A small shovel mounted underneath the rover stays folded inside the base during launch and descent. After landing, the shovel deploys downward using a linear actuator that positions it for soil collection. The rover then drives forward while the shovel scoops soil into a storage chamber separate from onboard electrical and mechanical components. This chamber holds the collected soil securely so that it does not escape during motion. Once collected, the soil is immediately tested by a sensor inside the storage chamber. The sensor tests the pH level of the soil and transmits it with timestamps to present to NASA for validation.

Within the payload, we secured four model astronauts (“STEMnauts”) in a compartment to protect them during launch and landing from conditions that would be harmful to real-life passengers.

We researched, prototyped, and tested different materials and shapes for the payload body and soil collection device. Our final design is a rover shaped like a half-cylinder, with the shovel and wheels on the flat side, based on construction and farm equipment used to move large amounts of soil. The payload fits within the space and mass constraints established by the rocket team.



TEAM MEMBERS:

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Daniel Smith-Montero (MAE)

ADVISOR:

William Oates, Ph.D.

SPONSOR:

Florida Space Grant Consortium

Team 512: Garage Door Opener Functional Test Fixture



Ghost Controls manufactures automatic gate and garage door openers and is launching a new residential product line requiring pre-shipment testing to ensure proper functionality. Current testing methods use full garage door systems, consuming significant floor space while increasing setup time and costs. We designed a compact testing device that replaces the large setup while maintaining comprehensive quality verification.

Our system tests garage door openers without damaging units or affecting their sale condition. Workers place units into a sliding drawer and initiate tests using simple button controls and a display screen. The tester automatically verifies motor operation, button functionality, lighting, audio alerts, and safety features. Internal sensors measure each function while small motors simulated button presses. A sensor, magnet, and wheel measures motor speed and direction, comparing measurements against specification values to identify defects such as weak motors or electrical faults. We implemented a smart camera to verify light color and location, while a dedicated sensor detects and measures sound alerts. The system tests safety detection by breaking a light beam, confirming the opener properly stopped or reversed when detecting obstructions.

We isolated the testing environment from external light and noise to ensure consistent results. After each test cycle, the device clearly indicated pass or fail status. All components fit within the drawer assembly to minimize spatial footprint and improve factory floor usability. The result is a compact, repeatable testing system that enables workers to test more units per day with consistent results. This design helps Ghost Controls improve quality assurance processes, decrease testing costs, and increase confidence that each garage door opener meets performance expectations before shipment.

TEAM MEMBERS:

Cole Gassman
Louis Pascal
Brandon Rivas-Sasvin
Jacob Schallhorn
Sophie Sifuentes

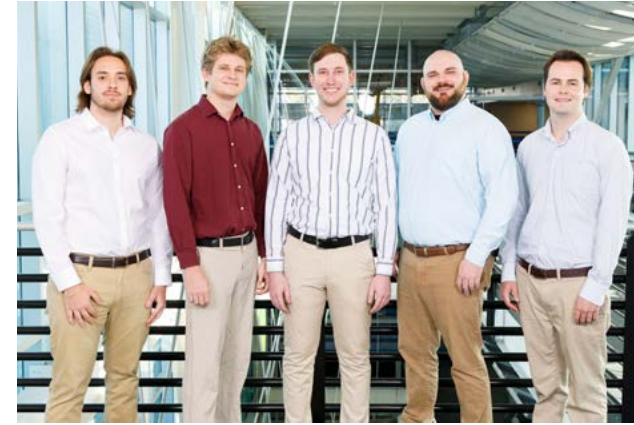
ADVISOR:

Murray Gibson, Ph.D.

SPONSOR:

Ghost Controls

Team 513: Automated Bell and Flare Machine Development



Workers at Heatcraft, an HVAC heat exchanger manufacturer, shaped copper tubes for hours each shift using a handheld, air-powered tool to widen tube ends and form funnel-like lips for joining tubes with heat and filler metal. Repeated use causes strain, fatigue, and pain in operators’ hands and wrists. We partnered with Heatcraft to reduce operator strain while maintaining production rates.

We designed and built a lever-driven tool that forms the same tube ends without harsh vibrations. Our device uses rotating expansion bits, similar to those on handheld drills, to smoothly widen tubes and create the required lips for assembly. We utilized leverage to minimize operator effort. We created multiple prototypes and selected a driving system matching current production pace, which allowed us to scale down our prototype design for initial testing and perform calculations for the final device specifications.

Testing demonstrated that our finished device performed quality reshaping of copper tubing at speeds similar to the air-powered device while reducing strain on operators. Our device enables Heatcraft to manufacture quality heat exchangers at the same pace without putting employees at risk of injury.

TEAM MEMBERS:

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Christian Micko
Angelo Mongiello
Ethan Skinner

ADVISOR:

Neda Yaghoobian, Ph.D.

SPONSOR:

Heatcraft

Team 514: Automated Deburr Machine for Bearing Oil Holes



We developed the Bearing Raceway Deburring Device (BRaDD) to automate burr removal from small metal bearings for our sponsor, JTEKT. During bearing manufacturing, lubrication holes drilled into the raceway often leave sharp metal burrs that can block lubricant or damage assembly tools, reduce product quality and bearing performance. JTEKT’s existing manual deburring process requires trained operators to complete tedious inspection and removal tasks, creating inconsistencies in surface finish and limiting opportunities for operators to focus on higher-value work.

We designed BRaDD to address JTEKT’s need for improved consistency and reduced manual labor as manufacturing moves toward automation. Our system accepts bearings of different sizes without manual adjustment by using a V-shaped support that naturally centers each part and positions the lubrication hole consistently. The V-shaped support contains rollers that spin to rotate the bearing during processing. As the bearing rotates, sensors detect the lubrication hole, and the deburring tool enters to smooth the inner surface. Once completed, the system moves the bearing to a finished pile.

BRaDD runs in a simple and repeatable sequence, providing JTEKT with a reliable automated solution that improves bearing quality while reducing manual deburring effort and supporting workplace productivity.

TEAM MEMBERS:

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Kat McCabe
Josh Ospina
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ADVISOR:

Pat Hollis, Ph.D.

SPONSOR:

JTEKT

Team 515: Unmanned Vehicle Development



L3Harris tasked our team with designing a mobile robot capable of exploring dangerous post-disaster environments without risking human lives. We developed an autonomous robot for complex search and rescue missions that navigates obstacles including curbs, rubble, and uneven terrain. The robot uses sensors similar to those in self-driving cars to detect obstacles and generate 3D environmental maps, enabling autonomous navigation decisions and preventing the robot from becoming stuck. We transmit collected maps and location data to operators in real-time.

We designed a simple, modular frame that facilitates rapid field repairs and future component upgrades. Lightweight materials provide structural rigidity while maintaining portability. We mounted cameras and laser sensors to the frame, allowing the robot to detect environmental features such as trees and buildings. Metal paneling protects internal systems against water, dust, and electrical hazards. The compact size enables easy transport of multiple robots for coordinated operations.

We delivered an autonomous robot that navigated dynamic urban environments using sensor fusion. The system provides user control over mapping parameters and driving modes. We programmed the robot to mark identified obstacles, supporting future rescue team operations. The modular design extends operational lifetime and enabled repeated field deployment. Our robot serves as a reconnaissance platform that identifies and maps hazardous conditions, protecting rescue workers from dangerous environments.

TEAM MEMBERS:

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Brady Ayers
Noah Battels
Owen Hayes
Omari Jones
Ethan Lindsay

ADVISOR:

William Oates, Ph.D.

SPONSOR:

L3 Harris



Team 516: Gallbladder Stone Device



We developed a surgical tool to help remove gallstones 10 millimeters and larger during laparoscopic surgery. Existing tools struggle to remove the larger stones, often forcing surgeons to convert to open surgery, which leads to longer recovery times and increased complications. We identified the surgeon's needs and translated them into design specifications. We optimized part selection, refined geometries and incorporated mechanical advantage into the device. This tool enables surgeons to complete gallstone removal through small laparoscopic incisions rather than converting to open surgery.

TEAM MEMBERS:

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Haley Hall
Matthew Luebke
Dylan Satahoo
Alexandro Valdez

ADVISOR:

Shayne McConomy, Ph.D.

SPONSOR:

Mayo Clinic

Team 517: Endoscope Technology *multidisciplinary team*



Surgeons performing ear, nose and throat procedures use endoscopes with varying angle rods to visualize different areas inside the nose. Frequently changing rods during operations significantly slows procedures and interrupts workflow. This project used software and hardware to help the surgeon's workflow and save surgical time.

TEAM MEMBERS:

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Mario Medina (MAE)
Lucy Miller (ECE)
Marc Nasnas (MAE)
Alex Rivas (ECE)
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ADVISOR:

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SPONSOR:

Mayo Clinic

Team 518: Model Base Systems for Motor Selections



NASA's Jet Propulsion Laboratory (JPL) designs robotic systems for space missions, ranging from spacecraft doors to Mars rover robotic arms. Building and testing these systems is expensive, so engineers need methods to predict performance before creating physical prototypes. Current approaches rely on simple calculations and past experience, which fail to capture how components interact or behave dynamically. We developed a digital simulation tool to address this challenge.

Our team created a software interface that helps engineers simulate actuator performance and make early design decisions more confidently. We determined the necessary scope and accuracy for these simulations to meet JPL's needs. We created computer models of motors, mechanisms, and control electronics, then integrated them into a unified simulation program using MATLAB, Simulink, and System Composer.

To validate our software, we employed digital twin comparison. We built a physical mechanism and compared its real-world performance against our computer model's predictions. Our tool allows engineers to modify motor settings, mechanisms, or controllers within the software and instantly observe how these changes affect overall system performance. The program helps identify whole-system behavior and detect errors early in development.

This tool saves resources and accelerates spacecraft design by providing JPL engineers with comprehensive information about design choices before committing expensive resources to physical builds. It enables analysis of system interactions that were previously impractical to evaluate, ultimately supporting more informed engineering decisions during early design phases.

TEAM MEMBERS:

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Roland Rivera
Taylor Shepherd
Michael Wright

ADVISOR:

Shayne McConomy, Ph.D.

SPONSOR:

NASA - Jet Propulsion Laboratory

Team 519: Lunar Regolith Mitigation Unit



TEAM MEMBERS:

Bryan Carpio
Stephen Gutsell
Casey Katsouris
Maija Miller
Brady Parris
Nicolas Villabona

ADVISOR:

Brandon Krick, Ph.D.

SPONSOR:

NASA - Johnson Space Center

NASA asked our team to design a storage system that holds tools used by astronauts on the moon and prevents dust from contaminating the spacecraft's living areas. Lunar dust is sharp and electrically charged, posing risks to both equipment and astronaut health.

We designed and tested a containment system that stores dusty tools and prevents dust leakage during missions. We subjected the system to shaker table testing to simulate spacecraft ascent and descent vibration loads, and the results demonstrated that the system maintained its seal. We verified leak performance by placing tape around the lid seals to capture dust and examining the samples to quantify dust escape.

Due to budget constraints, our sponsor waived NASA's strict flammability and off-gassing requirements. We built the prototype with cost-effective materials but recommended approved materials for flight applications. We also adhered to volume constraints, ensured the system accommodated suited astronaut operation, and eliminated sharp edges.

Our final design uses polycarbonate, a strong and durable plastic, and incorporates a dual-lid configuration. The outer lid employs toggle clamps to apply uniform pressure around the seal, while the inner lid features a maze-like geometry that forces dust through an extended tortuous path. This dual-lid approach protects the O-ring on the outer lid, the system's most vulnerable component, from the extremely sharp lunar dust that can cut or abrade the soft O-ring material.

Our system successfully contains lunar dust and protects nearby spacecraft equipment and crew. By addressing dust contamination challenges during lunar missions, our design supports safer operations and advances the next phase of lunar exploration.

Team 520: Cryogenic Fluid Management



TEAM MEMBERS:

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Spencer Hawes
Emily Nino
Malinda Perera
Elena Rudnitzky

ADVISOR:

Wei Guo, Ph.D.

SPONSOR:

NASA - Marshall Space Flight Center

NASA's future deep-space missions, including journeys to Mars, require spacecraft to refuel using cryogenic propellants that must remain at extremely low temperatures. Cooling systems maintain these fuel temperatures, relying on heat exchangers to remove excess heat. Traditional heat exchangers are often heavy and bulky, problematic for space travel where weight minimization is critical. While NASA aims to increase recuperator performance, increasing their size is not ideal.

We designed a recuperator using an internal coral-like porous structure to address this challenge. In our design, a thin wall separates the channels for hot and cold fluids, allowing them to intertwine without mixing. The complex geometry provides increased surface area, enabling more heat transfer in the same volume. Research showed that a coral-like porous heat exchanger core with diamond-shaped channels offers the best heat transfer performance.

We intended the design for 3D-printing, as the porous structure is too complex for traditional manufacturing methods. We printed multiple scaled-down versions in plastic and nylon to verify the design geometry. We also printed a final metal version to test heat transfer performance and pressure retention capability.

Our results indicate that coral-like porous recuperators are theoretically more efficient than current designs. However, due to current cost and size limitations of metal 3D printing, further development is required before this technology can compare to NASA's other designs.

Team 521: Fluid Power Vehicle Chassis and Drivetrain



TEAM MEMBERS:

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Joseph Espinal
Ausband Harris
Ishmael Hilaire
Dylan Wood

ADVISOR:

Mohd Yousuf Ali, Ph.D.

SPONSOR:

National Fluid Power Association

We designed a hydraulic-powered tricycle that replaces a conventional chain drive with a hydraulic transmission. When the rider pedals, the motion drives a pump that pressurizes hydraulic fluid stored in an accumulator. This stored pressure acts as an energy reservoir; when a valve opens, pressurized fluid flows to a hydraulic motor that drives the wheels forward.

To improve system efficiency, we redesigned the hydraulic circuit to incorporate two accumulators for fluid routing and modified the gear system to smooth power output. These changes balanced fluid pressure across the circuit and increased the gear ratio. We also developed a complete 3D digital assembly of the vehicle to verify part fit and integration on the existing frame prior to fabrication.

With all components delivered, we assembled the vehicle and conducted an extensive testing phase to verify proper function across all subsystems, making additional adjustments where testing indicated they were necessary. These combined improvements produced a more reliable vehicle with stronger competition performance.

This project demonstrates the importance of design selection and subsystem integration in fluid power applications—a domain widely used in construction and manufacturing but with limited hands-on exposure in undergraduate engineering education due to safety concerns and high equipment costs.

Team 522: Fluid Power Vehicle Powertronics



TEAM MEMBERS:

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Christopher Johnson
Mateo Sanchez
Kyle Thompson
Richard Vincent

ADVISOR:

Camilo Ordonez, Ph.D.

SPONSOR:

National Fluid Power Association

We designed and improved an electronic control and braking system for a hydraulic-powered bicycle competing in the NFPA Fluid Power Vehicle Challenge. Our bicycle combines a chain drive with a fluid power system, using the chain drive to charge accumulators and power the direct drive while fluid power transfers pedaling force to a motor driving the rear wheels.

Our primary objective was to enhance the bicycle's responsiveness and provide the rider with faster, clearer feedback through an LCD display. We updated the control code from the previous year's design to reduce delays between rider input and system response and improved display refresh rates so riders could monitor system behavior in real time.

We installed wheel speed and cadence sensors to capture operational data, which we streamed to the LCD display and logged for post-run analysis. This data collection allowed us to identify system behavior patterns and isolate areas for further improvement. The sensor data also enabled our "SmartDrive" mode, in which the regenerative braking system engaged and disengaged automatically based on riding conditions, producing more consistent and controlled system behavior.

Together, these improvements make the bicycle easier to control, more responsive to rider input, and more straightforward to test and refine.

Team 523: Unmanned Vessel for STEM Engagement



TEAM MEMBERS:

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Abby Hall
Maxwell Johnson
Sam Long
Donnell Moses
Jessica Sapp

ADVISOR:

Carl Moore, Ph.D.

SPONSOR:

Naval Surface Warfare Center

We designed a low-cost underwater robotics kit for the Naval Surface Warfare Center in Panama City to support their STEM outreach programs for middle school students. While many existing design challenges focus on land-based robots, fewer introduce students to underwater design and our project aimed to fill that gap.

Our design centers on a modular underwater vessel students assemble, wire and code themselves. The inner module uses four-inch PVC pieces, a clear dome and 3D-printed components to form a waterproof, low-cost enclosure. Students access the electronics bay from one end, insert components and reseal the module as needed. Because the inner module attaches to any compatible frame, students never need to modify this core piece.



For the frame, we used one-inch PVC pipe to keep construction fast, affordable and easy to reconfigure. Frame designs can vary in complexity to match different skill levels and challenge student creativity. Students mount the inner module and motors to their chosen frame, add floats or weights to tune buoyancy and control the vessel remotely with a handheld controller while viewing live footage from an onboard camera.

The modular architecture allows students to customize the vessel to their ability, giving them hands-on experience with wiring, fabrication and programming in an underwater context. Our goal was to deliver a platform flexible enough to grow with students while inspiring confidence and enthusiasm for engineering.

Team 524: Lightweight Engineering for Robot Chassis



TEAM MEMBERS:

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Akeeme Jackson
Jorge Miranda
Tobias Ryckis
Dean Talaa
Lihao Wu

ADVISOR:

Christian Hubicki, Ph.D.

SPONSOR:

Optimal Robotics Lab

We redesigned the internal frame of WaLTER Sr., a robot supporting explosive ordnance disposal operations, to reduce weight while improving reliability, safety, and ease of repair. Excess weight limits mobility, increases stress on internal components, and traps heat, all of which raise the risk of failure during critical missions.

We improved component arrangement for batteries, computers, and wiring to prevent movement during operation while keeping systems accessible for inspection and replacement. Technicians can now service key components without removing large sections of the robot, reducing repair time and the risk of wiring damage or incorrect reassembly.

The new chassis incorporates open sections for improved heat dissipation during extended missions and integrated protective features to shield internals from water, dust, and debris. By removing unnecessary material, our final design reduces overall weight while maintaining structural strength—improving mobility, lowering mechanical stress, and allowing more efficient operation under demanding conditions.

The result is a lighter, cooler, and more maintainable chassis that helps WaLTER Sr. operate reliably in high-risk environments where dependable performance directly supports human safety and mission success.

Team 525: Manufacturing for STEM Engagement



TEAM MEMBERS:

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Brandon Mckibben
Andrea Quant

ADVISOR:

Camilo Ordonez, Ph.D.

SPONSOR:

Rockwell Automation

We addressed a gap in hands-on STEM education: while many activities emphasize creativity and problem-solving, few demonstrate how automation works in real manufacturing or why it matters at scale. Sponsored by Rockwell Automation, we designed and built an automated pin button-making system that produces a finished product from raw materials through each process step, including pressing parts together and packaging the finished button, all with minimal user intervention.

We integrated motion, sensors and controls into one complete system to move parts, detect position and monitor timing. A key design focus was visibility and accessibility—each step remained observable, the process could be paused to examine motion and timing, and users could directly compare manual versus automated operation to see how automation affects speed, consistency and error reduction. We also prioritized safety, durability and fast operation throughout the design.

The final device functions as a small production line, producing one complete pin button in under 30 seconds and repeating the same steps consistently each cycle. This repeatability gave users a concrete demonstration of how automated systems achieve uniform results in production settings. The system is designed for use in classrooms, outreach programs and public STEM demonstrations, providing educators with a hands-on tool to connect engineering concepts to real-world manufacturing outcomes and spark students' interest in engineering and technology.

Team 526: Underwater Stabilization



TEAM MEMBERS:

Chandler Gazaway
Katie Hoenstine
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Moeub Lanh
Nicholas Olin
Sofia Sadir

ADVISOR:

Taylor Higgins, Ph.D.

SPONSOR:

RTHM Lab

Divers performing underwater work struggle to maintain position in ocean currents, where even small disturbances increase fatigue, reduce precision and raise safety risks. Most existing diving equipment focuses on assisting movement rather than keeping divers stationary, leaving a gap in active stabilization solutions. We designed Mosca, a thruster-assisted wearable device, to actively combat drift caused by underwater currents in real time.

We drew inspiration from the housefly, which maintains stability through rapid, small corrections—the same principle we applied to our design. Mosca consists of a wing-like fixture that attaches to a diver's back and integrates with standard diving equipment without restricting movement. Thrusters distributed along the fixture generate corrective forces in response to sensor-detected motion changes, enabling the system to dynamically counteract currents.

We evaluated Mosca's performance through simulations and physical tests replicating real underwater conditions, examining how battery constraints and system response speed affected positional stability. Our results indicate that active system response improves diver control within operational limits of depths up to sixty feet and durations up to one and a half hours. By shifting underwater stability from a passive to an active control problem, we demonstrate that thruster-based stabilization measurably decreases drift during underwater tasks, addressing a gap left by conventional passive diving equipment.

Team 527: 2026 IEEE SoutheastCon Hardware Competition



TEAM MEMBERS:

Samuel Artecona
Nicholas Brown
Lucas Girala
Cricket Skipper
Rhonda Smith

ADVISORS:

Shayne McConomy, Ph.D. and
Bruce Harvey, Ph.D.

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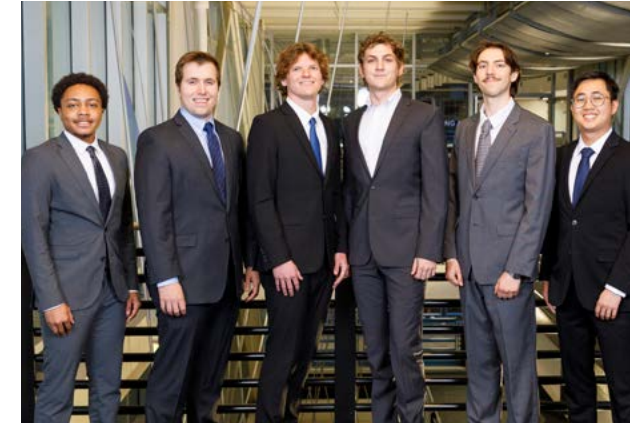
Department of Electrical and
Computer Engineering

We designed an autonomous ground robot and supporting drone to complete a series of physical tasks without human control for a student competition. Our system performed actions including pressing buttons, entering codes on a keypad, turning a crank, and removing or placing objects, all within a strict time limit. We prioritized reliable task execution and fast response throughout the design process.

We collaborated with a team of electrical and computer engineering students and organized ourselves into four subteams. The Chassis and Drive-train subteam designed the robot body, movement system and subteam integration. The Tasks subteam developed mechanisms for each physical task. The Navigation and Mapping subteam programmed autonomous movement, and the Drone subteam enabled color detection and wireless communication.

We adopted separate, purpose-built mechanisms for each task, emphasizing simple designs to reduce errors and improve reliability. For object removal, we built an extending arm to push the object. For object placement, we designed a holder that inverts to release the object. To turn the crank, we used a rotating bar. For both the keypad and button press tasks, we developed a rotating gear with an extending arm and sliding motors at each end to actuate the buttons. The drone identifies light colors and transmits that information wirelessly to the ground robot. This architecture ensures task accuracy, simplified control and maximized scoring potential during competition runs. *Note: This team won first place in the 2026 IEEE SoutheastCon Hardware Competition!*

Team 529: Haptic Hand Development



TEAM MEMBERS:

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Campbell Glass
Shane Rober
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Luke Vannini
Jin Zhu

ADVISOR:

Jonathan Clark, Ph.D.

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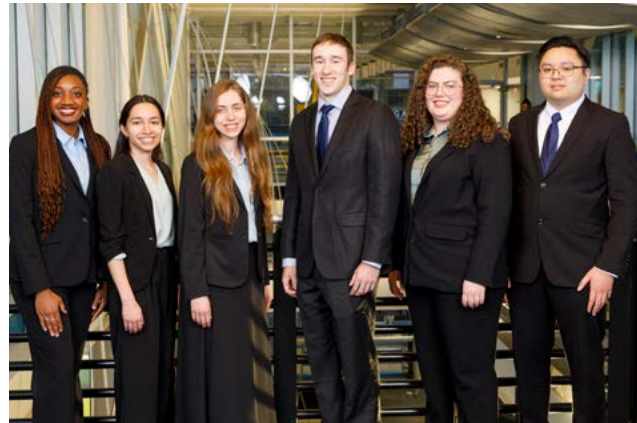
STRIDe Lab

We developed an affordable, open-source platform for teaching robotic hand manipulation to high school and college students. Many schools lack access to robotics education due to prohibitive equipment costs, so we designed a system built entirely from 3D-printed components and readily available parts to lower that barrier.

The system consists of two main components: a wearable glove and a robotic hand. The glove tracks the user's hand movements and translates them in real time to the robotic hand. Vibration motors at the fingertips provide haptic feedback when the robotic hand contacts a remote object, simulating touch. We 3D-printed a mold to shape a soft foam hand that approximates the feel of a human hand. A motor bank below the foam hand drives tendon-like strings that bend and move the fingers smoothly and naturally. We mounted the robotic arm to an overhead frame that enables movement in all directions, similar in mechanism to a claw machine, while an integrated wrist joint provides additional degrees of freedom for twisting and turning. Together, the frame and wrist allow the hand to move and orient freely in space, enabling realistic manipulation tasks and demonstrations.

This project contributes to the National Science Foundation's Engineering Research Center for Human Augmentation via Dexterity (HAND ERC), which advances dexterous robotics for operations commonly performed by humans. By delivering a hands-on, low-cost educational tool, we helped expand access to quality STEM resources in public schools and gave students a practical platform for exploring robotic dexterity.

Team 528: Buoyancy Control of Underwater Robot



TEAM MEMBERS:

Jordyn Bennett
Valeria Carrasco
Maria Florian
Travis Johnson
Hannah Klein
Vinh Vuong

ADVISOR:

Jonathan Clark, Ph.D.

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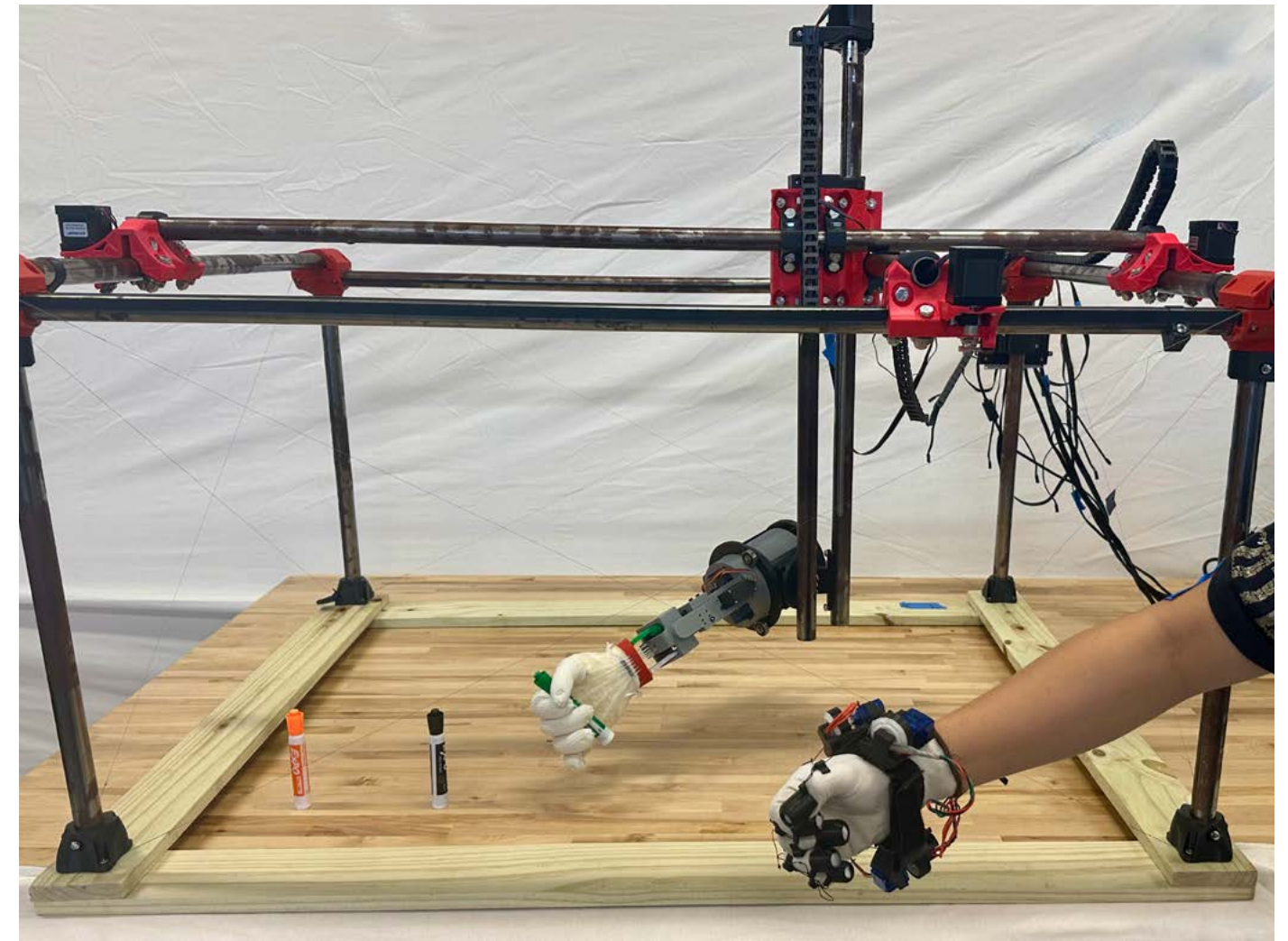
STRIDe Lab



We developed a buoyancy control device for an underwater robot designed at the STRIDe Lab. The robot walks on the sea floor, swims through open water and jumps to clear obstacles such as rocks or coral. Its current weight improves grip and balance while walking, but causes it to sink too quickly during swimming and jumping, limiting its ability to perform each locomotion mode effectively.

To address this, we designed a syringe-like device that moves water in and out of a sealed tube, thereby varying the volumes of air and water inside. When the piston expels water, the device retains more air, reducing the robot's effective weight in water. When the piston draws water in, the robot becomes negatively buoyant and sinks. Because the device attaches directly to the robot, we had to mount it near the robot's center of mass to preserve its original movement and balance, while also ensuring it could attach and detach easily for access to internal components.

We delivered a removable buoyancy control device rated for harsh underwater environments, including resistance to high pressure, temperature changes and corrosion from both fresh and saltwater during deep-ocean operation. The device enables the robot to switch between walking, swimming and jumping in a controlled and repeatable way, bringing it one step closer to fully autonomous ocean exploration.



Senior Design Teaching Faculty and Professors



Stephen Hugo Arce, Ph.D.
Biomedical Engineering



Ernesto L. Garcia, Ph.D.
Industrial & Manufacturing Engineering



Jerris Hooker, Ph.D.
Electrical & Computer Engineering



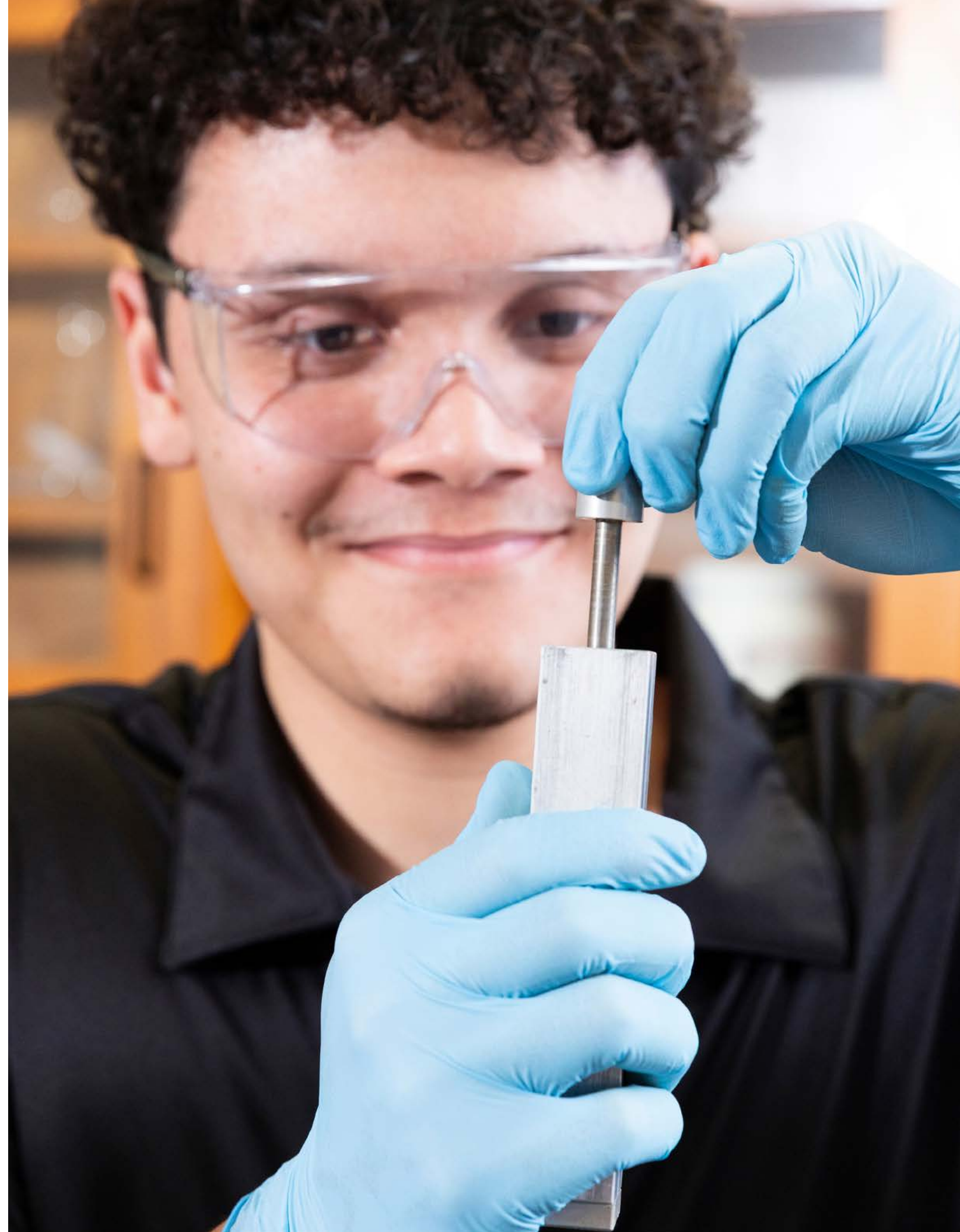
O. Sean Martin, Ph.D., P.E.
Civil & Environmental Engineering

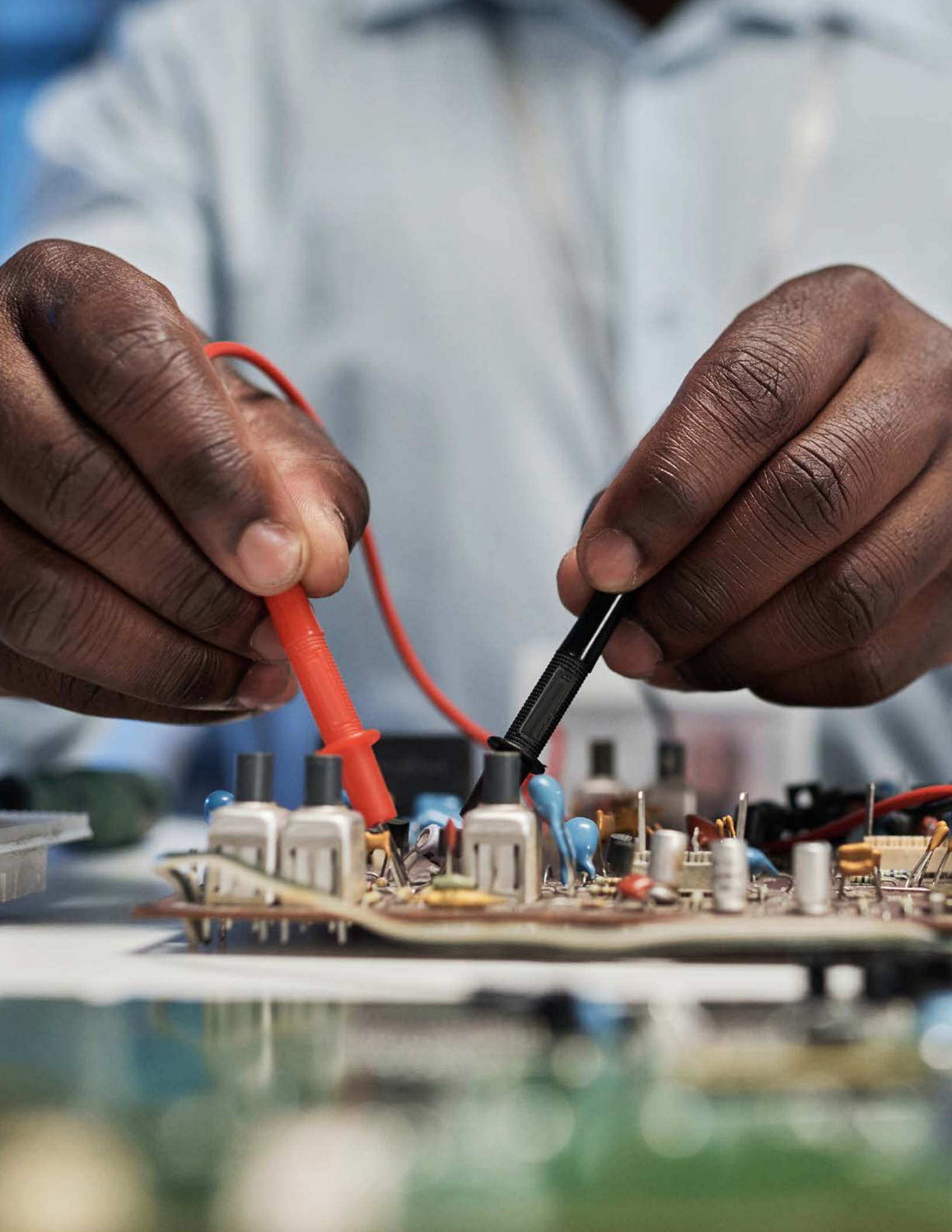


Shayne McConomy, Ph.D.
Mechanical & Aerospace Engineering



Robert J. Wandell, Ph.D.
Chemical Engineering





2026 Senior Design Sponsors

A big round of applause and thanks to our generous sponsors, who not only provide valuable monetary resources for these projects, but who also mentor and serve as important stakeholders for each of these projects. Our students learn many valuable skills from this process and these mentors, including teamwork, professional engineering principles, client and project management.

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