FAMU-FSU
College of Engineering

ENGINEERING Senior Design | 2024

Suvranu De, Sc.D.
Engineering Dean

Dean's Message

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 the civil engineering projects that juggle so many important factors like client budgets and the environment, 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 that 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' university in this book because we don't usually know (without asking) which student "belongs" to FAMU or FSU. Ours is unique college and these career-ready engineering graduates are well-positioned to infuse their new companies with enthusiasm, drive and the critical "soft" skills (that 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.

Table of Contents

Chemical and Biomedical Engineering

Civil and Environmental Engineering

Electrical and Computer Engineering

Industrial and Manufacturing Engineering

Mechanical Engineering

Chemical & Biomedical Engineering

Senior Design

The 2024 AIChE ChemE Car Competition Team 119 in the lab with their car, which is run and governed entirely by chemical reactions they designed.

Team 101: Recycling Single-Use Plastics into Usable 3-D Printing Filament

The prolific production of plastics—exceeding 8 billion metric tons worldwide as of 2022— has become an environmental problem. These materials are useful because they are cost effective and have diverse range of desirable properties. But these plastics end up in water and food supplies and natural ecosystems. In the US, less than 9% of plastic waste undergoes recycling. Polyolefins such as linear polyethylene (HDPE), form most of the world's plastic waste. Polyolefins are chemically inert, so chemical recycling and industrial composting is not an economic option.

Simultaneously, technological advancements in manufacturing are changing how industries produce consumer goods. Specifically, additive manufacturing and 3D printing techniques are now used to produce products, decrease material waste and maintain efficient operating processes. In the last decade, 3D printing has exploded in popularity across multiple industries to produce prototypes, spare parts and other product components.

The popularity of 3D printing, combined with the need to reduce the amount of plastic waste that enters landfills and natural ecosystems, made us curious about the intersection of these fields. To combine these two trends into a single sustainable idea, we investigated recycling singleuse plastics into usable 3D printing filament. Our experimental process included collecting, sorting and processing recycled materials from waste management partners and extruding these materials into filament. We 3D printed the filament into various shapes, objects and test samples to evaluate its mechanical characteristics and compare the properties of different filament types.

Recycling single-use plastics into filament promotes cyclical recyclability and reduces the environmental impacts of single-use plastics. Additionally, utilizing recycled materials in additive manufacturing and 3D printing production are desirable technologies for industrial sustainability and governmental recyclability initiatives.

Team Members
Lauren Bishop
Nickolas Boyd
Shelby Evans
Clay Kramer
Jeremy Newman
Emma Pollard
Ethan Wood

Advisor
Robert Wandell, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 102: Battery Management and Cooling

As electrical demands continue to increase, so do demands for cooling, particularly when applied to portable power and power storage systems. Lithium-ion, the preferred energy storage system, requires tight temperature control to operate efficiently and safely. We researched the applications of thermoelectric cooling compared to traditional cooling systems such as liquid and blower cooling systems.

We looked at the feasibility of this technology in an already saturated market of cooling systems to prove that employing thermoelectric coolers (TECs) not only meets specified cooling requirements but also provides clear benefits when compared to traditional cooling systems.

We subdivided the team into simulation, build and control teams that worked in concert to test this theory through simulations and an experimental prototype cooler setup. We discovered the heat flux generated by a TEC exceeded the necessary capability to cool the experimental battery housing. The control system found to be most efficient and effective when controlling battery heat is a hysteresis system using an Arduino microcontroller.

One of the biggest advantages that a TEC cooling system has over traditional cooling systems is its nature as a scalable heat pump. Instead of acting as a passive thermal bridge, it acts as an active one that allows for more precise temperature control. This precision can increase the lifespan of lithium-ion batteries and other expensive, heat-sensitive components such as high-power CPUs and crypto-mining processors.

Another clear advantage for the TEC cooling system is its size—it does not require extensive systems of heat pipes and fluid basins, allowing it to be more applicable to technologies where space is limited near the component that demands cooling (i.e., compact EV battery system cooling).

Because TECs have no moving parts, they require no expensive maintenance, meaning lower operating costs when compared to more traditional cooling systems seen in the market.

Team Members
(Front row)
David Chiang
Wilson Cornelius
Bryce Denick

(Back row)
Miguel Fletes
Dominic Garrett
Jason King
Antonio Ledesma
Munro Manning

Advisor
Robert Wandell, Ph. D.

Sponsor
FAMU-FSU College of Engineering

Team 103: Modular Distributed Ammonia Synthesis

Currently, nearly 50% of all food production is enhanced with fertilizer made by the Haber-Bosch (HB) process. Invented in 1914, this process utilizes purification techniques to refine hydrogen from fossil fuels, then combines it at high pressures and temperatures with nitrogen gas at massive scales. At the time, many scientists believed that alternative methods would inevitably replace the resource-intensive fossil fuel basis. More than 100 years and hundreds of major scientific advancements later, that is finally becoming reality.

Consisting of around 82% nitrogen, anhydrous ammonia is a popular form of fertilizer among farmers across the country due to its nitrogen content and its widespread infrastructure. However, its popularity has waned over the last 30 years due to its high transportation costs and risks. We aimed to produce locally-sourced, environmentally-friendly ammonia at a market-dominating price.

We designed a system of modular, small-scale ammonia plants spread across the "corn belt." Our process provides a desirable form of fertilizer with less risk, that significantly shrinks the carbon footprint of traditional production methods. As investment in green energy continues to grow, our product will only become cheaper, which is the singular concern of most farmers.

Our primary alteration to the traditional HB process is our choice of hydrogen generation. Since a major portion of HB production costs come from purifying natural gas, turning it into hydrogen, and then purifying that hydrogen, we used Proton-Exchange Membrane (PEM) electrolysis, which directly turns water (H_2O) into high-purity hydrogen (H_2) at scales perfect for our modular design. In combination with Cryogenic Nitrogen Distillation, modern advanced catalytic materials, and low-temperature flash separation, we can produce 50 metric tons per day of highly pure (<99.5%) anhydrous ammonia. Strategically employing "off-the-shelf" process equipment allows our design to be quickly deployed directly to where it's needed most, providing a clear path toward a future where our food supply is independent, secure and environmentally conscious.

Team Members
Kenneth Bains
Jacob Beaver
Ramon Veloso
Jayce Wheelhouse

Advisor
Robert Wandell, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 104: Modular Distributed Gas-to-Liquid Methane Conversion

The US Energy Information Administration estimates that up to 30% of natural gas (NG) reserves are flared into the atmosphere, producing an average 111,000 metric tons of CO_2 per year. NG is primarily composed of methane and is flared to create CO_2, which is a less potent greenhouse gas. NG is often flared when it is stranded in an isolated location, making recovery economically unviable. To combat the under-utilization of NG as an energy resource, we designed a modular process to harvest and convert it into useful, liquid fuel products.

Modular processes combine various unit operations into singular "modules," which can be prefabricated before deployment on-site. We designed three module sizes to receive 500, 2500, or 5000 MSCF/day of NG directly from a remote wellhead and produce fuel intermediates. The modules take advantage of "numbering up," which uses multiple smaller modules to create the throughput of one larger unit. This also allows for flexible redistribution of smaller units as wellhead production declines over time.

Our modules include a syngas unit which converts NG into syngas, a mixture of H_2 and CO. The syngas is then fed to a Fischer-Tropsch (FT) reactor which catalytically links carbon units into liquid hydrocarbon chains. We chose a microchannel FT reactor over a conventional packed bed reactor for its improved energy efficiency and higher syngas conversion. The liquid fuels are then separated into usable product ranges, which are then transported offsite to a processing plant for blending and distribution.

Our safety analysis revealed that based on OSHA component classifications, many of the chemicals in this process are hazardous, with flammability as the main concern. We considered safety implementations for operating conditions, transportation and storage hazards. We conducted the safety analysis in conjunction with process design to ensure ethical design choices and adherence to inherently safer design (ISD) concepts.

Our financial assessment included analyses of individual modules, initial deployment and redeployment, and other associated costs. Net present value (NPV) is a metric that shows how the value of an investment will change over time. Our secondary goal was to maximize net present value (NPV) with respect to the deployment and redeployment of our modules. We used CAPCOST to evaluate the overall profitability, which modelled NPV with respect to capital and operating costs.

Team Members
Brooklyn Ford
Josiah Lopez-Poindexter
Michael Merino
David Quirie
Alexis Tallon-Rendon

Advisor
Robert Wandell, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 105: Laminar Flow Nozzle

Flow characterization has many useful applications in chemical and biomedical engineering industries. Laminar flow in water produces a glass-like presentation that is visually pleasing. We wanted to produce a consumer-grade level laminar flow nozzle device that retains this aesthetic quality, but is comparable to other existing products which cost between $600 and $2000.

To start, we developed a test model to analyze key design choices for the nozzle geometry while also maintaining laminar flow. We used the dimensionless Reynolds Number (Re) to characterize between laminar and turbulent flow, which is dependent on diameter. For laminar flow, the Re must be under 2300 and it decreases when diameter is also decreased. We developed a mathematical model utilizing Re to choose optimal nozzle geometry. To validate our model, we used COMSOL to ensure the flow was fully developed and laminar. To minimize Re, we used the smallest cylinder commercially available: a 3mm-diameter coffee straw.

For our prototype, we used common materials and drew inspiration from successful DIY experiments. The main body of the device is made from PVC and holds the straws in place. We used a hose adapter to attach the device to a garden hose. Before entering the straws, water passes through sponge and mesh which regulate the entering pressure created by the garden hose. Combining knowledge from DIY experiments and modeling, we reached our goal of designing a laminar flow nozzle that is affordable and aesthetically pleasing.

Team Members
Stefano Cardenas
Annie Freeman
Leilanis Gonzalez
Camilo Ramirez
Valeria Santos Gonzalez

Advisor
Robert Wandell, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 106: Small Scale Water Treatment

We aimed to create on-demand, portable water treatment plant housed within a 1ft³ cube with a budget of $1,500. The spirit of our project stemmed from the 2022 American Institute of Chemical Engineers (AIChE) ChemE Cube competition. The primary objective was to purify 25 liters of water per day adhering to EPA and international drinking water quality standards. As a humanitarian effort, our goal was to streamline water purification processes so that water-insecure regions can purify worst-case scenario water with minimal equipment and energy costs.

One of surface water's challenges is the variety of contaminants present: dirt, clay, parasitic zygotes, viruses, bacteria and other organic matter. Individual contaminants can be resistant to certain techniques, requiring multiple purification strategies to remove or deactivate contaminants to reach drinking level quality.

Our cube features three different subunits: disinfectant, macro filtration and micro filtration. Each subunit targets specific contaminants present in surface water and is modular to allow for easy equipment replacement. We used an additional backwashing method to expand the lifespan of each unit.

Team Members
Kyle Casiple
Kevin Fay
Jesco Helling
Jared Marquez
Michelle Tyrrell
Alicia Wilson

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

Sponsor
FAMU-FSU College of Engineering

Team 107: Chocolate Rheology and 3D printing

Chocolate is the most popular candy produced in the world. Traditionally, it is presented as bars or nuggets, or molded and sculpted with a great deal of manpower and time. However, with an accessible 3D printer, people could create a custom chocolate figure at a much lower price. Our objective was to design and optimize a procedure to adapt an inexpensive 3D printer to "print" chocolate structures and establish a standard procedure to do so.

Chocolate is a delicate science, and its various crystalline structures can be lost past a certain temperature. The substance is a polymorphic, non-Newtonian fluid, making it an excellent 3D printing filament. We used a Creality Ender 3 printer with a Wiibox LuckyBot Food Extruder to combat clogging.
We used dark chocolate because it has fewer ingredients and higher cacao content, increasing its viscosity and making it better for printing. As a final product, we decided an acceptable print would be judged qualitatively and quantitatively for structural integrity and clean layers. To prepare chocolate to print and characterize, it must be melted—but kept below a temperature threshold, otherwise it will permanently lose its crystalline structure. We used an immersion heater to establish a standard tempering procedure and temperature. We then transferred the chocolate to either the printer for trials or the rheometer for characterization. To optimize our printing procedure, we characterized the chocolate with rheological studies, adjusting variables and optimizing our printing and tempering processes. We also used a cold plate to cool the chocolate after printing.

Our findings contribute to research on 3D printing alternative materials, specifically food. Chocolate companies are already funding research on 3D printing their products, but for just a few hundred dollars, we are doing the same.

Team Members
Cayman Alford
Nina Chong
Samer Hamdar
Payton Martin
William Spiers

Advisor
Robert Wandell, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 108: Microbial Cell Factories

Human serum albumin (HSA) a cellular protein profoundly important in maintaining health and combating disease. It is derived from large pools of human plasma, so access to the protein is heavily dependent on available and acceptable donations. The medical community's annual albumin request is about 500 metric tons worldwide, and the current source supply cannot meet such high demand. Additionally, such sources of albumin present potential dangers due to difficulty with ensuring donor traceability, in terms of an individual's viral status. With the large shortage and overwhelming need in mind, we wanted to bridge the gap in knowledge of producing albumin without direct human involvement.

We produced a form of recombinant human serum albumin (rHSA) that is indistinguishable from human-sourced albumin, made via the most optimized industrial biopharmaceutical process. We divided the project into two sections: pharmaceutical applications and industrial operations. In the first section, the team grew rHSA by injecting the albumin gene into Escherichia coli (E. coli) cells, and then studying the rate of growth in a controlled environment. Once the albumin proteins were extracted from the E. coli cells, we compared them with human-derived HSA with a western blot to detect and analyze varying proteins within the cell proved to be very effective.

For industrial operations, we modeled the process and efficiency of growing rHSA in a continuous flow, semi-batch and batch reactor. For further evaluation, we chose the reactor with the largest production rate of albumin.

We performed optimization by refining the growth model to reflect naturally occurring biological conditions from experimentally derived parameters found during pharmaceutical application efforts. We established a scale-up design of the optimized process to emulate a large-scale pharmaceutical company. Additionally, we did a financial analysis to show the feasibility of the system.

Team Members
Amber Dotson
Emmanuel Scott
Kemah Tah
Victoria Heerah

Advisors
Stephen Arce, Ph.D.
Robert Wandell, Ph.D.
Cesar Rodriguez, M.D.

Sponsor
FAMU-FSU College of Engineering

Team 109: Bioreactor Team

Healthcare providers around the world experience inconsistent plasma supply used for trauma victims and surgery. The limitation of the existing plasma supply system is that it is entirely reliant on donors, who don't consistently donate plasma, resulting in large fluctuations with long periods of low plasma stocks. This project aims to help mitigate the issue of the inconsistent plasma supply the healthcare system experiences by utilizing bioreactors and modified E. coli to create recombinant human serum albumin.

Team Members
Kira Brigman
Freydell Espinoza
Ryan Measal
Sofia Sheffler
Ryan Walker

Advisors
Robert Wandell, Ph.D.
Stephen Arce, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 110: VySpine

Our goal was to assess and suggest improvements for cervical implant technology. We aimed to develop a surface treatment to improve VySpine's PEKK-based spinal implants' osseointegration and osteoinduction to reduce patient recovery time, improve implant bone encapsulation, reduce recurrence of degenerative disc disease (DDD) and vertebral fracture symptoms.

PEKK is considered bio-inert, which is not ideal for the application this project works to solve. The current standard of care can be improved with the development of a surface treatment that works to improve PEKK-based spinal implants' osseointegration and osteoinduction properties, as it will allow faster and more reliable fusion of the cervical system with surrounding/adjacent vertebrae, minimize the risk of non-union between the implant and surrounding bone, enhance the long-term stability of the implant, enhance biocompatibility and reduce patient recovery time.

Team Members
Claudia Villalobos
Nico Sanchez
Katherine Martinez
Emily West
Chloe Patterson

Advisor
Stephen Arce, Ph.D.

Sponsor
VySpine, Dr. Brett Barry

Team 111: Resorbable Surgical Drain

In collaboration with Mayo Clinic, we developed an absorbable surgical foam and drain to address challenges in postoperative wound care. Current practices with surgical drains, though effective in many cases, have limitations that hinder their ability to comprehensively manage complications, particularly in large surgical wounds. The occurrence of seromas, a common postoperative complication, underscores the demand for innovative solutions to enhance the efficiency of wound healing processes. Our primary objective was to contribute to the creation of a solution that not only reduces complications like seroma growth, but also expedites the overall postoperative recovery process. The product aims to implement Negative Pressure Wound Therapy mechanisms to meet the requirements of outpatient recovery, eliminating barriers posed by fluid removal and tissue integration to expedite the recovery timeline.

Team Members
Sutton Scheuerle (ME)
Abby Scott (BME)
Astrid Daugherty (BME)
Savannah Braswell (BME)
Taylor Delaney (ME)

Advisor
Stephen Arce, Ph.D.

Sponsor
Dr. TerKonda, Mayo Clinic, Jacksonville

Team 112: Stemless Reverse Implant Analysis

Our goal was to create a safe and long-lasting total stemless reverse shoulder arthroplasty implant that can be approved by the FDA for consumer use. This type of arthroplasty would allow for a large range of motion compared to current models. However, the humeral component is more easily dislodged from the bone. We created a testing rig to apply force at various angles to mimic stresses from moving the arm.

To compare models, we used the maximum force at failure using a fixed sensor and the number of iterations at 20% of the max force. Our models were decided through modifications on the Exactech Equinox® model to increase contact area, allow for easier insertion and resist rocking motion. The models created were thinning the fins to a sharp edge at the bottom of the component and orienting the fins into a 'T' shape so that all fins are 90° to each other at the center. Stress vs. strain graphs may also be utilized for further comparison.

Results for testing the fins used for a reverse stemless arthroplasty procedure have yet to be obtained. The aim is to utilize these results to successfully display the implantation's capabilities. Results are helpful in showing how well the humeral component of the stemless reverse design remains stable in the bone. The number of iterations before failure is indicative of the lifespan of the implant component before dislodgement. The results also show the comparative success of the three different designs to each other for bone-component stability.

Team Members
Angelina Lahn (BME)
William Wartman (ME)
Santiago Lazarte (BME)
John Sorensen (BME)
Taylor Vanderlinden (BME)
Kiersten Cady (ME)

Advisor
Stephen Arce, Ph.D.

Sponsor
Dr. Tom Vanasse, Exactech, Inc.

Team 113: Biosense Webster

We created a device for Biosense Webster to establish a normalized relationship between the proximal and distal ends of cardiac catheters, in order to control the quality. Our primary focus was to improve Biosense Webster's current testing arena for catheters and create controlled testing conditions replicating the human body, with limited storage space. Key user design needs included uniform dial movement, repeatability, recording catheter tip movement and data storage. Design inputs translate these needs into specific requirements, emphasizing precise dial movement and accurate data collection. The current design comprises two main modules, a communication interface and a testing arena replicating internal body conditions.

The proximal-end uses a step motor and Arduino, while the distal-end features an acrylic box with cameras. The testing arena incorporates biomaterials mimicking blood flow and stabilizes components on a board for easy storage. We conducted experiments, generated concepts and selected a modular wooden frame with an acrylic box for the distal end. Stepper motors controlled by Arduino ensure reliable experimentation. Future teams working on this project could build a prototype, address potential issues related to compactness, image processing and mold creation, and explore alternative measuring methods.

Team Members
Vivian Bernard (BME)
Lauren Kazzab (BME)
Diana Shaughnessy (ME)
Katelyn Kennedy (BME)
Zachary Leachman (BME)
Sam McMillan (ECE)
Hunter Walsh (ECE)
Sarah Churchwell (ME)

Advisor
Stephen Arce, Ph.D.

Sponsor
Charles Lindholm, Biosense Webster

Team 114: Cervicare

Modern cervical cancer screening has many problems, specifically the lack of accessibility to women's healthcare, current healthcare disparities, patient pain and discomfort, accuracy of testing, and the lack of education and increased stigma surrounding women's reproductive care. We aimed to increase patient satisfaction, create more engagement in clear communication between the healthcare professional and the patient, and have higher rates of women in lower socioeconomic areas engaging in consistent screening.

To accomplish these goals, we created the CerviTech Endoscope, which contains attachments built in for comfort while still being effective and efficient. The CerviTech Endoscope breaks down into four main components: the endoscope, the swabbing tool, the spring lock and the shaft. The shaft, a major component of the device, was created from an autoclavable biomedical resin, aimed to be multiuse and small in diameter to decrease the invasiveness and discomfort of the procedure. The swabbing tool is the collection device for the culture sample and is inserted into the shaft once in place in the vaginal canal. The spring lock is attached to the end of the canal after the swab is inserted and ensures necessary pressure onto the cervix to collect the sample—nothing more and nothing less. The spring lock can also be adjusted based on the condition of the cervix.

If successful, the lower manufacturing cost of the device will allow for a decrease in the cost of examination and an increase in procedure affordability and accessibility for people with cervixes across the nation.

Team Members
Kiram Harrison
Annie Lazo
Ethan Lewandowski
Fernando Carrillo

Advisor
Stephen Arce, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 115: Toothtunez

Dental anxiety affects a large portion of the population, leading to dental care avoidance, resulting in compromised oral health. We addressed this concern by developing a motorized bite block aimed at alleviating anxiety induced by dental drilling noises. Utilizing bone conduction technology, the device emits vibrational frequencies through the jaw bones, reducing patient anxiety and enhancing the overall dental experience.

The project is significant in improving patient attendance, making procedures safer and reducing treatment costs.

The primary stakeholders of this device are patients seeking enhanced dental care, healthcare providers and manufacturers. The innovation's potential impact on patient satisfaction and the dental equipment market, valued at $6.28 billion, shows the economic significance. Relevant standards guided our design process, ensuring compliance and reliability. We developed prototypes and carried out extensive testing including: load bearing, assembly reliability, vibration characterization and sterility tests. Intellectual property considerations helped drive the design approach as we emphasize modular assembly to avoid any infringement.

Team Members
Matthew Jutkofsky
Emely Rojas Martinez
Nicolena Weaver
Jake Zelahy

Advisor
Stephen Arce, Ph.D.

Sponsor
Jordan Rigsby, DMD

Team 117: Hanger Clinic

Patients with below-the-knee amputations who use prosthetic legs often have issues with the fit of the prosthetic leg due to the changing volume of the residual limb throughout the day. To date, there is no compact, affordable device available to the general amputee community that easily and accurately measures volume change throughout the day, alerting the patient that changes need to be made with the amount of prosthetic socks worn, or alerting a device inside the prosthetic to automatically adjust for them. Such devices are in development, such as self-adjusting prosthetics and heat sensors. However, these products widely available, entirely accurate or affordable for the general amputee community. We created a device to measure volume control using a pressure sensor that changes the resistance in a circuit, displaying an output change in voltage. The resistance change can be directly related to a change in volume, and can be calculated through transform functions relating resistance and voltage. We hope to then connect this device to either an inflatable bladder or a user interface where a signal is sent from the device indicating the allotted threshold has been overreached. If we are successful, the amputee community will have a new device to help them use their prosthetic without suffering from injury or frustration.

Team Members
Michael Malakasis (BME)
Hannah Minium (BME)
Samuel Pagan (BME)
Isabel Santamaria (BME)
Hamza Khan (ECE)
Andrew Boren (ECE)

Advisor
Stephen Arce, Ph.D.

Sponsor
Matthew Dunford,
Hanger Clinic, Tallahassee

Team 118: BOGO Diffibrulator

While the prevalence of shock refractory ventricular fibrillation is low, survival remains incredibly rare. Different defibrillation methods have been proposed to improve outcomes, but the double sequential external defibrillation (DSED) technique is the most promising. We aimed to produce a device, that can deliver the same functions as a manual defibrillator and employ the DSED technique without the need for an extra defibrillator.

The DSED technique describes sending energy via electrical current through the heart forward and backward twice with each sequential shock at slightly different directions (vectors). Our design contains the same basic circuitry as a manual defibrillator but employs more semiconductors and capacitors to control shock directions (vectors) and timing (time between shocks). We developed two final prototypes.

Prototype 8 has two additional capacitors for the rapid release of energy for the subsequent vector, and prototype 9 reuses the original capacitors to shock the following vector but creates a delay for recharge. Prototype 8 will likely be most effective in the field; with supplementary components, the design holds multiple defibrillator capacities in one system. The capacitors are charged and discharged with select semiconductor switches; the design's energy output is measured by the energy held in the capacitors, 200-J maximum, and the current through four outputs (resistors to mimic human resistance) is measured to verify capacitor discharge. The design must be scaled down to work safely in the lab, so capacitors are charged to approximately one joule while the control semiconductors remain the same. The primary verification measurement is the voltage over specific outputs at different times—the control of capacitors discharging through specific outputs at select times.

Team Members
Chinedum Aniemeka (BME)
Marie Chmara (BME)
Kazi Henry (BME)
Eva Karjono (BME)
Gage Bednarz (ECE)
Alysha Vidal (ECE)

Advisory
Stephen Arce, Ph.D.

Sponsor
Nick Gregory, Ph.D.

Team 119: AIChE ChemE Car Competition

In 1999, The American Institute of Chemical Engineers (AIChE) introduced efforts towards producing alternative chemical energy sources by starting an annual student chemical engineering competition, the AIChE Chem-E-Car Competition. This competition revolves around building a small-scale (shoebox size) car that is powered by energy produced by a chemical reaction. A chemical reaction must also be used to stop the vehicle. Students compete with teams from other universities in guiding their car as close as possible to a certain target distance. The distance the car must travel, which is usually between 15-30 meters, is not revealed until the day of the competition. The operation of the car is controlled by varying the concentrations and quantities of the reactants. The designed car must be capable of driving the target distance in less than two minutes.

To achieve this goal, we utilized 16 thermal electric generators (TEGs), which generate current and voltage when exposed to a temperature differential. This temperature differential is created by placing a hot reactor on one side of the TEGs, and a cold reactor on the opposite side. The hot reactor consists of an exothermic (heat generating) acid-base reaction of sodium hydroxide and hydrochloric acid contained in a copper chamber. This hot reaction reaches 50-55ºC. The cold reactor is filled with a mixture of ethylene glycol and water; when frozen, the cold reactors reach an approximate temperature of -30ºC. The TEGs are "sandwiched" between the hot and cold reactors and wired in two sets of series in parallel to produce enough current and voltage to power the car's motor.

For the stopping mechanism, we used an "iodine clock" reaction. The reaction has two steps: the first step produces iodine molecules, and the second step consumes them. When the rate of production of iodine exceeds the rate of consumption of iodine, a color change occurs due to the excess iodine molecules in the solution. The time before the color change can be altered by varying the quantity of thiosulfate, a key reactant in the consumption of iodine. The color change was detected by a photosensor that relayed information to an onboard Arduino controller, which triggered the car to stop after the solution turned dark. We generated a model to correlate the required amount of thiosulfate to the time required to reach the specified distance based on the velocity of the car.

The 2024 FAMU-FSU College of Engineering Chem-E-Car team's car was called the 'TEG-C' for 'Totally Epic Go-Cart.' We traveled to Auburn University in Auburn, Alabama to compete in the annual Southern AIChE Regional Annual Conference. We were proud to take home first place in the Chem-E-Car Poster Presentation session.

Team Members
(Front Row)
Lauren Bishop
Stefano Cardenas
David Chiang
Nina Chong
Annie Freeman

(Back Row)
Josiah Lopez-Poindexter
Jeremy Newman
Emma Pollard
Valeria Santos Gonzalez
Emmanuel Scott
Alexis Tallon-Rendon
Kira Brigman
(not pictured)

Advisor
Robert Wandell, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 120: Rock ‘n Rest

Our objective was to create a rocking motion device for a rocking chair, automating its movement. We developed the device to help people with autism, including kids, who need a constant motion to relax and fall asleep without supervision.

Team Members
Jose Maggiorani
Josh Bachinsky
Geovani Castaneda
Rothiel Davis
Huyen Bui

Advisor
Stephen Arce, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Civil & Environmental Engineering

Senior Design

Team 224 redesigned an intersection as part of the FAMU Way Phase IV project, which is near this mural at Anita Favors Plaza at Lake Anita, Tallahassee.

Team 201: Green Acres at Pedrick Residential Subdivision

Finding a low-cost and safe single-family home in Tallahassee, can be challenging. Our senior design project, Green Acres at Pedrick, focuses on solving this issue by designing a subdivision near the intersection of Mahan Drive and Pedrick Road.

We produced a plan to maximize space and provide modest homes in a safe and lovely area. We created a road, houses, sidewalks and much more. The new stormwater inlets, ponds, swales and pipes in our design reduce flooding during rain events. Streets and sidewalks provide easy access to area and ensure pedestrian safety. New trees replace those impacted during construction to add the feeling of being in nature.

We also included utilities (water and sewer lines) and fire safety to provide each house with clean water and efficient facilities. These combined aspects make Green Acres at Pedrick an excellent place to live, allowing families to own a home of their own and the chance to develop a community — turning Green Acres at Pedrick into more than just a housing area.

Team Members
Paul Abiri
Marc Maschio
Austin Pierce
Dominic Trunkett

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Magnolia Engineering
Scott Kell, PE

Team 202: Capitola Corners, Tractor Supply Co.

Our project developed an empty cattle grazing lot outside of Tallahassee for a new Tractor Supply Store. We delivered all plans and an environmental analysis report for this project.

The site consists of a Tractor Supply Store with a parking lot, access road and loading bay. The new site required design of two stormwater ponds, one to service the main parking lot and another for back lot where the loading dock will be. To ensure that all water on the site will drain into these two ponds, we designed a network of pipes. To make sure that the natural environment of the site is not destroyed, we handled all natural features with care. Our aim for this project was for the local community to have a store nearby to meet its unique needs.

Team Members
Shelby Albers
John Awad
Spencer Nick
Alex O'Brien
Chris Stephens

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Barkley Consulting Engineers, Inc.
Doug R. Barkley, MS, PE, SI

Team 203: SR 10 (US 90) Improvements Monticello

The City of Monticello has seen recent improvements to its downtown area, resulting in an increase in pedestrian and vehicle presence. The current infrastructure cannot service this increase in volume. We designed an improved infrastructure that will provide service to all roadway users and pedestrians.

Our design improvements include roadway, drainage, and signing and pavement marking. Our roadway design includes milling, resurfacing and widening. We redesigned existing features for the widening and lane reconfiguration. Our design also includes bulbouts as an improvement to pedestrian facilities. These bulbouts serve as added safety measure to protect pedestrians while crossing intersections. With the improvements to the infrastructure, the City of Monticello will be able to safely handle the increase in vehicle and pedestrian presence.

Team Members
Stephen Wright
Joseph Legacy
Beau Alday

Advisor
Sean Martin, Ph.D., P.E., FRSE

Sponsor
WGI
Jarret Hansen, P.E.
Travis Richards

Team 204: May Street Drainage Project

May Street in St. Augustine, Florida, faces recurring flooding issues due to its outdated drainage system and deteriorating road conditions. To address these challenges, we provided a drainage redesign project to revamp the existing infrastructure. Our project scope encompasses the stretch of May St. from San Marco Ave. to Hospital Creek, a key two-lane urban roadway within the city.

The current drainage system is ill-equipped to manage heavy rainfall, leading to regular flooding on May St. To rectify this, we adopted a solution based on the guidelines outlined in the FDOT Drainage Manual. Our improvements include installing new drainage pipes along May St., with extensions to Magnolia Ave and Nelmar Ave. Additionally, strategically placed inlets at 100-foot intervals will help capture excess rainwater and prevent road flooding.

Simultaneously, the project includes a comprehensive plan for road enhancement. The existing road surface will be milled, and a new layer will be added to meet the city's road standards in addition to installing new drainage system of curbs, gutters, inlets and pipes. Our objective was to create a safer, more reliable road infrastructure for the community and travelers alike.

This project holds great promise for the May St. area, as it addresses long-standing flooding issues and improves the overall road conditions. By implementing these upgrades, we aim to enhance the quality of life and safety for residents and commuters in St. Augustine, ensuring that the area is prepared to manage adverse weather conditions and to provide a smoother and safer travel experience for all road users.

Team Members
Lindsey Ramin
Angeles Urtubey
Jacob Grigsby
Emily Espinoza

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Jacobs
John Glenn, PE
Zachary Sespico, EI

Team 205: S.R. 97 Bridge Replacement at Little Pine Barren Creek

The bridge at Little Pine Barren Creek, in the northern part of Escambia County, Florida, was built in 1941. It is a 5-span 75-foot bridge. According to the National Bridge Index, the bridge is classified as structurally deficient by receiving a rating of "4" for its substructure and has a sufficiency rating of 32.6. The existing bridge carries two 12-foot lanes with no shoulders and raised curbs that support non-crash-tested posts and rail-type barriers. Little Pine Barren Creek Bridge serves as a hurricane evacuation route by occupants in the surrounding gulf regions, which means the route must always remain accessible.

We redesigned the bridge in a cost-effective manner and minimizing impacts to the surrounding environment and community, while replacing the structurally deficient bridge to maintain travel access. To meet all the design goals, decided on a cast-place flat slab bridge design that will increase the length of the bridge to 90 ft. The flat slab design will reduce the number of substructure units in the crossing; thus, improving its hydraulic characteristics at the opening and lower cost of construction. The width of the bridge is extended to 47 ft, including two 12-foot travel lanes along with 10-foot shoulders and F-shaped traffic railings.

Constructing the new bridge safely and in a cost-effective manner ensures that the hurricane evacuation route stays open.

Team Members
Marquez Davis
Nasir Feaster
Darlie Ibrahim
Steven Numa

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
HNTB,
David Crombie, PE
Tasha Acosta, EI

Team 206: Jackson Hospital Urgent Care/Wound Care Center

The Jackson Hospital Urgent and Wound Care Center is a proposed urgent care facility in Marianna, FL at a highway intersection. Urgent care facilities treat non-life-threatening illnesses and injuries. Marianna lacks access to this type of medical care. A new urgent care center will provide residents with better access to affordable, convenient healthcare To improve access to affordable healthcare, we considered existing site conditions. The existing site was a gas station. Based on architectural plans, we completed the structural design of a 115 x 80-ft. single story building. Our scope includes structural and geotechnical facility design. We also recommend site and parking layout based on code standards. We found the best design to be a steel framed building with isolated footings.

Our ultimate design goal was to design the building and foundation to withstand applied loads. We also compared alternative types of building materials. Our structural design presents adequate framing and connections within the building. The geotechnical design presents foundation sizes that can support the building loads and site conditions. We recommend site grading, parking lot and roadway criteria. We also propose site connection to surrounding roadways.

During construction, there will be high traffic and noise for nearby residents. Despite this, the addition will help the Marianna community. The Jackson Hospital Urgent/Wound Care Center will add purpose to a currently unused site. Residents of Marianna will have increased access to affordable healthcare, job opportunities, and quick medical attention.

Team Members
Avery Hall
John Hayes
James Long
Jack McDonald

Advisor
Sean Martin, Ph.D., PE, FRSE
Kamal Tawfiq, Ph.D., PE, F.ASCE

Sponsor
DHM Melvin Engineering

Team 207: Starbucks on West Pensacola St.

Our project was new site design for a Starbucks location in the Westwood Square Shopping Center at the corner of West Pensacola Street and Ocala Road in Tallahassee. The design includes a drive-through and parking area, facing West Pensacola Street.

The site is located atop the current detention pond that serves the block. Due to this, our project included designing a new stormwater management system to fulfill the existing pond's capacity and address the post-development drainage needs. To create space for the building, drive-through and parking while still managing post-development drainage, the pond was replaced with an underground stormwater management chamber system. This new system connected to the existing stormwater pipe along West Pensacola Street. We designed the underground chamber system. Our site layout serves the architect's blueprint and meets the drive-through and parking space demands based on calculations derived from a nearby Dunkin' Donuts. The project design complies with MMRT zoning district regulations, the City of Tallahassee Land Development Code, Starbucks Corporate Standards, ADA Requirements and FDOT Standard Plans for 2023-24.

This project carries significant social impacts for the community. It introduces a new coffee shop where residents can gather, work and enjoy coffee. It should also take some traffic away from the other nearby Starbucks locations. In addition to these benefits, the new Starbucks is expected to create employment in the local area, which will help the community.

Team Members
Morgan Arnason
Abigail Ensing
Marlon Feitosa
Hayden Lenk
Olivia Owens

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Moore Bass Consulting, Inc.
Ben Hood, PE

Team 208: Village of Estro Sprouts Farmers Market

Our "Village of Estero Sprouts Grocery Store" project addresses a pressing need in Estero, Florida: convenient access to a grocery store for its residents. Our focus was to transform previously vacant land into a thriving commercial property. We designed the site plan, encompassing critical elements such as a 30,000-square-foot grocery store building, a well-equipped loading dock, a spacious parking area, pedestrian-friendly walkways, essential water, and sewage infrastructure, and efficient drainage systems. Our design incorporates an environmentally responsible waste management area located proximate to the loading dock, facilitating the efficient disposal of waste and promoting sustainability.

We aimed to meet the immediate needs of Estero residents and contribute to the overall development and growth of the local community. By providing this grocery store, the project significantly improves the quality of life and enhances the economic prospects of the Estero region.

Team Members
Shayna Coram
Joshua Johnson
Symone Robinson
Reuel Teelucksingh

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Atwell, LLC
Nik Kasten, PE
Griffin Furlong, PE

Team 209: Moody Air Force Base

Imagine a road within Moody Air Force Base called Stone Road. It's taken a beating from heavy military trucks and bad weather, making it dangerous for the military personnel who use it.

Our goal was to make Stone Road better in a few ways:

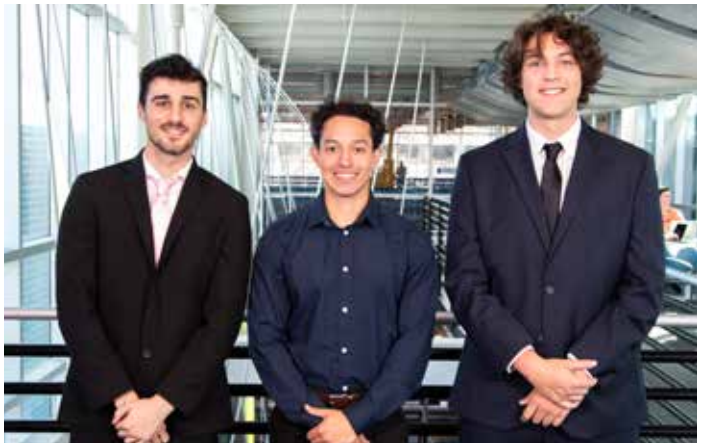
- Replacing the top two layers of the road with stronger stuff so it can handle heavy trucks.
- Building a strong wall next to Mission Lake to stop water from pushing on the road.
- Widening the road and adjusting its path by the lake.
- Demolishing the old bridge and building a new walkway on top of the new wall, with guardrails for safety.

We used AutoCAD, Excel, and Tekla Structural Designer 2023 to make detailed plans and make sure the wall is strong and safe. We were also careful not to cause too much trouble for the people who live nearby during the project and to protect the environment.

Our project had some big impacts:

1. Safer driving: The road is safer for military vehicles with better asphalt and wider lanes.
2. No more flooding: The wall stops the road from flooding, so it is reliable.
3. Safe walks: The new sidewalk with railings keeps pedestrians safe.
4. Better looks: The road looks better, making it nicer for everyone.
5. Not much fuss: We made sure people did not get upset with our project because it was all about safety and thinking of the community.

In the end, our work on Stone Road at Moody Air Force Base made it much safer and better for everyone who uses it.



Team Members
Pablo Arteaga
Ricardo Patino
Julian Sonnier Cardet

Advisor
Sean Martin, Ph.D., P.E., FRSE

Sponsor
Moody Air Force Base
Jessica Vuong
April Whitbeck

Team 210: Wakulla Regional Songbird Well and Water Treatment Plant

The Wakulla Regional Songbird Well and Water Treatment Plant struggles with poor water quality. It is in a neighborhood of Wakulla County in Crawfordville, Florida. The specific problems with the water quality include poor taste, unpleasant odor and a brown-pinkish color during the winter season.

These problems stem from issues such as poor contact time with the chemicals that the distribution company uses to clean the well water. Currently the well water has a contact time of 1-2 minutes total for the chemicals. Two- to three hours is the necessary amount of time to clean the water to a safe measure. We designed a plan to improve the water quality that includes changing the filter media, increasing the contact time with the chemicals by designing a contact tank, and adding new high-pressure pumps. Our plan requires adding bases to support the weights for the new additions. We added a new structure to house the pumps. A backwash tank at the plant creates a ditch when emptied, so we added a retaining wall to prevent the ditch from becoming bigger. We included pipes to connect the system together.

The citizens of the nearby neighborhoods will begin to enjoy better water quality once the entire plan is finished. This allows the citizens to use the water more comfortably for their daily needs.

Team Members
Jeremy Fletcher
Sebastian Jaramillo
Nayeli Marcial

Advisor
Sean Martin, Ph.D., P.E., FRSE
Kamal Tawfiq, Ph.D., P.E.

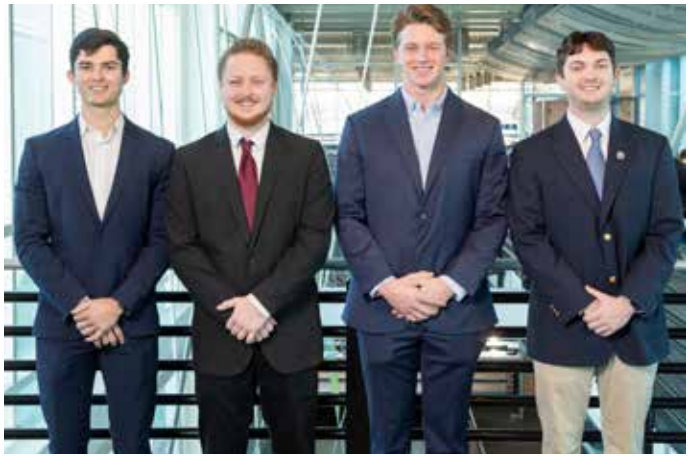
Sponsor
Florida Rural Water Association
Sterling Carroll, P.E.
Peyton Piotrowski

Team 211: Torreya State Park Campground Paving and Regrading

The Torreya State Park Campground Paving and Regrading project was focused on upgrading the infrastructure and accessibility of the park's Weeping Ridge Campground. Torreya State Park is in Bristol, Florida. It is a popular site for hiking, camping and birdwatching. The site is on a high point in the park and contains a dirt road that loops around the site. The park is kept up and owned by the Florida Department of Environmental Protection. This project had several key parts: paving the campsite road, upgrading the camper/RV spaces by adding parking pads, and meeting drainage needs. These upgrades will enhance visitor experience while preserving the park's natural beauty.

The site is 4.226 acres and mostly occupied by campers/RVs with some primitive camping areas. The dirt road was paved for a more even and stable driving experience. The previously dirt camper and RV campsites were turned into concrete pads for motorists. Proper stormwater analysis was needed as 1.383 acres of impervious area required new drainage solutions. Some of the minor improvements include the addition of two concrete pads for bike racks and the replacement of all wooden benches and fences on site. We were responsible for a plan set that included general notes and details, demolition and erosion control, site improvements, drainage and cross sections. All new facilities were designed to be ADA compliant.

With the new amenities, the project aimed to attract more visitors to the park, resulting in increased revenue while keeping the park's natural beauty. These goals align with Florida's promise to enhance public facilities and ensure sustainable use of natural resources for current and future generations.



Team Members
John Carlson
Nate Merrill
Carson Prugh
Andy Wood

Advisor
Sean Martin, Ph.D., P.E., FRSE

Sponsor
Halff Associates;
Ryan Culton, P.E., M.B.A.
Austin Cushing, P.E.

Team 212: Lake McBride Residence

Our senior design project was a residential home in Tallahassee, FL. The house is approximately 36,000 square feet and lakefront. The overall problem with the project was the size of the home. This caused issues with location of utilities, drainage and unique shapes.

The overall area for allowable building was a little under two acres. For a typical home this would not be an issue, however, this home was approximately one acre itself. There was a large oak tree that caused issues with finding a suitable area for a septic tank and well. Reorganizing the orientation of the driveway made enough area for these utilities. Runoff water into the lake was another concern. Using natural resources, the water was filtered into the soil before reaching the lake.

We did not structurally design the entire home due to the size. Instead, we broke the house into sections and designed the most important components. We provided drawings for the foundation, first and second level framing, and roof framing plans. The entire first floor was framed out of wood and the second story was framed from steel with steel columns going to the foundation. From there, we broke the home into sections for specific details of key components. These details were enlarged drawings that highlighted connections, member sizes, and called out important structural points aspects. We did calculations to support the specifications we drew on the details.

Our design aimed to please the client while maintaining the legal code. Price, sustainability and environmental impacts were considered for this design.

Team Members
Matheus Brandao
Connor Burk
Luis Cruz
Nasser Doud
Andre Nacional

Advisor
Sean Martin, Ph. D., P.E. FRSE

Sponsor
Kever McKee Engineering,
Barry Pujol

Team 213: COE Building A Renovations

A recent increase in the number of students at the FAMU-FSU College of Engineering required renovations to the building to preserve the quality of life on campus. Inside Building A, our client wanted additional teaching and study space. We delivered floor plans with enough space for 300 additional students. The existing atrium of Building A was designed to be filled with two floors which fill in the empty overhead space. To make space for the renovation, we removed the metal sculpture in Building A.

Outside of the building, the campus pond was improved using best management practices to encourage wildlife to live there. Certain conditions in the pond like sediments and erosion will affect the final design. The improvements also keep the pond from flooding across the nearby road. This pond design is intended to meet the recently changed state requirements of water quality.

We also designed a walking path made of engineering materials, giving students a safe walking path to other parts of campus, away from the roadway. It also teaches them about the materials used in civil engineering. Five different materials were used for the walking path: concrete, rubber, asphalt, masonry and wood. The removed sculpture will be installed along the path as an example of civil engineering design. Each of the path materials has have a real-life example of the material in use. Altogether, the improvements to the campus including the building interior, the pond, and the walking path increased the quality of life for all students, staff, and visitors.

Team Members
Kylie Augustine
Andrew Hedderman
Dominic Rodio

Advisor
Sean Martin, Ph.D., PE, FRSE
Kamal Tawfiq, Ph.D., P.E., F.ASCE

Sponsor
Barkley Consulting Engineers, Inc. –
Doug Barkley, P.E.
Josh Del La Cruz, E.I.

Team 214: Naples Health & Fitness Plaza

In Collier County, Florida, there is a demand for amenities related to health and wellness. Gulf Coast Ventures is a developer in South Florida that focuses on increasing commercial development. They created a concept for the Naples Health and Fitness Plaza that consisted of three one-story buildings including an athletic training center, a Vale Food Co. restaurant and a physical therapy facility. We designed a site on an undeveloped 4.5-acre parcel of land in Collier County. We were responsible for creating a site, utility, grading and drainage plan.

Our designs had to comply with the Collier County Land Development Code (CCLDC) and the South Florida Water Management District (SFWMD). Along with the three buildings, the site plan had to include at least one pretreatment detention area to aid in the increased runoff on the developed site. We used Civil 3D to make the concept come to life. The design process involved shifting various aspects within the site to meet the client's needs and abide by the standards set in the CCLDC and the SFWMD. A few of these standards included building setbacks, parking requirements and minimum grades across the site. The completed project will generate economic growth in the community by providing more opportunities for residents. Additionally, the Naples Health and Fitness Plaza prompts increased physical activity and healthier lifestyles within the community.

Team Members
Nicole Devaney
Nicole Nelson
Taylor Petersen
Cody Schellinger

Advisor
Sean Martin, Ph.D., PE, FRSE.

Sponsor
Atwell, LLC
Nik Kasten, P.E.
Griffin Furlong, P.E.

Team 215: I-10 Rest Area Truck Parking Expansion Okaloosa County

The semi-truck parking lot at the I-10 rest stop in Okaloosa County, Florida had an ongoing capacity issue. There were not enough parking spaces to accommodate the number of trucks entering the stop. As a result, truck drivers had been parking on the road shoulder and other less than ideal areas. The Florida Department of Transportation (FDOT) secured the funding to expand the parking lot. Our team was tasked with designing a new parking lot while mainly focused on maximizing stalls per acre. In addition, installation of an Intelligent Transportation System (ITS) capable of displaying the number of available spaces in the lot.

Challenges associated with this project included a mandate that we work within the current right of way. We also had to make sure that our design interfaced with the existing structures on the property. We did not want to modify the passenger car parking lot or bathroom facilities. To implement the redesign, we increased impervious area and were forced to move an existing tree line. We reshaped the storm water ponds on the property to handle all runoff. To add many spaces without increasing the footprint too much, we opted to utilize back-in spaces. This differed our design from the existing layout which utilized pull through spaces only. Our completed design offered 84 total spaces, with four being handicap accessible. The original parking lot only had 50 total spaces, two being handicap accessible. Our redesign accounted for a 68% increase in usable parking spaces. The enlarged capacity of the new parking lot provided more truck drivers with a safe, secure and free place to stop and rest.

Team Members
Kevin Arabi
Alan Cutler
Jack Horning
Ryan Lopez

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Michael Baker International:
Joey DeFrancisco, P.E.

Team 216: Misting Springs Subdivision

Crawfordville, Florida's population is growing. We developed the site design for the Misting Springs Subdivision, a residential neighborhood on an existing 34.98-acre plot of undeveloped land in Crawfordville. Our goal was to divide the land into the highest number of lots in the most cost-effective way. The client requested recreational areas for the residents and that a portion of the land be left for future commercial use.

This project scope included erosion control, lot layouts, roadway, utilities, grading and stormwater design. Site design was made using the Wakulla County municipal code. The recreational area was designed to meet the Americans with Disability Act (ADA) standards. We ensured that the subdivision design mitigated flooding. We provided an analysis, preliminary cost estimate and project schedule after completing the plans.

Our design included a recreational area that includes an amenity building and a mail kiosk, plus an additional recreational area that is labeled as a park. There are two ponds located on this parcel to ensure proper stormwater design. In total, 94 residential lots were able to be provided. The design is functional and effective and considers customer, ecological, environmental and societal impacts.

Team Members
Peyton Brocksmith
Layla Chyle
Andrew Nelson
Stephan Senich
Connor Worontsoff

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Urban Catalyst Consultants,
Sean Marston
Berkley Lewis
Michael Giglio

Team 217: Laurel Road Redesign

The Sarasota area in southwest Florida has experienced a lot of growth in recent years, with many construction projects ongoing. One area included in this high level of growth is Laurel Road, in southern Sarasota County next to the City of Venice. There are many new construction projects planned along the road. Additionally, there is a school located here. The school, along with the developments, presents a traffic problem. The road was not built to handle the amount of people using it, so Sarasota County asked us to address this problem.

The road's biggest issue was the intersection in front of the school. There was a large amount of traffic attempting to turn right into the school, but it lacked a separate right turn lane. Furthermore, a new neighborhood was planned across the street, and kids would need to travel across Laurel Road to get to and from school. We redesigned the intersection to address these problems.

We added a right turn lane into the school and another leg to the north side of the intersection, as well as adding crosswalks. Further down the road, we noted the large amount of construction being planned along Twin Laurel Boulevard and the lack of a traffic light between Twin Laurel and Laurel Road. To address this, we added a traffic signal and crosswalks here, and added a right turn lane for the westbound side of Laurel Road. We believe these designs provide simple solutions to the problems at hand.

Team Members
Kevin Brock
Edward Erickson
Alec Hale
Jacob Unger

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Sarasota County Transportation Planning, Paula R. Wiggins, P.E., MBA

Team 218: Michael the Cleaner Site Remediation

The Michael the Cleaner site in Sarasota, Florida was listed by the Florida Department of Environmental Protection as a hazardous site because it was polluted by chemicals used in dry cleaning. These chemicals got into the soil and groundwater, both on and off the site.

Laundry facilities use a variety of chemicals that end up in the environment when they dispose of their wastewater. When these chemicals reach groundwater, they reduce the oxygen levels. This is harmful to nearby wells and, in this case, a body of water that was less than a quarter mile away.

Gutteridge Haskins & Davey (GHD) checked the quality of the groundwater and soil by taking samples from monitoring wells. Tests showed that the pollution came from the old dry cleaners. They found five harmful chemicals, one of which could cause cancer. GHD suggested a plan to clean up the site. It included removing some of the polluted soil with natural processes to clean the groundwater. They also wanted to monitor the area to make sure it was improving. They planned to inject bacteria into the wells to clean up the polluted water and soil. They figured out how much bacteria and nutrients they needed based on the condition of the groundwater and soil. They also needed to decide how deep to inject the bacteria and how to get it into the wells.

Team Members
Nicole Blanchard
Darius Far
Alexander Rodriquez
Rayana Watford

Advisor
Sean Martin, Ph.D., PE, FRSE
Jeffrey Farner, Ph.D.

Sponsor
Gutteridge Haskins & Davey (GHD)
Jenna Martin, P.E.

Team 219: Stormwater Pond Relocation Project

S&H Investments Group, a real estate developer located in Clay County, Florida, owns a large piece of land on US Highway 17 in Fleming Island, Florida. They planned to relocate an existing stormwater facility to another location on the project site. There are two ponds on the project site, a wet retention pond in the northwest and a dry detention pond in the southeast which fulfilled the purpose of controlling run- off/overflow.

Our project aim was to fill and grade the existing northeast pond and create a new stormwater facility next to the existing southeast dry detention pond. The new pond could be expanded and combined with detention pond. The purpose of this project was to maximize the land usage equally of north parcel for future developments or retail.

We used multiple engineering disciplines to carry out this project, such as Civil – AutoCAD Civil 3D model for basin area; environmental – Bentley's StormCAD for hydraulic model and drainage calculation; and geotechnical – for reviewing soil reports and flood zones for the project site. The project also required modifying an existing environmental resource permit (ERP) from the St. Johns River Water Management District (SJRWMD) and the approval of the Clay County Board of County Commissioners. The project site had already passed the zoning requirements. We followed multiple environmental, land development and city planning codes to maintain ecological balance and sustainable development of the project.

Team Members
Russ Freeman
Om Patel
Kevin Siem
Ryan Toth

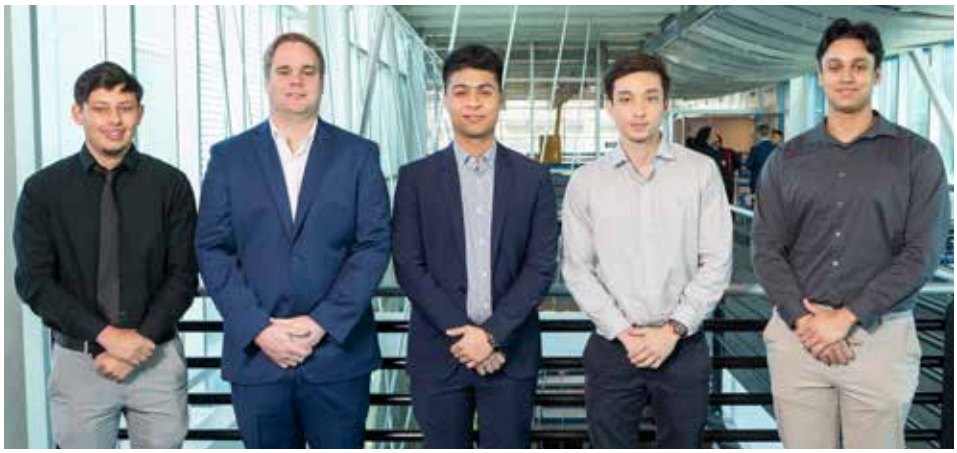
Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
National Stormwater Trust, Inc.
Mark P. Thommasson, P.E.

Team 220: Betton Road Traffic and Pedestrian Enhancement Project

Betton Road is a heavily traveled roadway that joins Centerville Road and Thomasville Road in Tallahassee. Betton Road is a road near the town's main hospital and is in the center of a neighborhood and park. This makes the road unique due to its various uses. Due to the amount use, it has worn and come to the end of its service life. Our project rehabilitates the road and adds pedestrian enhancement.

Since the road is heavily traveled and embedded in an urban community, this provided us with a unique task, making this a little bit more complicated than a normal rehabilitation project. Given the condition of the road we decided to do a full rehabilitation down to the subgrade layer. When fully redoing a road, the drainage needs to be considered. Betton Road had some drainage problems around Hickory Avenue that we fixed with a new curb and gutter. To increase pedestrian safety we added a pedestrian crosswalk north of Lee Avenue. We also redesigned the existing crosswalk at Trescott Drive. We used traffic calming devices including decreasing the widths of the lanes from 12' to 10', accomplished by increasing the width of the sod between the sidewalk and gutter. After the rehabilitation, drainage improvements and pedestrian enhancement, Betton Road is safer for drivers and pedestrians.



Team Members
Dylan Butterfield
Max Carr
Fernando Guerra
Jeffrey Huynh
Julian Mirabal

Advisor
Sean Martin, Ph.D., PE, FRSE
Jeffrey Farner, Ph.D.

Sponsor
Eutaw, Inc.
Lane P. Lucas, P.E.

Team 221: Horse Barn Road Over Blue Creek Bridge Replacement

The Horse Barn Road Project consists of a 70+ year-old timber bridge that was deemed "defective" in 2021. Erosion was found beneath the structure and the current alignment was not suitable for the proposed conditions.

We determined the following permits were required for this project: environmental resource permit (ERP), Florida Department Environmental Protection (FDEP), nationwide permit and a construction permit. Our plan calls for demolishing the existing bridge and replacing it with a concrete box culvert that includes wing walls to account for the existing open channel flow of the creek. Essentially the dirt road is repaved, 50 feet on each side of the box culvert. We conducted a geotechnical analysis to determine the soil layer and its respective strength. Then, we did a hydraulic analysis to consider the hydrological features of the watershed and the hydraulic capacity of alternatives. Our results indicated that both alternatives have high conveyance efficiency, so we selected a precast box culvert with wing walls and performed a structural analysis. We determined live loads, dead loads and geostatic pressure to ensure the slab foundation and wing walls were structurally sound.

We realigned Horse Barn Road to meet our minimum length of curve radius and to preserve an existing tree on the site. The road base consisted of six inches to support the roadway use load and conditions. To enhance the roadway conditions, we added reflective signage and pavement markings to increase user mobility and safety.

Team Members
Joshua Davis
Venet Desir
Mkharis Lindsey
Octavius Maxey
Tyree Young

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Mead and Hunt
Micheal Schwier, P.E.
Matt Johnson, P.E.
Fadi Alsharif, P.E.

Team 222: Bonifay Regional Stormwater Park

The City of Bonifay recently completed an important project aimed at improving stormwater management and creating a valuable community space. This project introduced a new community park in an area that was once undeveloped.

Two ponds were designed to tackle flooding and drainage issues while also making the landscape more attractive while supporting local wildlife. Water from heavy rain is first collected by an underground pipe system located beneath a nearby road, which then directs the water into the second pond, situated at the far end of the property, close to a creek. This pond acts as the first line of defense against flooding by storing excess rainwater. The water then moves from the second pond to the first pond, which is closer to the road. Surrounding landscaping adds to the visual appeal and helps clean the water.

An additional feature of this project is an eight-foot-wide sidewalk around the ponds, as well as several benches, giving the community a place to enjoy the outdoors and connect with nature. There was an old water tunnel (a culvert) located in the stream behind the newly constructed ponds. It was causing water to stagnate which reduced the system's performance. The old culvert was demolished, and a new one was installed lower than before. This change improved water flow, ensuring the stormwater management system functioned at its best. Overall, this project did more than just manage stormwater. It has transformed an unused space into a beautiful park that reduces flood risk, supports biodiversity, and provides a relaxing spot for the community.

Team Members
Makoto Gazzara
Andrew Hurdis
Braden Runey
Jessica Smith

Advisor
Sean Martin, Ph.D., PE, FRSE
Jeffrey Farner, Ph.D.

Sponsor
DHM Engineering –
John Udochi P.E.
Brent E. Melvin P.E.
Ryan Huges P.E.

Team 223: Domino's Site Redevelopment

In early 2021, the Domino's located at 1528 W Tennessee St. in Tallahassee burned down. The building would be demolished, and a new building and site layout put in its place. We designed plans for the new site.

To ensure our project fit within the city's redevelopment requirements, we considered impervious area, landscaping and access to different modes of transportation (such as pedestrians, cyclists, and public transit users). We also wanted to make the site more visually pleasing.

We focused heavily on the site layout (including geometry, water and electric connections and material costs), improving stormwater drainage and building a retaining wall to support the building. We also adjusted the stormwater drainage on the site, increasing the permeable area.

Our solution was to create a one-way road through the site with angled spaces. This reduced the area of asphalt, allowing more space for greenery and benches. It also kept traffic from backing up on W. Tennessee Street, an important, high-traffic road. This required the building to be moved closer to the corner of the site, hence the need for a retaining wall. For proper slopes on the roads, the wall had to go most of the way around the building except for the parts around the entrances. Our site also required enclosed bike parking and an accessibility ramp, which are included on the plan sheet. With this project, we created a more transport friendly and accessible site.

Team Members
Anna Hennis
Sean Moran
Deegan Tarrillo
Trevon Welch

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
DHM Melvin Engineering, Inc.

Team 224: FAMU Way Phase IV

Our aim was to make a roundabout at the intersection of FAMU Way and Adams Street in Tallahassee, Florida. This project was the fourth phase of renovating FAMU Way. The city wanted to make the transportation system safer, look better and work more efficiently.

Our main aim was to improve traffic flow and the way the intersection looked by building a roundabout instead of the current traffic lights. This change would reduce traffic jams and make accidents less severe, creating a safer space for drivers, cyclists and pedestrians. Overall, we wanted to make the roads safer and give people a smoother, more efficient experience.

Our challenge was designing a good-looking road that also fixed traffic problems. The roundabout had to work well and not cause trouble for the local property owners.

Team Members
Nicole Boulenger
Kelsie Craig
Megan Noto
Fletcher Perrigo
Zachary Stewart

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
City of Tallahassee
Kyle Andree, P.E.

Team 225: Woodville Safe Route Sidewalk

Safe pedestrian passage is important, especially when located near a school zone. Leon County requested a safe route sidewalk to the Woodville K-8 school in the Canyon Creek Rd. neighborhood, located in Woodville, FL.

We evaluated existing conditions and determined the various obstacles present at the site. We met with our project sponsor (H.W. Lochner, Inc.), performed a site visit and then gathered information based on the Florida Department of Transportation (FDOT) standards and regulations.

We determined the most efficient design plan for a safe route and additional improvements that should be made. We designed a sidewalk to be nearly 1700 feet in length and five feet wide. We decided not to add a curb to the roadway, but instead included a buffer between the sidewalk and roadway with a width of five feet. This buffer helps pedestrians maintain a safe distance from oncoming traffic. The sidewalk connects from the Old St. Marks Trail to the north side of Canyon Creek Rd., the east side of Shumard Dr., and finishes by running parallel to the north side of Bur Oak Dr. The route includes two unsignalized pedestrian crosswalks which intersect Shumard Dr. and Hackberry Dr., which we designed according to the FDOT standards. The completed route provides not only a safe way for pedestrians to get to the school, but also for efficient daily use.

Team Members
Adam Kinnon
Iran Matias-Ramirez
Caroline Perry
Joshua Vincent

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
H.W. Lochner, Inc.
Lauren Squillacote, P.E.
Scott Simmons, P.E.

Team 226: Pavement Reclamation at Rock Hill

This project addresses a pressing need on Rock Hill Road, which extends approximately 10.8 miles from US 331 (SR 83) to SR 81 in eastern-central Walton County, Florida. The project focuses on the full-depth pavement reclamation, milling, resurfacing and construction of a 5-ft. paved shoulder with a sodded shoulder for the entire project length. The proposed typical section for Rock Hill consists of two 11-ft. travel lanes with a 5-ft. paved shoulder and a 2.5-ft. sodded shoulder that will remain normally crowned to match the existing typical section.

We designed the site plan, including critical elements such as resurfacing the road, improving drainage, signage and roadway marking. Some persistent problems with the current road were heavy flooding and frequent accidents. Our primary goals were to provide an extension to the road, solve the problems of flooding, provide a cost-effective solution, and reduce the need for future work on the road. By resurfacing the road, we significantly improved the quality of life and safety in the area.

Team Members
Jylon Bennett
Khair Hanif
Andre Harper
Charles Harper

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Chipola Engineering Group, Inc.
Blaine M. Varn, PE

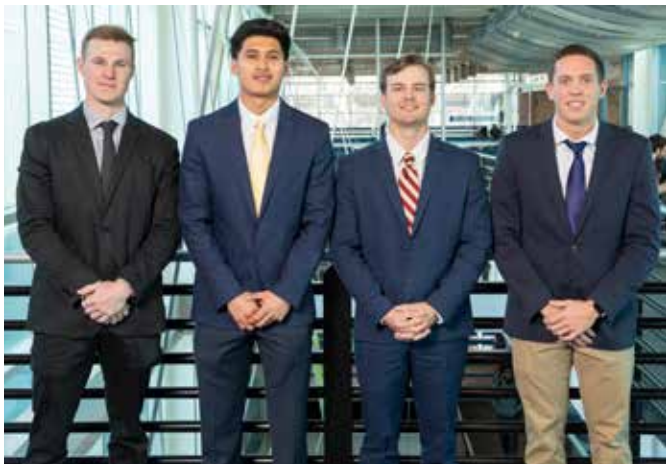
Team 227: Bald Point State Park Kayak Launch and Day Use Area

Bald Point State Park is 4,800 acres of wilderness located in Franklin County, Florida. More specifically, it is where the Ochlockonee Bay meets the Gulf of Mexico. The park features woodlands, tidal marshes and freshwater ponds.

Park visitors can engage in activities such as nature walks, bird watching and beach walking. Chaires Creek runs through the site. Our projecct proposes a kayak launch in Chaires Creek so visitors can enjoy more of what the park has to offer.

Our plan includes pavilions, restrooms, kayak launch and parking. The client, the State of Florida, requested the project to feature Americans with Disabilities Act (ADA) accessibility; 20 parking stalls; pick-up truck and trailer-accommodated parking lot and stalls; stormwater management designed to Florida Department of Environmental Protection (FDEP) and North Florida Wastewater Management District (NFWMD) guidelines; restrooms above the 100-year floodplain; and all site facilities located outside the wetland buffers.

Project challenges included keeping the construction outside of the wetland buffer, minimizing the effects on the nearby ecosystem, and keeping construction costs low. Our simplified site design solved these problems. We observed the boundaries and effects on the surrounding ecosystem. To keep construction cost low, we minimized material surface area low. We kept site functionality high to enhance visitor experience and reduce wasted space.



Team Members
Austin Ashley
Omar Mejia
Miller Shelfer
James Thompson

Advisor
Sean Martin, Ph.D., PE, FRSE

Sponsor
Stantec Consulting Services, Inc.
Chad Mason, P.E.
Chandler Hatcher EIT
Olivia O'Bryan, EIT

Team 228: Grand Ridge K-8 Cafetorium

The Grand Ridge School is planning to increase its capacity. This construction includes renovating existing buildings and adding an elementary wing. With this capacity increase, the current cafeteria will not be able to accommodate the new amount of students. The school needs a new cafeteria to meet new capacity requirements.

We designed the site for the new cafeteria. While planning our design process, we found other ways to improve the site. Our design includes a stage with supporting areas and various utility rooms. We also made sure the building could be used as a hurricane shelter.

Once complete, the structure will meet the school's increased capacity needs. The building will also be useable as an auditorium area and a hurricane shelter, giving the people of Grand Ridge closer protection during a hurricane warning. Including utility rooms in the structure may limit the number of problems that could occur. If the utilities were designed elsewhere, the utility lines could get damaged.

Team Members
Sebastien Abney
Shekinah Adaghe
Agustin Diaz
Anthony Washington

Advisor
Sean Martin, Ph.D., P.E., FRSE
Pedro L. Fernández-Cabán, Ph.D.

Sponsor
David H Melvin Engineering
Jamie M. Graham, P.E.

Team 229: ALDOT Welcome Center

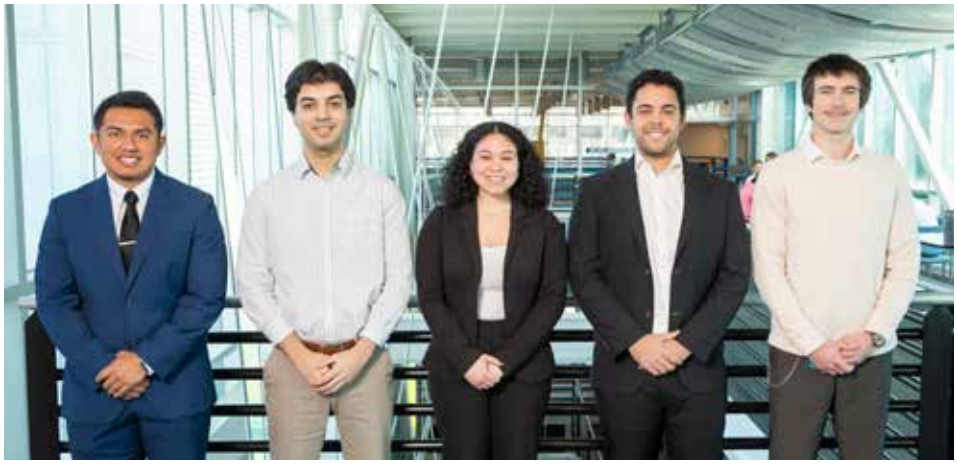
The Alabama Welcome Center is a rest stop located at the Tennessee-Alabama border in Limestone County. The building needed to be updated, and the Alabama Department of Transportation (ALDOT) was looking to renovate the site.

Our proposed Welcome Center needed to be relocated further from the highway, with newly designed stormwater management. We also had to redesign the car and truck parking areas. The onsite structures and memorials had to be removed or rearranged to meet the proposed design including the Saturn 1B rocket memorial which had to be disassembled and removed entirely.

A risk we considered in the design was potential sinkholes from the area's limestone. We did adequate research, testing and water management to avoid issues with the on-site conditions.

We designed an alternative site that is safe and functional. One of the proposed designs puts the Welcome Center Building in the center of the parcel. The truck parking would be placed on the rear side of the building opposite U.S. Highway 31. The car parking lot would be placed in front of the building and on the side closest to the U.S. 31. The retention pond would be placed north of the building and adjacent to the truck parking lot. The area covered by the building and parking lots would stay relatively similar to the original layout.

The second alternative uses the same parking lot layout as the first design but has a smaller detention pond in the same area, with an outlet that reused the existing ditch and culvert. With the newly designed Alabama Welcome Center, the site can be reopened, and visitors can enjoy what the location has to offer.



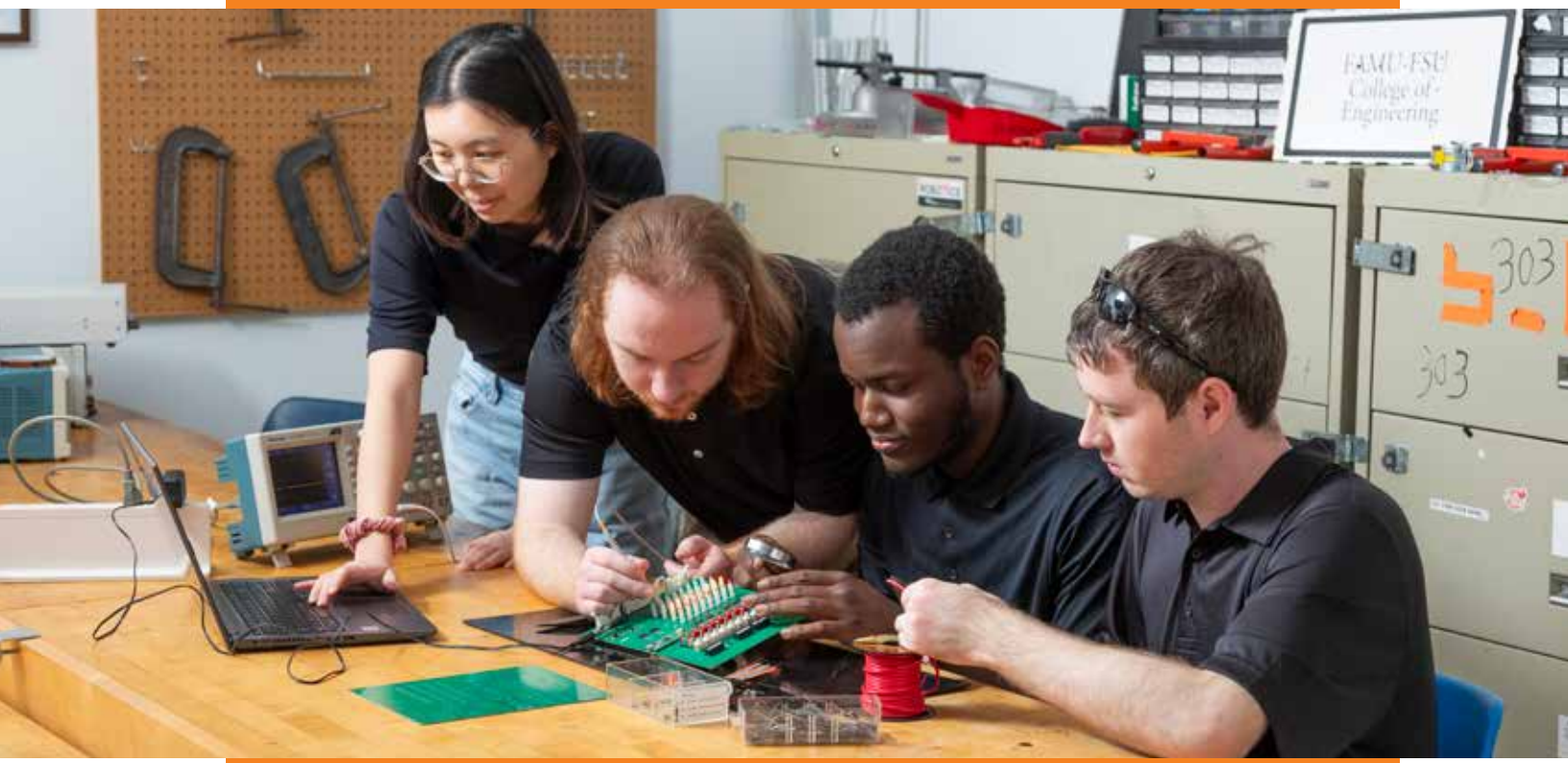
Team Members
Edgar Cruz
Anthony Feliciano
Makaila Jaramillo-Holmes
Andres Prieto
Markel Valmana

Advisor
Sean Martin, Ph.D., P.E., FRSE

Sponsor
Alabama Department of Transportation
Martin Clark, P.E.

Electrical & Computer Engineering

Senior Design



Members of Team 308 designed a Fuel Pump Simulator Board to assist engineers developing point-of-sale fuel pump hardware and software test their prototypes in the lab.

Team 301: IEEE SoutheastCon 2024 Hardware Competition (Multidisciplinary Team)

The purpose of this project is to design a robot for the IEEE SoutheastCon 2024 hardware competition. In this competition, the robot must be able to pick up blocks and move them. The robot must also be able to pass over a 7-inch gap and press a button, performing these tasks quickly and without any outside control. One important strategy we used was optimization.

The competition uses a point system that gives more importance on reaching the button at the end than moving the blocks. This meant our design only needed to focus on reaching the button, with extra points added by moving blocks around the course. We designed the robot using a chassis with four wheels as a base for the other parts. We used sensors to move through the course and locate blocks. We used a combine to pick up and store the blocks.

Our design employs a microcontroller to send signals to all other parts of the design. After the design was assembled, we focused on testing and tuning the robot to complete the competition objectives. We designed, built and tested a robot for competition, and it performed as expected.

Team Members
Vivienne Gemma (ME)
Norman Downey (ECE)
Alexander Macksyine (ECE)
Coleman Thompson (ECE)
Kristian Sapien (ME), *Not Pictured*

Advisor
Shayne McConomy, Ph.D.
Linda DeBrunner, Ph.D.

Sponsor
Intel Corporation

Team 302: IEEE SoutheastCon 2024 Hardware Competition

For the IEEE SoutheastCon 2024 Hardware Competition, we designed a robot that could overcome obstacles including transporting supply boxes to designated areas, climbing hills and traversing a gap. To ensure optimal performance, we selected a robotic base that aligned seamlessly with the project requirements.

We incorporated IR sensors for navigation, enabling our robot to detect and follow lines with precision. This feature enhanced the robot's ability to navigate complex terrains. The heart of our system was the Arduino Mega, chosen for its robust computing power and versatile input/output capabilities. To drive the motors, we implemented the L298N motor controller, a crucial component that facilitated efficient motor control. The entire system was powered by a 12V DC battery bank, routed in parallel to both motor controllers and the Arduino. This power configuration ensured a reliable and sustained energy supply, crucial for the seamless operation of the robotic platform. Our goal with our robot was to be able to complete the course quickly and reliably to achieve as many points as possible, with no risk of penalties and unexpected errors.

Team Members
Jevin Scrivens
Sean Reidy
Jahi Hudgins
Carter Cerekwicki

Advisor
Bruce Harvey, Ph.D.

Sponsor
Intel Corporation

Team 303: Kinetic Aero-Solar Renewable Energy Nexus (KAREN)

As global energy demands escalate and non-renewable resources dwindle, we must explore sustainable alternatives. Renewable energy—notably wind and solar power—emerges as a pivotal solution for future energy needs. We integrated these resources into a cohesive system capable of generating power during periods of low solar or wind activity.

Our primary goal was to design a compact renewable energy generator specifically tailored to meet the needs of farmers in remote rural areas where access to sufficient electricity for essential agricultural machinery is limited. By downsizing the project, we enhanced its versatility, enabling users to deploy the device wherever it's needed most. We reduced the generator size to optimize energy output while minimizing costs and spatial requirements.

Our central objective was to create a dual solar and wind generator capable of generating a minimum of 100W of power. It had to be easily transportable by a single individual and resilient enough to withstand winds of up to 45 mph. To achieve this, we integrated a "sunflower" concept for the solar panels, allowing them to track the sun's trajectory throughout the day to maximize power generation. Additionally, we used horizontal axis wind turbines, similar to those employed in large-scale wind farms, to effectively harness wind energy.

By combining innovative design principles with proven renewable energy technologies, our project empowers rural communities with reliable, sustainable energy solutions while fostering environmental stewardship and technological advancement.

Team Members
William Touza (ECE)
Andrew Putnam (ECE)
Carlos Vilarino (ECE)
Brandon Ortiz (ECE)
Alberto San Segundo (ME)
Tristan Witkowski (ME)

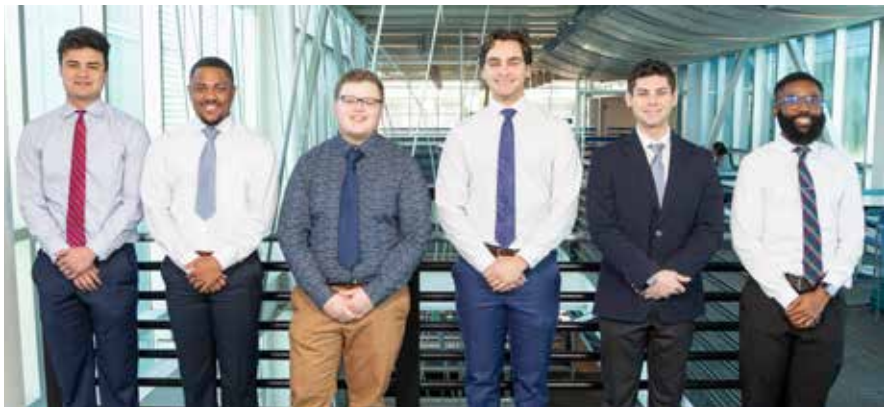
Advisor
Simon Foo, Ph.D.

Sponsor
Bruce Morrison

Team 304: FPL Remote Switching Device

This project aimed to improve how Florida Power & Light closes fuse switches for safety. When something touches the power line or too much current is flowing through the lines, a fuse will pop open to stop the flow of electricity down the line. To close these switches, linesman first ensures safe conditions and use a stick that can extend up to 40 feet to grab the burnt fuse and replace it with a new one.

Our project focused on designing a new reclosing switch device to replace the traditional hook stick. Our solution is easier for the user, can be controlled remotely, is portable, and stores multiple fuse cartridges. Our results include an advanced reclosing switch device for utilities that can hold extra fuses and puts a new fuse in at the click of a button.



Team Members
Nick Grant (ME)
Nicholas Haynes (ECE)
Jacob Ray (ME)
Christian Perez (ME)
Andrew Lois (ECE)
SirDarius Lomack (ECE)

Advisor
Doreen Ayafor (FPL)
Ted Gonzalez (FPL)
Kyle Bush (FPL)
Rodney Roberts, Ph.D.

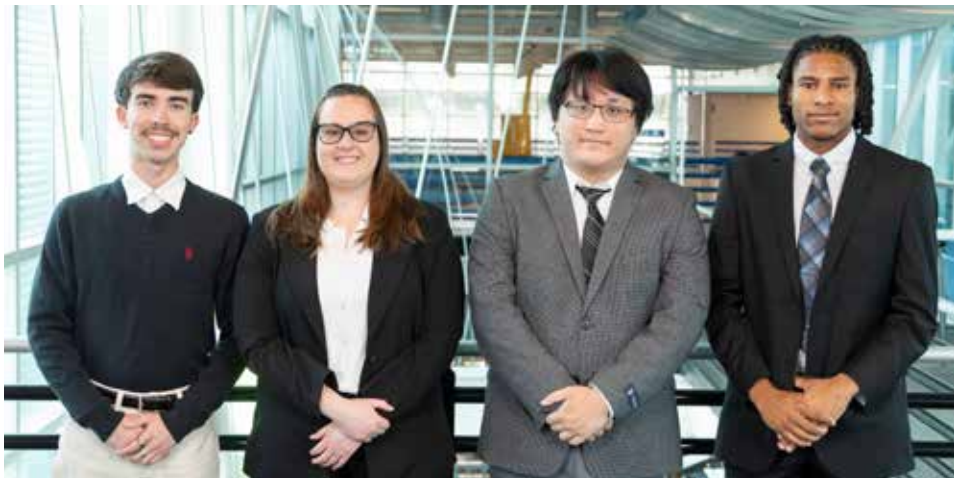
Sponsor
Florida Power and Light

Team 305: MLT Information Dissemination Project

Our project incorporated an interactive holographic display system designed to introduce students to the company Management Leadership for Tomorrow (MLT). We used the Pepper's Ghost technique to project a three-minute marketing video provided by our sponsor. This method created a hologram-like illusion and offered an engaging visual experience.

We strategically placed a piece of transparent material at an angle between the viewer and the video source. The video was projected onto this material, reflecting light to make the image seem to be in mid-air within the hologram box. This innovative use of reflection and perspective draws viewers in and captures their attention as they learn about MLT's mission and the Career Prep program.

A user-friendly touchscreen interface mounted on an adjustable arm accompanies the holographic display, which allows students to interact with the content. The entire system is mounted on a stable stand, making the educational tool accessible and engaging. The Pepper's Ghost illusion not only enhanced the visual appeal of the information but also helped invite students to envision their future success through MLT's programs.



Team Members
Noah Grant
Genevieve Cruickshank
Jeffrey Hung
Caleb Meriweather

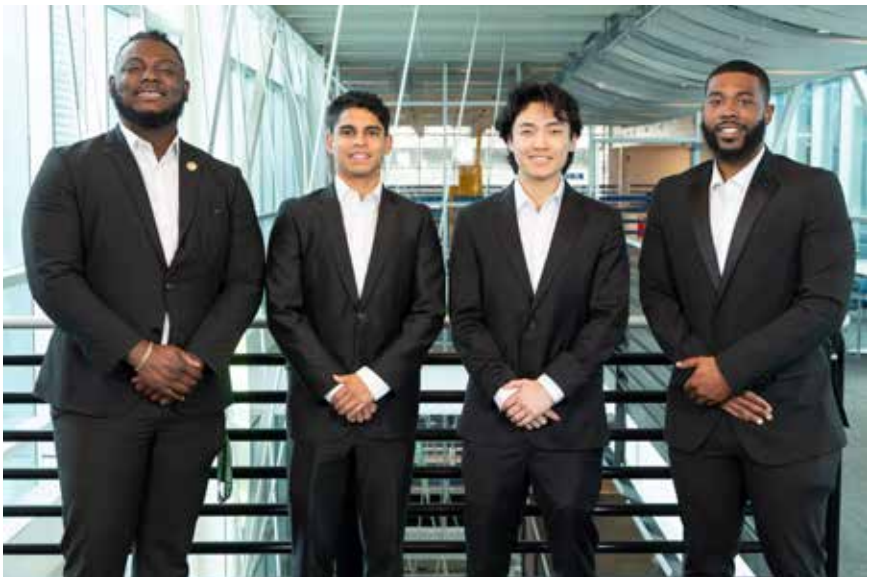
Advisor
Jerris Hooker, Ph.D.
Pairris Jones (MLT)

Sponsor
Management Leadership for Tomorrow

Team 306: Home Power Monitor

We focused on creating a cost-effective power monitoring system to help to lower electricity bills. We accomplished this task using sensors connected to a small computer inside a home's circuit breaker box, enabling us to track power usage within a house. Some of the challenges we faced included creating the software that runs the system and displaying the necessary information. Ultimately we ensured stable connections and addressed issues with input and output.

We developed a home power monitoring system that effectively gathers and presents real-time data on electricity use. The system provides insights into trends in individual appliances and total energy consumption. This encourages energy-saving behaviors and enables well-informed decision-making. By displaying what uses the most energy, our system allows users to make better choices regarding their electricity usage, which will save them money.



Team Members
Jamar Brown
Oscar Naranjo
James Kim
Deangelo Humphrey

Advisor
Omar Faruque, Ph.D.

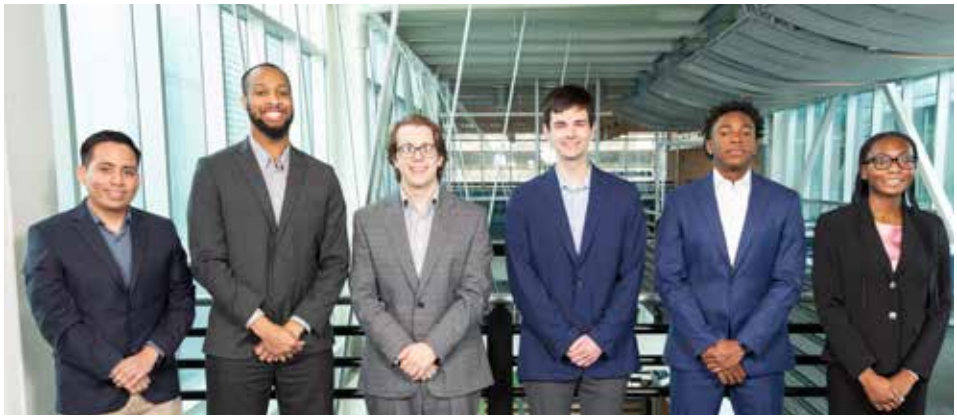
Sponsor
Talquin Electric

Team 307: IV Curve Tracer

Knowing the voltage and current of electronic components is important when working on engineering projects. IV (current voltage) tracers are tools used to measure voltage and current levels through electronic components over time. They can be used to evaluate the condition of a solar panel. Most IV tracers are expensive, limiting their use.

This project created an inexpensive IV tracer that mounts over a Keysight measurement equipment. We divided the process of making this tool into hardware design and software development. The hardware design included many test designs, resulting in a final board design that created an IV circuit. The software focused on making it user-friendly and sending the necessary signals to all the devices connected to the computer.

In the end, we built a device that measures standard electronic parts. When connected to a Keysight measurement equipment and a computer, the device displays the IV curve measurement on an app. The device is compact, easy to use, and accurate. The app is simple and shows the measurement of the tested device. The app can adjust the graph horizontally and vertically, display measurements over a desired current or voltage, and show different plots.



Team Members
Diego Abad
Charleston Andrews
Henry Degner
Daniel Corrar
Robert Bozeman
Oluwatomi Thomas

Advisor
Uwe Meyer-Baese, Ph.D.
Daniel Isin – Keysight

Sponsor
Doug Baney – Keysight Director of Education

Team 308: Fuel Pump Simulator Board

Our team was asked to redesign a printed circuit board (PCB) that was an older design and could not be controlled by a computer.

We needed to design a new circuit board that would be fully controllable through a computer and without a connection to a computer. The board would need to match all the functionality of the original board. Finally, a casing would need to be designed to protect the board. This redesigned board would be used to make testing other products easier. The board would simulate up to eight fuel pumps and the flow of fuel from them, allowing engineers to build tools to measure amounts of gas being pumped without needing to bring an actual fuel pump into their working environment. Our simulator design needed to account for a variety of situations, allowing users to work with imperfect fuel pumps.

We successfully created a Fuel Pump Simulator Board by crafting a parts layout, soldering them to a PCB and writing code that would be installed onto the board. We made an 3D-printed enclosure to protect the board from damage. After testing, we found that it functioned as intended. We created a functioning simulator board with the capabilities our sponsor needed. The board also had extra features the original did not have.

Team Members
Alex Papka
Yi Ming Huang
Levi Fincher
Adekunle Gbadamosi
Joshua Pierre-Louis

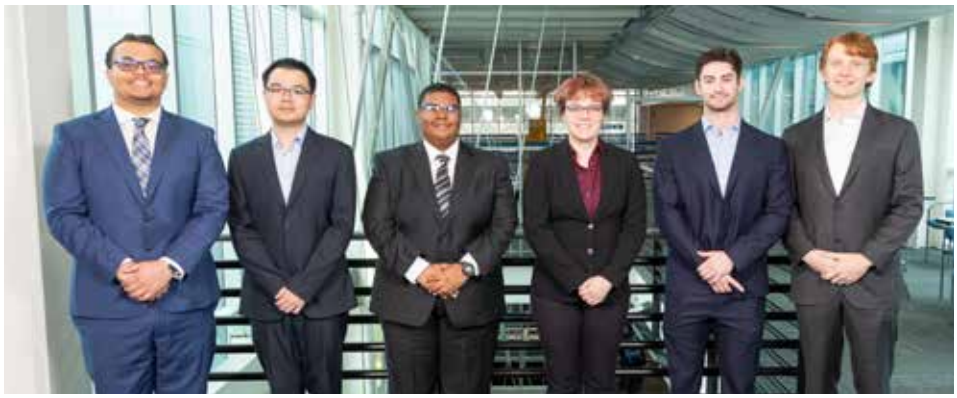
Advisor
Petru Andrei, Ph.D.
Mark Butsch
Brian Ruck
Daniel Copeland

Sponsor
Syntech Systems

Team 309: Automated Aquaponic Farm

As the climate changes and demand for food increases, we need modern approaches to farming. Our goal was to make an automated aquaponic farming system that uses Light Detection and Ranging (LiDAR) technology to track the plants grown in a small farm bed. A LiDAR sensor uses the pulse from a laser to create 3D models and maps of the objects around it.

We wanted to use this technology to measure and track the growth of plants in an aquaponic farm. We combined the VLP-16 LiDAR sensor with a Genesis farming robot tool called FarmBot that moves the camera around a planted area to take daily measurements. After collecting the data, we designed a system using Google Cloud and Python to store the data from the farm for future reference. We also used the data to make graphs of plant growth over time. In the future, this project could be scaled up to use in commercial farms to determine what plants are growing and track plant growth rate compared to previous seasons.



Team Members
Rahsaan Corbin II
Ngoc Duong
Shaylah Fleming
Julia Gonzales
Jared Hunter
Jack Mcauliffe

Advisor
Victor DeBrunner, Ph.D.
Jesse Edwards III, Ph.D.
(CIA Grant)

Sponsor
FAMU-FSU College of Engineering

Team 310: Biomedical Monitoring for Astronauts (BMA)

Spacesuit design is currently an active area of research. Engineers and scientists are always working to improve current and future missions in space. Working in a pressurized suit in outer space presents a range of challenges. These include monitoring the in-suit environment and the astronaut's health. We created a sensor system for monitoring an astronaut's health and in-suit environment. Our goal was to accurately measure critical metrics for research and safety purposes.

Our sensor system consists of three modules, the first of which is a set of environmental sensors for measuring CO_2 concentration, ambient temperature and humidity. To monitor astronaut health, we designed a set of biomedical sensors on the foot to measure heart rate, sweat levels and body temperature. Finally, a main processing unit reads and interprets sensor data. We designed and fabricated a custom printed circuit board to house the processor. The device can measure selected variables, store them locally and transmit the data to an external device. This project was a proof-of-concept design to monitor astronaut vital signs and the environmental conditions in a spacesuit. Our final deliverable serves as a prototype for a sensor unit that could be used during an extravehicular activity mission.

Team Members
Evan Cloutier
Austin Roberts
Jada Davism
Dallas Toth
Landon Hicks
Nicholas Billmire

Advisor
Babak Noroozi, Ph.D.

Sponsor
L3Harris

Team 311: Speak Simply AI (SSAI)

We set out to create a device that uses machine learning to perform language translation. Our goal was to create a tool that would teach non-STEM majors about how technology is used to translate from one language to another.

To build the tool, we chose hardware parts that work well together. The central processing chip provides the device with open internet access for real-time translations. The circuit board allows for flexible testing and organizing of parts. A user-friendly touch display allows for easy input and viewing of text, while a microphone allows for clear speech capture.

The "brain" of the device is the central piece of the project, thanks to its powerful yet easy to use features and ease of programming. Our device uses an AI model to perform text-to-text, speech-to-text, text-to-speech and speech-to-speech translation. We used an API (application programming interface), to deliver real-time translation to users. We reached our goal of teaching others how complex technology can be incorporated into everyday use. The project brings the wonders of AI and language translation closer to all students, no matter their background.

Team Members
Megan Brais
Jadarrian Brown
Joshua Brown
Sydney Dudek
Aireyona Mercer
Naela Luna

Advisor
Shonda Bernadin, Ph.D.
Lisa Ryoko Wakamiya, Ph.D.

Sponsor
Department of Electrical & Computer Engineering

Team 312: Drowsiness Detection Mirror

Hundreds of thousands of deaths occur every year due to drowsy driving. With assisted driving technology improving each year, reducing the tragedies of drowsy driving is becoming more likely. Our drowsiness-sensing rear-view mirror will enable car manufacturers to predict when the driver is sleepy and enable assistive driving features.

We used a radar system inside the mirror to record data from the driver. The radar emits a wave and calculates the driver's breathing rate and head tilt from the reflected wave. A slower breathing rate and a driver's head tilting down for an extended period suggests they are getting drowsy. The device uses signal processing to extract these physical signals. Next, the data is fed into an algorithm which predicts if the driver is falling asleep due to changes in their body. Once the algorithm estimates the driver is falling asleep, it alerts the vehicle's operating system to activate safe driving measures. We conducted tests at times when there is a high risk of feeling sleepy, such as at night. We used a chest belt to record breathing rate, while head angle was observed directly. Our mirror was able to detect drowsiness about a third of time. Since every person has unique sleep patterns, personal calibration could be introduced in a future design to adjust for this. Also, other factors that indicate drowsiness, like heart rate, could improve the accuracy of the model.

Team Members
Theodor Owchariw
Lucas Tores
Victor Bellera Tovar
Luke Forbis
Benjamin Covitz

Advisor
Bayaner Arigong, Ph.D.
Johnathan Casamayor

Sponsor
Department of Electrical & Computer Engineering

Team 313: Army Research Lab Web Interface

Our project addressed a challenge in the DEVCOM company involving a remote controlled drone. The initial interface for this drone developed in the DEVCOM lab was difficult to use and outdated. We wanted to create a simpler app using a different programming platform to produce a more user-friendly interface. We intended to achieve this goal by creating multiple web pages, each responsible for different functions of the drone. These improvements would enable easy access to essential information and allow the user to easily make software changes.

Our motivation was to relieve the burden on the DEVCOM lab and enhance overall company productivity. We were successful—we crafted a user-friendly interface, complete with a login page for added security. The interface allows employees from various departments, even those with limited knowledge in drone operations, to effortlessly perform required tasks.

By making the drone's basic functions easier to understand and use, we were able to create a simplified and efficient work environment. This project not only benefits individual departments but also contributes to the company's overall effectiveness. The simplified interface ensures that employees can access and operate the drone without complex training. This simplification allows for a more inclusive and productive workplace.

Team Members
Francisco Malave
Jose Hernandez
Ashok Phatak
Andrew Poirer
Yosuf Young
Anaice Soares

Advisor
Jerris Hooker, Ph.D.
James Humann, Ph.D.

Sponsor
NSIN

Team 314: IoT Battery-less Wearable Device

In the fast-paced world of technology, people were always looking for sustainable solutions. Using batteries in Internet of Things (IoT) devices caused big environmental problems, like pollution and resource depletion. We had a new idea: a wearable device that doesn't need batteries. Instead, it uses energy from the sun and heat from the body to work.

We wanted to make a healthcare device to be worn on the forearm. The device could monitor body temperature, heartbeat, and movement—all displayed on a phone.

We designed a system that could harvest energy from the sun and body heat to convert it into usable electrical energy that could power our device. To detect parameters of the human body, we used sensors which relied on this electrical energy to work. These sensors were then processed by a device that functioned like a human brain. We used a microcontroller to organize and control the various components. We assembled all the parts in a way that could be worn on your forearm that was aesthetically pleasing and ensured successful operation. We were driven by the need for sustainable IoT technologies. By harnessing solar and thermal energy, our device offers a renewable power source. Our motivation stemmed from a desire to create a greener future for the next generations.

Team Members
Ameen Babbs
Brock MacDonell
Ian Zegouros
Jimmy Croxton
Kevin Harvey

Advisor
Jinyeong Moon, Ph.D.

Sponsor
Department of Electrical and Computer Engineering

Industrial & Manufacturing Engineering

Senior Design

Members of Team 408 show off materials used in Lunar Regolith 3D Printing, their design project.

Team 401: Information System Design

We developed a comprehensive dashboard for Johnson & Johnson aimed at enhancing progress tracking within the company. By aggregating data related to profits & losses, absenteeism, overtime and training, we highlight discrepancies compared to the targets set at the beginning of each year. Given the scale of Johnson & Johnson, it is crucial to provide managers with a clear understanding of their control and the progress achieved or possible. Our solution not only ensures data integrity but also empowers managers with actionable insights.

Team Members
Angela Rada
Gabriel Parsonis
Trenton Tookes

Advisor
Ernesto Garcia, Ph.D.

Sponsor
Johnson & Johnson

Team 402: Solar Panel Design (Multidisciplinary Team)

Our project addresses NSIN/SOCOM's energy needs during their field operations. We developed a portable solar panel array that soldiers could swiftly deploy to harvest energy and power their tactical devices. The key requirements were portability, combat environment adaptability, immediate energy access, durability, pliability and stealth. Using materials that enhanced camouflage and heat dissipation, we limited the heat signature emitted by the array. Our solution not only increased energy independence but also contributed to operational stealth and adaptability.

Team Members
Karina Campos (IME)
Ricardo Jerez (IME)
Devin Lloyd (IME)
Rustam Horri (ECE)
Gerron Lewis (ECE)
Sean Morran (ECE)

Advisor
Ernesto Garcia, Ph.D.
Shibin Yu, Ph.D.

Sponsor
NSIN-SOCOM

Team 403: Carbon Nanotube Human Machine Interface (Multidisciplinary Team)

Our project demonstrated the utility of patented carbon nanotube sensor technology in the development of hand prosthesis for individuals. Our sensors are printable, low-cost and thinner than sensors currently on the market. We integrated multiple motion sensors into an ergonomic glove to detect the wearer's hand gestures through changes in electrical resistance. These sensors could be useful in the medical field for tracking rehabilitation progress in extremities or even controlling a robotic hand for those suffering irreversible hand damage.

While this project seemed relatively straightforward, there were many challenges to achieving the desired output gestures on the robotic hand based on the wearer's hand positions. To start, we had to design electrical filters to minimize noise and ensure accurate data was gathered from each motion sensor. The sensors had a very small strain range and detected tiny moves, so we had to design the glove needed to ensure that desired movements were detected. Furthermore, we had to program the robotic hand so that output movements correctly represented the user's movements. The results of this project could lead to great improvements in helping those with hand damage.

Team Members
Nathan Kulikowski (IME)
Ryan Kerbaugh (IME)
Riley Ostrander (IME)
Mason Finnell (ECE)
Phillip Robertson (IME)
Jordan McHardy (IME)

Advisor
Ernesto Garcia, Ph.D.
Joshua DeGraff, Ph.D.

Sponsor
HPMI

Team 116/404: Antibiotic Sensitivity

E. coli is a type of bacteria that lives in the intestines that is responsible for over eighty percent of urinary tract infections (UTIs). However other bacteria, such as klebsiella, proteus, and enterococcus can also cause a UTI.

The most common method of diagnosing UTIs is through urinalysis, urine culture and patient medical history. Both urinalysis and urine culture typically require 24 to 48 hours before bacteria can be identified and the UTI can be diagnosed effectively. In emergency UTI cases, general antibiotics are required before a lab-based diagnosis can be made.

Inappropriate antibiotic prescribing is somewhat common for UTIs, and as a result, bacteria can build resistance to antibiotics, rendering the drugs less effective. ViCell Rapid aims to rapidly detect antibiotic resistance in bacteria commonly found in patients with upper or lower urinary tract infections (UTIs), and therefore reduce the necessity of general antibiotics.

Team Members
Bryce Collier (IME)
Kenyon Graham (IME)
Sierra Broga (IME)
Sydney Carrow (BME)
Andrew Alagha (BME)
Skylar Klein (BME)

Advisor
Ernesto Garcia, Ph.D.
Stephen Arce, Ph.D.

Sponsor
Dr. John Sheele
Mayo Clinic, Jacksonville

Team 405: Protection Canopy for Military Operations

We worked with NSIN-SOCOM to develop a design for a durable and versatile camouflage canopy to integrate a solar panel under different environmental and operational conditions. After research and consultation, we provided recommendations for a prototype that can function efficiently under different scenarios using adjustable straps and hooks. This technology could be used not only to integrate solar power in military operations but also in civilian applications such as firefighting, camping and hunting.

Team Members
Silvia Garcia-Mayorca Paz
Laura Flores
Benjamin Peterson
Jackson Davis

Advisor
Meredith McQuerry, Ph.D.
Sherry Schofield, Ph.D.

Sponsor
NSIN-SOCOM

Team 406: Analysis and Improvement of Back-Office Operations

KLS Martin medical technology company working since 1896 to develop and market individual patient solutions. KLS Martin's individual patient solutions allow an intimate and personalized medical conversation between the patient and doctors. We worked with the KLS Martin team to thoroughly characterize, analyze and provide recommendations for implementing improved practices to enhance various back-office processes.

After touring the Jacksonville KLS Martin location, we used Microsoft Office dashboards to the decontamination process, Python scripts to the collections process, and a PowerBI dashboard to effectively measure warehouse worker productivity. We provided quick and accurate solutions, eliminating KLS Martin's bottlenecks in their back-office processes.

Team Members
Nicholas Herbst
Jose Diaz
Emilio Acosta Moran
Brayden Crews
Gregorio Correa Sanchez
Emma Blue Dee

Advisor
John Taylor, M.S.
Ernesto Garcia, Ph.D.

Sponsor
KLS Martin

Team 407: Patient Falls Reduction Analysis

Tallahassee Memorial Healthcare (TMH) is a private, not-for-profit community healthcare system comprised of a 772-bed acute care hospital, a psychiatric hospital, multiple specialty care centers, three residency programs, 22 affiliated physician practices and partnerships with various organizations. At the center of the healthcare system in Tallahassee, Florida is the main facility, Tallahassee Memorial Hospital, which serves as the major care center for the North Florida and South Georgia region offering an array of inpatient and outpatient services.

The hospital has more patient falls than the national average. We worked with the Tallahassee Memorial Hospital Performance Improvement division to improve the current patient fall prevention program implemented in their Orthopedic Unit. We took a Lean Six Sigma approach in our analysis to uncover the root causes for TMH's patient fall rate.

Team Members
Edgardo Olivares Posey
Andrey Rojas
Coby Barron
Lucas Deininger

Advisor
Arda Vanli, Ph.D.

Sponsor
Tallahassee Memorial Healthcare

Team 408: Lunar Regolith 3D Printing

With plans underway for establishing a crewed outpost on the Moon, the need for innovative construction methods is paramount, especially given the astronomical costs associated with transporting materials from Earth. The cost of launching payloads to the Moon using the Space Launch System (SLS), estimated at over $75,000 per kilogram, underscores the urgency for alternative, cost-effective solutions.

In-situ resource utilization (ISRU) and additive manufacturing (AM) using lunar regolith have emerged as promising avenues for sustainable lunar architecture and equipment production. ISRU presents a viable approach to leveraging local resources, in this case lunar soil and biologically available binders, urea, sodium alginate, and methyl cellulose, as a potential reduction of the reliance on Earth-sourced materials. Among the potential applications, lunar regolith-based AM technology offers a promising avenue for constructing habitation and equipment on the lunar surface since it is seen as a replacement for Ordinary Portland Cement.

This study examined the feasibility of laser based additive manufacturing for lunar applications, focusing on the utilization of lunar regolith as a primary material. Chemical and geological characteristics of lunar regolith, coupled with operational considerations for AM technology in lunar environments, are thoroughly explored. By assessing the viability of AM with lunar regolith, this study contributed to the development of cost-effective and sustainable construction practices for future lunar missions.

Team Members
Elizabeth Owojuyigbe
Anthony Psulkowski
Zaire Shaw
Isabella Sheffler

Advisor
Tarik Dickens, Ph.D.
Ernesto Garcia, Ph.D.

Sponsor
NASA Marshall Space Flight Center

Team 409: Radiation Testing Resistance for Hypersonic Flight Materials

Understanding the potential of advanced materials for hypersonic flight is crucial for pushing the boundaries of aerospace structures. The recent advances in this study show hybrid polymer composites improved resistance to high-energy radiation. Boron nitride (BN) stands out for its impressive thermal stability, high thermal conductivity and strong mechanical properties, making it ideal for hypersonic upthrust and re-entry applications. However, traditional thermoset matrices often suffer from chain scission, crosslinking damage and free radical formation when exposed to radiation, leading to reduced mechanical performance.

This study explores tailoring the mechanical response of BN/carbon fiber/phenolic composites to radiation by incorporating varied BN loading during manufacturing. We exposed samples to X-ray radiation, followed by an evaluation of their mechanical performance and microstructural evolution. Results show promising mechanical properties, and further testing was performed to assess the impact of radiation exposure on the material's strength and overall metrics.

Team Members
Kalea Gant
Tionci Greene
Kaiya LaRue
Jaylan Maddox
James Williams II

Advisor
Rebekah Sweat, Ph.D.
Tarik Dickens, Ph.D.
Ernesto Garcia, Ph.D.

Sponsor
Sandia National Laboratory, Los Alamos National Laboratory, HPMI

Mechanical Engineering

Senior Design

Team 502 designed, built, tested and launched these rockets as part of the AIAA NASA Student Launch competition near Kennedy Space Center in Titusville, FL.

Team 501: Tribometer in Spacelike Conditions

Tribometers measure several different quantities such as the coefficient of friction, the wear rate, the friction force and the normal force. For space exploration, tribometers must operate in space-like conditions—in a vacuum and in high or low temperatures and pressures. Tribometers exisit that can operate in these conditions, but they typically have long setup times and can only test one sample at a time. Testing more than one sample at a time is important to the aerospace industry because it saves time and therefore reduces costs.

We designed a tribometer model that decreases the setup time and is able to test more than one sample at the same time by having three miniature tribometers side by side. Our tribometer can test in space-like conditions and be both accurate and safe. This is a big step forward for tribological research. Our tribometer will help lead to the increase of high-quality aerospace components. This research increases the understanding of materials under space-like conditions. Overall, our tribometer will lead to the improvement and effectiveness of the aerospace industry and materials.

Team Members
Branham Channell (ME)
Javier Ibanez (ME)
Cobi Johnson (ME)
Madison Retherford (ECE)
Joshua Wesley (EE)

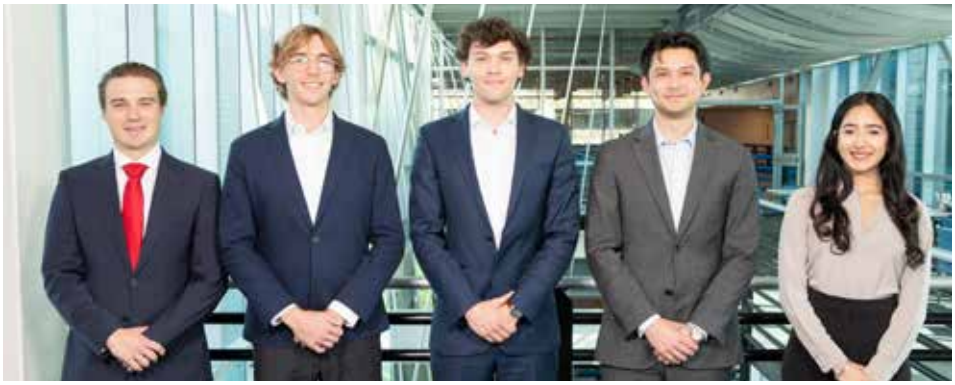
Advisor
Shayne McConomy, Ph.D.

Sponsor
3M

Team 502: AIAA NASA Student Launch

We aimed to qualify for the NASA Student Launch Competition. This competition is held annually in Huntsville, Alabama. We designed, built and launched a high-powered rocket to reach a height of 4250-ft and deliver a payload. The Zenith Program is a club tied to the AIAA.

To achieve a successful flight and recovery, we developed our full-scale rocket by running flight simulations, static testing and building a half-scale model to test the design in flight. Our rocket consists of three body sections and is designed for two separation events during descent. The rocket integrates fiberglass, aluminum, 3D-printed hardware, an off-the-shelf motor and flight computers to ensure peak performance. The competition challenges teams to explore different ways of independently landing a 5-lb payload without a parachute or streamer. In response, we designed a lander with a foam shell to absorb impact energy. Our primary focus is to set the base for our club by creating a new standard for competition qualification. We also want to build this base to carry on our work with future teams. Our rocket has a tail cone design aimed at reducing drag, and fin and nosecone designs to increase stability. As we navigated design corrections aligned with industry standards, we wanted to contribute data to NASA's Artemis program and to the search for practical high-power rockets by testing new design ideas and combinations.



Team Members
Nicholas Hux (ME)
Jacob Miller (ME)
Jacob Schmitt (ME)
Connor Zhou (ME)
Atzimba Avellaneda (CEE)

Advisor
Shayne McConomy, Ph.D.

Sponsor
Florida Space Grant Consortium (FSGC)

Team 503: Formula 1/10

We wanted to develop a chassis for a 1/10th scale self-driving racecar. We developed the chassis (frame) to package and protect various autonomous driving components. The components consisted of a depth sensing camera, a LiDAR (Light Detecting and Ranging) sensor, a computer which controls the car through a motor, a speed controller and a servo motor to steer the car. The frame also needed clearly defined metrics that affect how the car moves. The most important metrics were the center of gravity and moment of inertia.

One project goal was to protect the self-driving components in case of a collision. In the F1TENTH competition, the may can collide with the track borders or with other racecars on the track. The borders are made from plastic air ducts that can move in case of a collision. The competition also consists of a head-to-head race. For this, the frame needed to survive a collision with another car. However, autonomous collision avoidance was outside of the scope for the project. We designed the frame for a 70-mph impact survival tolerance. This only feasible if the car leaves the racing area but collisions in normal operation would not damage the vehicle frame.

Another goal was to limit the weight and height of the car for handling purposes. Limiting weight allowed the car to go around corners faster, while limiting height reduced the amount the car tilted outward while going around a corner, which would reduce traction. The distribution of the self-driving components was also important to the handling of the car. The placement of these components affected the center of gravity. If the center of gravity was too far off center, it caused one set of wheels to lose traction prematurely. This decreased lap times, which are important for performance in the competition.

Team Members
Aaron Hastie
Adam Imamura
Kyle Lozano
Alex Soriano
Ja'Quan Young

Advisor
Shayne McConomy, Ph.D.

Sponsor
RAS Lab

Team 504: Dialysate Water Filter

Our goal was to reuse wasted water by creating a cleaning filter for spent dialysis water. This is important because water wasted in dialysis is greater than 50 percent. Dialysis mimics the way the kidneys filter blood within the body. A dialysis machine must use ultra-pure water to prevent infection. Our sponsor provided the goals and targets for this project.

The filter attaches to dialysis machines in hospitals and treatment centers, cleaning enough water for dialysis to finish within 3 to 4 hours. We first run standard tap water through a reverse osmosis drinking water filter. Our custom filter then uses carbon nanotubes to remove unwanted particles from the wastewater to bring it up to "ultra-pure" quality. The filter membrane is a thin, black sheet made up of thousands of individual tubes which allow water molecules to pass through while the bigger molecules catch on to the membrane. The tap and wastewater move through this membrane to produce ultra-pure water. This clean water runs through the dialysis machine and the carbon nanotube filter again. To make sure the water is ultra-pure, it's measured for remaining total dissolved solids with a digital water quality testing pen. Disposable water quality strips measure the samples for metals or other chemicals. We took water samples and tested at two places. They're tested before and after the carbon nanotube filter to show if the water is clean. The total dissolved solids measurement meets the standards of ultra-pure water. The disposable strips results also met the ultra-pure water standards.

Team Members
Kencin Autry
Matthew Kennedy
Timothy Norman
Lapadre Proctor
Lily Thompson

Advisor
Shayne McConomy, Ph.D.

Sponsor
Apollo Medtech, LLC

Team 505: Wearable Fashion Technology

We were tasked with making a device to help search and rescue teams in situations where buildings have collapsed. We created a head-up display (HUD) that goes into a helmet. The display shows valuable information like the user's pulse, blood oxygen levels and harmful gases nearby. The helmet has extra components to ensure the user is safe in these tragic scenarios. We made sure all the electronic parts fit inside the helmet's frame but didn't compromise the user's comfort. These parts include a liquid-crystal display (LCD) screen on the brim, reflected onto the visor with a reflective patch to show the user their information. Other parts include a pulse oxygen sensor, lithium-ion battery, speaker for team alerts and a Teensyduino microcontroller. To make sure everything fit perfectly, we designed and 3-D printed the helmet ourselves. This gave us more control over component placement.

We had specific goals throughout the process. First, we wanted our device to work during long missions. Following our sponsor's specifications, we made our device work for 72 hours intermittently (about 3 days) and 18 hours without stopping. We determined device power needs and chose a suitable lithium-ion battery. This way, we would not need to fix it as often, and it could be used continuously.

In addition to our device, we made a system of gas sensors mounted to the user's body to warn about potentially dangerous gases in the area. Multiple sensors detect gases at different heights. Data is sent back to the HUD, where the status displays and rescuers in a building collapse scenario could easily know if there was a threat to their safety.

Team Members
Kartika Ahern
Eliot Hamilton
Malachi Johnson-Taylor
Patrick Molnar
Maxwell Orovitz

Advisor
Shayne McConomy, Ph.D.

Sponsor
CIA

Team 506: Wearable Gas Sensor

To address the need for search and rescue operators to be aware of the air conditions around them, we collaborated with the Central Intelligence Agency to design a wearable monitor that checks surrounding air composition for combustible gases. Existing gas sensors are typically handheld and limit the user's ability to use both hands during operation. Our monitor was engineered to liberate the user's hands, allowing them to choose how and where they wear it.

We split the project into two teams: the gas detection team (Team 506) and the display team (Team 505). Team 506 further split tasks into three main subsystems: the box, the sensor suite and the sensor integration code.

Our computer, voltage regulator and battery are housed in a water- and impact-resistant box designed with heat fins to cool the components. It is compact and lightweight, allowing the user to secure it anywhere on their body without obstructing motion. The sensor suite is connected to the box by a MIL-Spec cannon connector, ensuring a reliable connection.

The sensor can be positioned anywhere on the body, allowing the user to adjust its positioning for different scenarios and their own comfort. For the most accurate data, the sensors should be worn on the upper body when detecting lighter gases and on the lower body for heavier gases.

Effective communication with the display team was critical to project success; this is paired with the sensor integration subsystem. To ensure user safety, the monitor must provide the display team with accurate data of the surrounding air quality. The project is successful when both teams integrate the gas sensor into the wearable technology.

Team Members
Shawn Butler
Benjamin Labiner
Alex McIvor
Jane Nordhagen
Michaela Porcelli

Advisor
Shayne McConomy, Ph.D.

Sponsor
CIA

Team 507: Complete Composter

As our population grows, it is vital to improve the methods of reusing resources, leading to environmental and economic sustainability. Current practices of soil fertilization cause an endless cycle of increased strain on the ecosystem, expensive solutions to fix them, more farming regulations and higher prices for everyone. Food waste, an underused resource, is sent to landfills and produces harmful emissions. These issues can be solved by turning that waste into compost, a cheap natural resource. We set out to design an economic approach to composting that is both autonomous and accessible by anyone at any scale.

We wanted to make sure our device was not only efficient in producing compost, but one that consumers would enjoy using. Through surveys we were able get an understanding of what an ideal composter would be for people of all experience levels. Methods which make the process quicker, reduces odors, and assist with the environmental/economic goals required to live a sustainable life, were highly desired. With this data in mind, we analyzed the composting process in depth to find how to optimize the process.

Our device utilizes multiple sensors to accurately monitor every variable involved in the composting process (carbon, nitrogen, potassium, carbon dioxide emissions, etc.). From there, an automated system can rotate the composter or hydrate the material whenever the oxygen or moisture levels fall too low, keeping the compost in ideal conditions. This system improves the quality of the compost and lowers the barriers of entry for the everyday person.

While designed primarily with small scale gardeners and hobbyists in mind, this system can be scaled for larger industrial farming operations. This scaling up could reduce agricultural waste by 20% and provide natural fertilizer for future crops at no additional cost.

Team Members
Adam Comegys
Elias Haase
Bailee Ku
Benjamin Sayer

Advisor
Shayne McConomy, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 508: Engineering Serves

Beth-El Mission is a farmworker ministry in Wimauma, Florida. Their mission is to provide food for both food-insecure families and migrant farmworkers in their community. Our objective was to give Beth-El a solution for distributing their dried goods.

Beth-El has two key issues: lifting 50-pound bags of dried goods and giving out even amounts of food. Lifting these large bags of dried goods is an issue because most of their workers are elderly volunteers. Giving out uneven amounts of food can make the problem worse, and as a result, families may go without food. Some families rely fully on Beth-El's aid for their weekly meals, meaning they may go without food some days if the food quantities aren't consistent.

To solve these issues, we designed a two-system solution that targets the issues with Beth-El's distribution process. To resolve the lifting issue, we set up a lifting system allowing volunteers to easily lift and transport the dried goods. The updated distribution system allows Beth-El to have better portion control. This means that Beth-El can give out fairer portions of food. These solutions were assessed in simulated environments like those at Beth-El. Instead of designing these systems, they were bought from outside sources. This allowed the team to focus on the optimization process for Beth-El, rather than the design of the physical items.

Besides the main concerns of lifting and distribution, Beth-El also wanted to keep a community environment for their volunteers because they are worried that reducing the community environment will lead to a reduction in volunteers. The solution is to place several volunteers at every station. This will allow them to converse easily, meeting Beth-El's desire for a community focused environment.

Team Members
Alejandro Bendeck
Adrian Canepa
Cody Hayward
Jared Sizemore

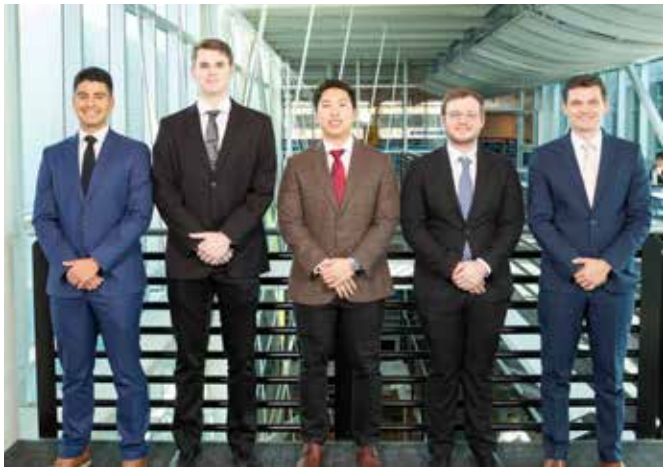
Advisor
Shayne McConomy, Ph.D.

Sponsor
FAMU-FSU College of Engineering

Team 509: Mylar Sticker Debris

Corning Inc. is a ceramics company that makes diesel particulate filters. These filters are very brittle throughout the manufacturing process. These filters are picked up by a robot tooling and centered on a table, which is called the justification process, before being partially filled with cement. When the robot is completing the centering process, the tooling repeatedly grabs and releases the filter. As it releases, debris from the outer layer of the part falls onto the pattern sticker, which is used to create a seal with the robot tooling. This debris creates a problem for the filling process, due to the seal being compromised by the debris.

We created a design to catch the debris before it falls onto the pattern sticker. As the robot encloses the filter, our design covers most of the quarter-inch gap between the robot's tooling and the filter. The debris then falls from the filter onto our design, keeping it away from the sealing zone on the pattern sticker. Our design is a simple and effective solution within a complicated manufacturing process. It has no moving parts and employs a minimum amount of materials, lowering the cost of the entire design. Our design's effectiveness is proven by its ability at catching debris and ensuring a proper seal between the tooling and the sticker.



Team Members
Anthony Arroyo
Austin Cramer
Khanh Nguyen
William Shuman
Nathan Thompson

Advisor
Shayne McConomy, Ph.D.

Sponsor
Corning

Team 510: IGV Testing Fixture

Compressors are mechanical machines that capture the surrounding air and store it in a tank. The compressor's inlet guide vane contains seven blades that open and close. These blades regulate the inlet airflow. Occasionally, these blades may fail to open or close.

We aimed to develop a tool to check the proper work of two out of seven inlet guide vane blades for Danfoss Tallahassee campus. Our test apparatus employs two lasers and two receivers, assigned evenly across two blades. Placement of lasers and receivers precisely show whether a blade opened or closed. The laser aims at the edge of the blade to ensure proper coverage. To prevent damage to the sensors, we created an acrylic cover to store them safely.

We devised a method to test steel ball motion, showing compressor blade status. A magnet causes the ball to move. Magnetic sensors measure the magnet's strength for moving the ball. For testing, sensors at the housing ends assess if the inlet guide vane running status as the tool works. Finally, the fixture records and tracks each tested inlet guide vane's color. We selected steel and aluminum for their strength and resistance in a manufacturing environment. Our testing fixture created for Danfoss a method to confirm each inlet guide vane assembled. During the assembly line, the inlet guide vane could prevent problems having faulty parts. This tool could test those parts to make sure it is working properly, that prevents future problems down-the-line when the complete compressor undergoes testing. A piece of acrylic will cover the top of the receivers to withstand scratches and impacts.

Team Members
Joseph Bechara
Hunter Dabbs
Tye Fountain
Thiago Rufato Todesco

Advisor
Shayne McConomy, Ph.D.

Sponsor
Danfoss Turbocor

Team 511: Honing Cooling Process

In response to the need for a cooling procedure for shaft bearing assemblies following the honing process, we developed a solution that meets production rate and supports customer demand. Our primary objective was to identify and develop a creative cooling approach for shaft bearings during the assembly phase. We developed useful solutions, leading to creating mechanical designs and a refined control plan.

We designed a conveyor belt, a key step forward in the study of cooling and production of bearings. After refining the bearings by honing and heating them to a temperature of three hundred degrees Celsius using an induction furnace, a machinist places them onto the conveyor belt. In the cell are three conveyor belts rotating the bearings around. The belts are laid out in a U-shape to maximize space and ensure the bearings return to the operator. A bumper guides the bearings as they transfer onto each belt. Motor driven fans will be installed above each conveyor belt. They will evenly spread direct airflow, reducing the time needed for the bearings to cool down. This consistent cooling is important for preserving the bearings' reliability and functionality for assembly. The belts will run at a specific speed to give the bearings enough time to cool to a predetermined temperature. Once the bearings reach the desired temperature. They gently transfer from the conveyor belt onto a ball bearing transfer table. This table organizes the bearings based on their completion order. This automated method improves efficiency and reduces the risk of disorder. This method of organization simplifies the workflow. It promotes the retrieval and further processing of bearings. Proper incorporation of this method ensures a productive, organized, and improved cooling for shaft bearings.

Team Members
Drake Bishop (ME)
Evan Gonzalez (ME)
Carly Tabares (ME)
Eljin Rhymes (IME)
Peter Varjasi (IME), *Not Pictured*

Advisor
Shayne McConomy, Ph.D.

Sponsor
Danfoss Turbocor

Team 512: Mini-TT Shaft Stub Bearing Press

We worked with Danfoss to upgrade their Mini-TT shaft bearing press to accommodate various types of shafts and bearings. We met with Danfoss to learn their customer needs and understand how the existing press works. After brainstorming sessions, we formulated solutions to Danfoss's existing problems. We created key goals from the targets and metrics to decide on a new press design. Our focus was to add safety features to allow for a safer and more user-friendly press while maintaining the same pressure and function.
To meet the design constraints and budget, we upgraded the existing press by redesigning a new frame with a larger work area. For function, we made the press taller to account for the new shafts that will be placed in it. To ensure user safety, we upgraded the the press shield from plexiglass to a wire mesh steel cage. As a long-term solution, we suggested a 20-ton hydraulic press with a larger work area and increased stroke.

We gave Danfoss a quote and outlined specifications of the new desired press. In 2025, Danfoss will order the new press we recommended. During this project, we learned how to adapt to unexpected challenges and find creative solutions to problems on the fly. The project shows the importance of clear communication and teamwork within a group setting. We implemented our understanding of various subjects, such as mechanical systems and thermal fluids. Doing so, we were able to create a working press for Danfoss.

Team Members
Cassie Bentley
Clark Cooley
Colby Gullo
Brent Mynard

Advisor
Shayne McConomy, Ph.D.

Sponsor
Danfoss Turbocor

Team 513: Automated Shaft Flux Measurements

Danfoss Turbocor makes compressors for use in various applications. These compressors spin blades using a special magnetized shaft to cut down on friction. Assessing the quality of the magnetized part is tricky and needs too much manual work. Therefore, Danfoss asked us to create a device that can automatically read the magnetic flux, which is a measure of the total magnetic force that passes through the shaft.

The device nickname is the AFR (Automated Flux Reader), and it is designed to measure the magnetic flux of the shafts automatically and precisely. For Danfoss this project frees up workers, lowers production errors in the shafts, and saves money.

The AFR is an electronic device with two main duties. These are to use a fluxmeter sensor to measure and record the flux of the shaft's magnetic region. The AFR secures the shaft in a horizontal position while spinning it using a motor. Then, the flux sensor travels the extent of the shaft using a linear rail and a second motor. The spacing between flux measurements is, at most, five millimeters apart. A programmed controller manages the electronics' tasks to get flux measurements over the shaft's magnetic region.

The AFR helps Danfoss test shaft quality in a much easier way than previously done. It also gives more reliable data than before by removing human error, making measurements more precise and consistent. Additionally, AFR is easier for users because they only need to set the needed measurements for testing at the beginning and load the shaft. Then the AFR will automatically plot the data onto graphs on a computer. The Automated Flux Reader will continue to help Danfoss with improving their shaft designs for years to come.

Team Members
Andrew Atallah
Sean Hemstreet
Joshua Huls
Liora Louis

Advisor
Shayne McConomy, Ph.D.

Sponsor
Danfoss Turbocor

Team 514: Robot to Traverse Uneven Terrain

Dow Inc. is a company known for producing polyurethane, rubber and acrylic acids. Producing these materials creates toxic gases that can cause explosions and chemical fires. To uphold safety standards, Dow sends employees to inspect and repair pipes used for production. This task has put workers at risk of toxic gas exposure, which can lead to fainting or death. We aimed to reduce the risk of worker harm as they perform inspections and repairs.

To help workers safely perform these tasks, we designed a robot named Luffy that can do this dangerous work instead of a human. The worker will have a controller that controls Luffy's tank tracks and a telescoping arm that helps Luffy climb up or down a pipe by constantly pressing against the pipe wall. The robot body holds three gas sensors and two wide-angle cameras. These parts should allow the user to inspect cracks and gas levels inside a pipe without exposing the worker to a toxic environment.

There were several constraints for Luffy's design: it must fit within different pipe sizes, move using a remote control and use sensors to detect gas leaks. With our design, Luffy successfully moved through pipes and climbed areas with 45- to 90-degree inclines. Luffy's cameras successfully livestreamed video to a computer screen with minor delay. Also, the gas sensors reported accurate air quality levels to the user through Wi-Fi. We created a successful design that can help identify basic inspection targets like gas leaks and pipe cracks.

Team Members
Carson Clark
Roshard Jackson
Geraina Johnson
Jacob Larkins
Katherine Lopez
David Ramos

Advisor
Shayne McConomy, Ph.D.

Sponsor
Dow, Inc.

Team 515: Bearing Part Painter

Our sponsor, JTEKT North America, asked us to create an automated bearing retainer painter. JTEKT makes needle roller bearings that visually look similar but serve different purposes. For this reason, they need to paint the retainers for easier customer identification. Currently, they apply Dykem, the layout pain, by hand—a tedious effort. We created a machine that accurately paints a stripe of Dykem, centered around the outside diameter of the bearing. The machine is adjustable for bearing retainers between 7/8 inch to 2 ½ inches in outer diameter. Our machine decreases the company work hours devoted to painting the bearing retainers, which allows employees to focus on completing other tasks.

We defined three main systems in the project: part intake, part painting and part dispensing. Our part intake method uses a hopper that the user hand-loads, which funnels into the part painting system. The dispenser creates a pause between parts when moving them to the painting system, preventing the machine from backing up and failing. The painting system consists of a conveyor belt that rotates the bearings while the paint applicator precisely contacts the section of the bearing retainer. Following the painting, the machine moves the parts to a container for drying.

Our machine is versatile, allowing for different bearing sizes and colors of paint to be used. The machine is also durable, with a frame made of 80/20 aluminum extrusion. The machine fits under a fume hood, limiting the user from Dykem fumes. Overall, our project successfully achieves the goal of quickly and efficiently painting the bearing retainers.

Team Members
Mason Gibson
Wesley Jean-Pierre
Maximilian Jones
Andrew McClung
Anthony Wuerth

Advisor
Shayne McConomy, Ph.D.

Sponsor
JTEKT North America

Team 516: Compact Suture Device

Medicine has seen tremendous advances in the past centuries, while suturing techniques and instrumentation have largely remained static. Suturing consists of physicians and other healthcare providers manually driving a needle with a thread through both sides of an open wound for approximation. This technique has proven to be the most effective at closing wounds and involves several tools including the use of a needle driver, toothed forceps, scissors and multiple needles and threads, which can be physically tasking and time-consuming. At the end of a surgical procedure, suturing a wound may take anywhere between 30-45 minutes depending on the size of the wound, while operating rooms in the United States may range anywhere from $400-$6000 an hour. Automating the suturing process can ease the mental and physical strain on healthcare professionals and can reduce the overall time and cost spent suturing.

To optimize surgical efficiency and promote cost-effectiveness, we developed a compact wound closing device to enhance the suturing process during medical procedures. To improve the suturing process, we analyzed three components: a needle puncturing the skin, a knot tying mechanism and device ease of use. To drive the needle through skin, a mechanism comprised of a set of gears pushes the needle along a track. For knot tying and increasing ease of use, the device has a disposable part that comes with a pre-loaded suture. The pre-loaded suture has four pre-looped loops. The loops are pushed out into the path of the needle so it is hooked, and the surgeon pulls the suture to secure the knot. Additionally, the disposable part can snap on the pen, further increasing usability.

This device produces a consistent output along the wound, decreases time spent in surgery, and improves the physical and mental fatigue of the healthcare professionals, while targeting surgical precision and effectiveness.

Team Members
Solomon Andrews
Andres Lopez
Charles Partin
Justin Simmons
Jake Wass

Advisor
Shayne McConomy, Ph.D.

Sponsor
Mayo Clinic

Team 517: Cardiopulmonary Stress Test

During the COVID pandemic, the Mayo Clinic of Florida closed its cardiopulmonary testing facility, where technicians perform CPETs (Cardiopulmonary Exercise Test) on patients. During a CPET, patients ride a bike or run on a treadmill to maximal exercise and are completely exhausted. This test demonstrates how well the heart and lungs work together and separately in the patient. The lungs release more particles and likely any potential virus particles as their breathing becomes faster and deeper with more strenuous exercise. Any potential viral emission put others in the room at danger of becoming sick.

An important part of the CPET is the patient face mask, which contains sensors that measure gases, breaths and other physiologic functions. These sensors transmit data to a computer that create graphs which is interpreted by the physician to determine the patient's heart and lung health. We created a new mask attachment that allows the patient to breathe normally through the mask while particles are filtered out of their breath. Normally, the patient must breathe in and out of the same hole, but our attachment has separate ports for inhalation and exhalation, as well as a one-way check valve. This check valve closes the inhalation hole and allows the patient to breathe out only through the exhalation hole, which contains the filter material. Using two ports in the design makes patient breathing easier and reduces stress on the filter material. This design also minimally affects the patient test data, which allows the physician to make the correct diagnosis. Adding filter material to the mask attachment prevents viral particles from entering the air, making CPETs safe to have with contagious patients.

Team Members
Diego Del Real Ramos
Zachary Fletcher
Jai-Lynne Sosa-Gagni
Alexander Urschel
Abigail Williams

Advisor
Shayne McConomy, Ph.D.

Sponsor
Mayo Clinic

Team 518: Powder Removal in Microgravity Environments

Our goal was to develop an effective way to clean parts in low gravity. Selective laser melting is a 3D printing method that uses a laser to melt metal powder. Powder placement and heating occurs layer by layer until the part finishes. This leaves extra metal powder on the finished part. Cleaning the surface with a traditional method works but removing powder from inside the part is difficult. Powder becomes stuck inside the part and can prevent intended use.

Holes in a design can hold the powder causing issues such as added weight and blockages. The powder can stop parts from working correctly and damage can occur when a part is used with powder inside. Metal powder is also an extreme health and explosion hazard, so it requires containment to prevent injury or harm. The powder has the capability to float in low gravity, increasing these risks. Cleaning methods such as sandblasting and brushes clean the part well but use gravity to work. We developed an ultrasonic cleaning bath for use in low gravity. We chose ultrasonic bath for its cleaning and automation possibilities. We also designed a method to measure parts cleanliness. This project is unique because it uses a pump to fill the cleaning chamber, first with cleaning fluid and then air pumps in to remove the water, drying the part. This method allows the design to work in low gravity. Our design cleans parts without user intervention, providing industries with automatic cleaning and the ability to clean in low gravity.

Team Members
Cole Daly
Kyle Evans
Alexander Fryer
Chelsea Kiselewski
Tripp Lappalainen
Lauren Mcnealy

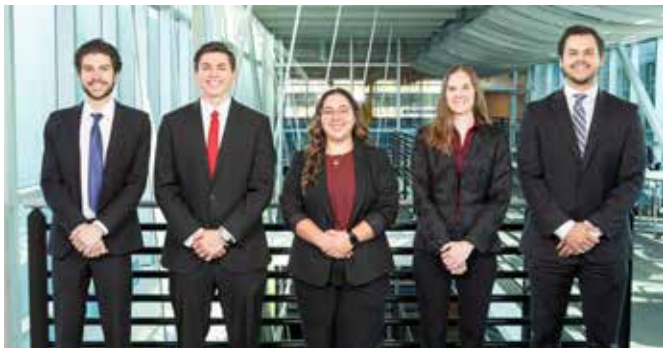
Advisor
Shayne McConomy, Ph.D.

Sponsor
NASA - MSFC/JSEG

Team 519: Retaining Water Ice in Regolith at Vacuum

Funded by NASA, our project goal was to design a test fixture that would mimic the space environment on the Moon's surface. Space is a vacuum, where pressure is zero and temperature is below zero in the Celsius degree range. Regolith, which is soil on the Moon's surface, contains 95% dirt and 5% water (as ice). NASA wants to extract hydrogen and oxygen from the water in the regolith and use it to make spacecraft fuel. This would allow spacecraft to refuel while in space and increase the travel duration. Earth is warmer than its Moon, so the test box first needed to cool down the regolith. To do this, liquid nitrogen slowly dripped onto the soil and expanded into a gas. This expansion occurs because the surrounding temperature is warmer, so the liquid nitrogen evaporates. Then the nitrogen gas flowed through the soil. Liquid nitrogen also flowed through two plates to conduct heat from the sides. We used temperature sensors to measure the temperature at various locations throughout the soil. To achieve water content, we evenly mixed water with sand and used moisture sensors at several places to measure how much water was still present in the dirt. This was important because the water would also evaporate out of the dirt. To reach vacuum pressure, we placed the test box inside NASA's vacuum chamber and pumped it down.

The project was important because it allowed NASA to perform tests on the regolith with realistic conditions to achieve the most accurate data possible. This will help NASA develop and improve technology for space travel to the moon, and space exploration to other planets in the future.



Team Members
Kevin Hernandez Lichtl
Luke Leibkuchler
Katherine Mesa
Megan Reid
Trent Walker

Advisor
Shayne McConomy, Ph.D.

Sponsor
NASA - MSFC/JSEG

Team 520: Actively Sealed Cryogenic Coupler

The connection between a fuel depot and space vessel is secured with a coupler that prevents leakage, limits boil-off and protects cryogenic fuels. NASA relies on effective coupling to supply cryogenic fuel to space vessels to continue deep space exploration. Through collaborations with industry professionals, we designed, modeled, built and tested a cryogenic coupler to facilitate a successful connection for fueling. We optimized the seal locations to decrease leakage and boil off, which is the main weakness of current designs. The coupler will be actively sealed, meaning that it is always closed except when the halves come together to allow for fuel transfer. We researched the materials used on the coupler for their unique properties: stainless steel for its strength, machinability and thermal properties, Teflon for its resilience at cryogenic temperatures, and Omniseal® 103A for its effective sealing in current NASA applications. We selected affordable spring-energized seals that resemble the Omniseal's properties for this project. We conducted a water leakage test to improve the coupler design before cryogenic fluid testing and used environmental correction factors to obtain flow/leakage rates. Testing using liquid nitrogen allowed us to check the effectiveness of our springs and seals at low temperatures.

Our testing confirms the coupler can be used in deep space missions or applications involving cryogenic fuel transfer by minimizing leakage and maximizing lifetime. By maximizing the fuel transferred, NASA is now saving on the cost of fuel lost during the connection process to leakage and boil-off. The coupler's ability to retain fluid at the ideal temperatures confirms our finalized design results in an improved coupler.

Team Members
Jason Goldstein
Lauren Roche
Sean Rodney
Valerie Rodriguez
Nicolas Sgammato

Advisor
Shayne McConomy, Ph.D.

Sponsor
NASA - MSFC/JSEG

Team 521: RoboBoat

The RoboBoat competition, an annual event joining teams from across the globe, challenges them to navigate their robotic boats through an obstacle course. The tasks within these courses change each year.

Our boat hull was an improvement of the FSU Panama City team's 2019 hull, with reinforcement placed to support weight. We focused on developing electrical parts, specifically the navigation system, and aimed to make it easier for future teams to use and adjust depending on their needs. The apparatus follows the competition safety standards and has flexible code that works with different sensors and motors. The vehicle is also able to sense and navigate on its own. The code used to operate the boat is well documented for the future teams to build from.

The safety standards call for the boat to have a physical and remote kill button and to waterproof electrical parts. To do this, we created an on-board kill switch (a big red button). There is another button on a remote control that turns off the power from far away using radio signals. These kill switches instantly shut down all power going to the components throughout the boat in case of emergencies. A rubber seal added around the edges of the hull protects the electrical parts from water. For power, two batteries provide the charge. Using these components, the boat is able to navigate precisely to certain spots, identify obstacles ahead and steer clear of obstacles met along the way.

Team Members
Ivanna Caballero (ME)
Andly Jean (ME)
Nicholas Norwood (ME)
Makenzie Wiggins (ME)
Sophia Barron (EE)
Michael Fitzsimmons (EE)
Lucca Meyer (EE)

Advisor
Shayne McConomy, Ph.D.

Sponsor
Naval Surface Warfare Center

Team 522: Manufacturing Device to Promote STEM Engagement

Rockwell Automation, an industry leader in technology services, asked our team to produce a system demonstrating the steps of automated manufacturing to K-12 audiences. The mission is to educate students about the manufacturing process and engage students in STEM (Science, Technology, Engineering or Mathematics) topics.

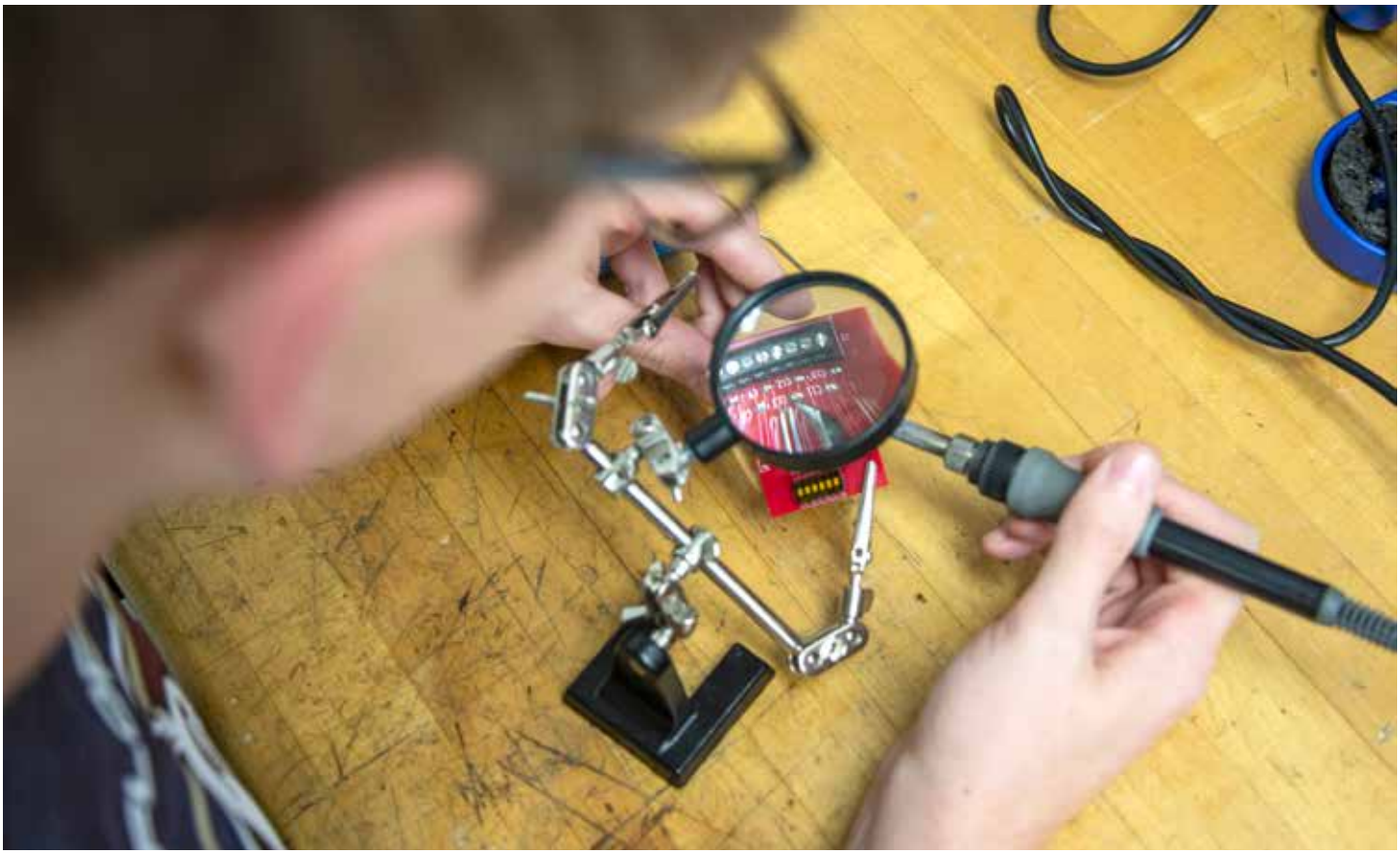
We designed a system that builds a decorative metal button. We chose this end product for its ability to demonstrate various manufacturing stages. We aimed to have the system produce one pin per minute and provide safe viewing by children. We also wanted it to engage audiences by encouraging interaction. Our end goal was to produce a system that Rockwell would be proud to showcase and use for engaging the public in automated manufacturing.

Our manufacturing system consists of stations showing different processes related to common steps in manufacturing. One such step is user personalization where a student can insert a unique design into the system. The system uses a visual sensor to check if the design fits the preset rules, demonstrating the system's ability to quality control its inputs and outputs, a fundamental step in the manufacturing process. The system can display the various steps of manufacturing on a screen at the same time as the machine is processing the metal pin, keeping the user engaged by describing each step of the process. The design uses computer-aided design and testing software such as CAD and emulate3D to test the efficiency of the manufacturing process. The physical model uses Rockwell hardware alongside other parts.

Team Members
Luis Garcia (ME)
Chloe Keiran (ME)
Caleb Mears (ME)
Maria Rojas (ME)
Mark Hanna (EE)
Caden Schwartz (EE), *Not Pictured*

Advisor
Shayne McConomy, Ph.D.

Sponsor
Rockwell Automation



Senior Design Teaching Faculty and Professors

Stephen Arce, Ph.D.

Ernesto Garcia, Ph.D.

Jerris Hooker Ph.D.

Sean Martin, Ph.D.

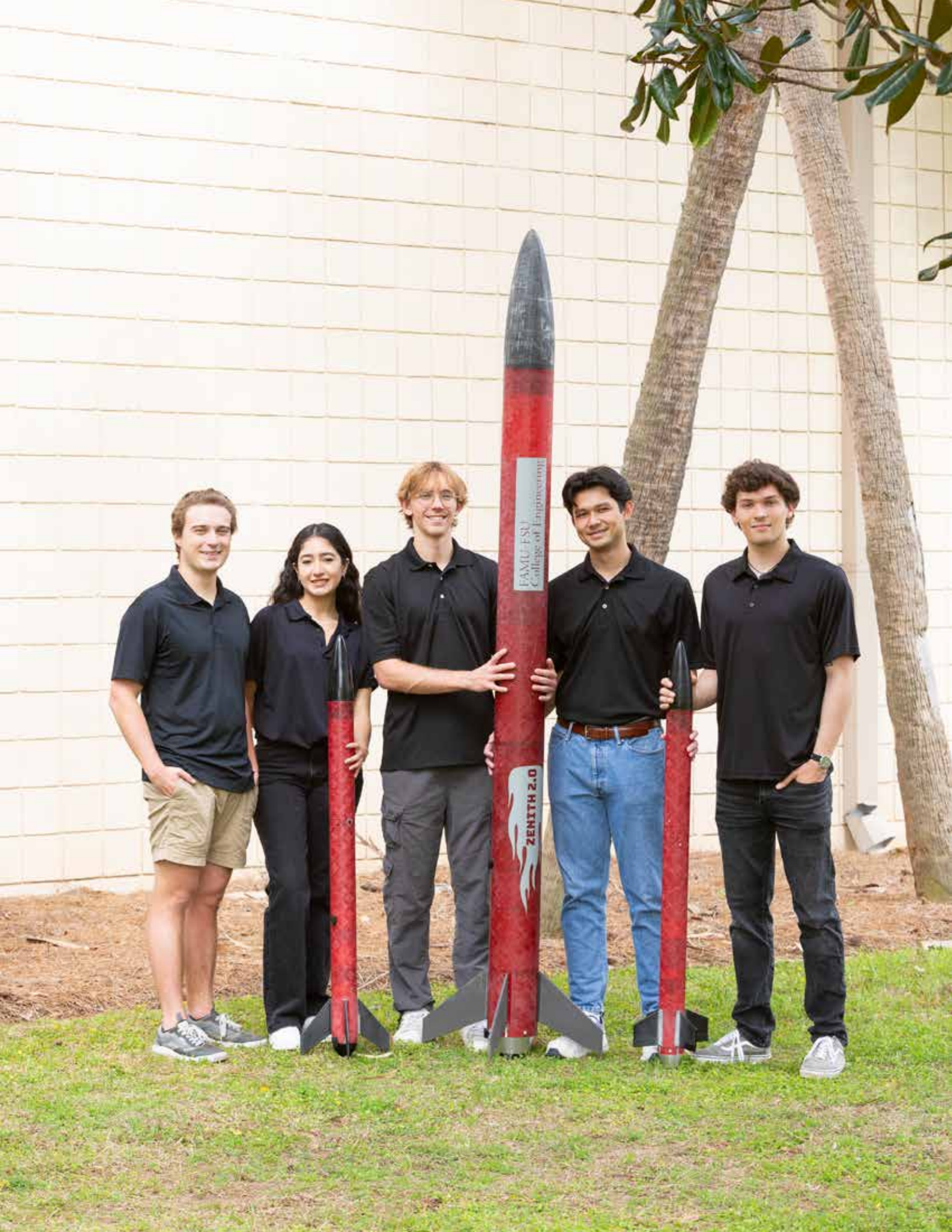
Shayne McConomy, Ph.D.

Robert Wandell, Ph.D.

2024 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.

3M
Alabama Department of Transportation
Apollo Medtech, LLC
Atwell LLC
Barkley Consulting Engineers, Inc.
Biosense Webster
Chipola Engineering Group
CIA
City of Tallahassee
Corning
Jim and Sandra Dafoe
Danfoss Turbocor
DHM Melvin Engineering, Inc.
Dow, Inc.
Eutaw, Inc.
Exactech, Inc.
Florida Power & Light
Florida Rural Water Association
Florida Space Grant Consortium (FSGC)
Dr. Nick Gregory
Gutteridge Haskins & Davey
Halff Associates
Hanger Clinic Tallahassee
High-Performance Materials Institute (HPMI)
HNTB
H.W. Lochner
Intel
JTEKT North America
Jacobs Engineering
Johnson & Johnson
Keysight
Keeve Mckee Engineering
KLS Martin
L3Harris
Charles R. Lindholm
Los Alamos National Laboratory
Magnolia Engineering
Management Leadership for Tomorrow
Mayo Clinic Jacksonville
Mead and Hunt
Michael Baker International
Moody Air Force Base
Moore Bass Consulting, Inc.
Bruce Morrison
Christina Morrow
NASA
NASA - MSFC/JSEG
National Stormwater Trust, Inc.
Naval Surface Warfare Center
NSIN-SOCOM
NSWC
Jordan Rigsby, DMD
RAS Lab
William C. Rickles
Roark Dental Corporation
Rockwell Automation
Katherine Rosario
Rachael Rosko
Sandia National Laboratory
Sarasota County Transportation Planning
Brett Scharmett
Stantec
Syntech Systems
Tallahassee Memorial Healthcare
Talquin Electric Cooperative
Texas Instruments
Urban Catalyst Consultants
VySpine
WGI


FAMU-FSU
College of Engineering
ZENITH 2.0

FAMU-FSU College of Engineering

2525 Pottsdamer Street
Tallahassee, FL 32310
www.eng.famu.fsu.edu

One **college,**
two **universities,**
unlimited **opportunity.**

The FAMU-FSU College of Engineering is the joint engineering institution for Florida A&M and Florida State universities, the only such shared college in the nation. We are located less than three miles from each campus. After satisfying prerequisites at their home university, students learn together at the central engineering campus with its adjacent, associated research centers and a national laboratory.