College of Engineering and Computer Science
UNIVERSITY OF CENTRAL FLORIDA

Spring 2019
SENIOR DESIGN SHOWCASE
Monday, Nov 25
10 a.m. - 3 p.m.

Harris Engineering Center, Engineering I and II Buildings
UCF Main Campus

Schedule

Showcase of Projects **10 a.m. – 3 p.m.**
Engineering I Atrium
Engineering II Atrium
Harris Engineering Center (HEC) Atrium, Room 101 & outside

Featuring 70+ projects made by collaborative teams of graduating seniors in the following disciplines: aerospace engineering; computer engineering, computer science, electrical engineering, industrial engineering, mechanical engineering, and photonics.

Awards Reception **3:30 p.m. – 5 p.m.**
Engineering II Atrium

Enjoy refreshments as UCF engineering and computer science alumni volunteer judges from industry recognize the top projects in each discipline, the top multi-disciplinary project and Best-In-Show. Presented by the CECS Alumni Chapter.

Table of Contents
for Project Summaries and Table Locations

PROJECTS INVOLVING MULTIPLE DISCIPLINES

CO2 Emissions Management Tool for Mitsubishi Hitachi Power Systems
Engineering II Table 85 A&B

Majors: Computer Science; Industrial Engineering; Mechanical Engineering

A user-friendly, easy-to-read system that monitors CO2 emissions of power turbines to help achieve environmental regulation compliance goals. The system displays real-time data of different components of the power plant in a series of charts and graphs for mobile and desktop viewing, offering plant operators up-to-the-minute data on emissions in a simple and understandable interface. This project serves as an improvement to the client's current monitoring tool that only displays raw data.

Spider Robot Duct Inspection for UCF

Majors: Computer Science; Mechanical Engineering

Teams were tasked with building autonomous robots small enough to traverse through the HVAC systems of UCF buildings, with the goal to map the duct systems and view any leaks in the HVAC system using a camera mounted on the robot. This project will help UCF Utilities and Energy Services reduce the cost of updating outdated duct system maps. Many buildings were built decades ago and over time the original drawings have been lost or not created accurately. Many building renovations are not reflected in current duct maps. The robot moves using electric motors and a track system similar to a tank. To traverse vertical sections, a second set of tracks mounted at the top will extend upwards and tension out against the walls. A LiDAR system creates 3D map of the ducts, with continuous scanning that records where each duct wall is. A thermal camera may be used to notice variable spikes in temperature of the ducts.

Black Team: **HEC Table 36** Blue Team: **HEC Table 38**
Gold Team: **HEC Table 37**

Florida Solar Beach Buggy Challenge for Duke Energy

Majors: Mechanical Engineering; Computer Science

Each team was challenged to develop an environmentally-safe, autonomous beach buggy capable of transporting 120 pounds that runs completely on solar power and has the ability to avoid obstacles. The main application is to serve as a beach rescue vehicle or transporting supplies, within a $2,000 budget. A computer science team advised the three ME teams

Blue Team: **HEC Table 32 (outdoors)** Black Team: **HEC Table 34 (outdoors)**
Gold Team: **HEC Table 33 (outdoors)** CS advisory team: **HEC Table 35 (outdoors)**

Cloud Tracking for Orlando Utilities Commission
ENG II Table 79

Majors: Computer Science; Mechanical Engineering

This team was tasked with creating a system to track clouds and predict their solar power output impacts. Solar energy sources can be unreliable due to dependence on direct sunlight. This system strives to increase the prevalence and reliability of solar output. By knowing the impacts beforehand, OUC has the ability to switch to an alternate energy source in advance of the cloud event to prevent power interruptions and save money. The project consists of a weatherproof camera connected to a data processor and a solar sensor station, and provides a live-feed of the sky at any given time. With the camera imagery, the system employs optical flow and cloud coverage algorithms to predict cloud movements relative to the sun over time. The processer uses machine learning (taking into consideration historical power production trends) to predict solar power output at any given time.

PROJECTS INVOLVING MULTIPLE DISCIPLINES
continued

Robinson Observatory Refresh for UCF
ENG II Table 78
Majors: Computer Science; Electrical Engineering; Mechanical Engineering
This team created a sub-scale model of UCF's Robinson Observatory telescope that needs an upgrade. This team has modified the open source code of Stellarium to create control settings and commands to directly control the model telescope's movements. The user can also capture pictures from the attached camera, which can then be uploaded to the Robinson Observatory's archival website. The system provides for photo searching, tagging, and also project management to ensure the observatory teams can efficiently collaborate on research projects.

Home Safety and Automation System
ENG II Table 86
Majors: Computer Engineering; Photonics
This system provides a way to easily use household electronic appliances through motion detection technologies, which provides convenience and fire detection safety. This project facilitates the management of smart devices such as lamps and outlets, through an easy-to-use interface. Users can add modular components to a main central unit where they will have the ability to control and view power usage of the devices. Intended for people who want to add smart devices to their household in a simple way while keeping costs low.

Laser Speckle Contrast Imaging to Visual Vascular Flow Through a Leaf
ENG II Table 87
Majors: Computer Engineering; Electrical Engineering; Photonics
This visual project gives biology researchers the ability to further classify leaf structures and understand how water and nutrients flow through a leaf. The system uses a laser light source and an imaging system to capture the speckle pattern created by the reflected laser light. When the laser light is reflected from something that is moving, the contrast will decrease. This system will display a heat map of high and low flow, similar to imaging systems used in the medical field to image blood flow. This system costs less than devices used in medicine, and is portable and rechargeable so it can be used in the field.

COMPUTER SCIENCE

"Child Check" Safety Web and Mobile Application
HEC Table 1
Enhances co-accountability between guardians and care providers, integrating with daycare's attendance taking. Parents only use the app to report an absence. If child does not show up to daycare but the absence is not reported, then the system will alert parents and daycares with increasing severity. The goal is to reduce occurrences of children being left in cars.

AptImage: Video Tech-Support Calls
HEC Table 2
With a goal to reduce the number of tech-support in-person visits, this system allows a technician to see a customer's tech problem with audio and video while instructing the customer on how to resolve the issue. Allows for a video call with tech support without risking the user's private information.

Stereoscopic Image Analysis for the National Cemetery Administration
HEC Table 3
The names of 20 U.S. Civil War soldiers buried in St. Augustine were improperly recorded many years ago. With computer vision and machine learning in conjunction with trigonometry, this program analyzed old Civil War photographs taken of their names carved into wooden headboards that have since rotted away along with the information. The system will use technology to properly identify the graves and record the correct names on the headstones.

RV Weather App for RV Intelligence
HEC Table 8
This Bluetooth-enabled system displays weather alerts and warns users of incoming weather conditions, to help the user protect their RV awnings from severe weather damage. The system gives warning in enough time to take action. It can also prompt an automatic awning retraction if the correct hardware is installed. System retrieves weather observations around two separate geo-fences.

Community Oversight of Privacy and Security Android App
HEC Table 4
The "CO-oOPS" Android application helps users determine if other apps are safe for users to grant access to their phone's private data such as photos or contact information. This is a social network that uses a "community-based education" model with an engaged, proactive community of users/contributors.

CemetARy: Augmented Reality in the Cemetery
HEC Table 5
Finding information about a fallen soldier buried at any one of 136 national cemeteries can be daunting. This mobile application makes the history of the soldiers easy to access, in a user-friendly way to locate the gravesites using a cell phone. This system uses OCR (optical character recognition) to detect lines of text on a headstone, then uses that information to conduct a search for biographical information, enabling a more enriching experience for visitors.

SCRIBE: Artificial Intelligence to Transcribe Audio Data for NASA
HEC Table 6
Mission critical staff can generate large amounts of audio data. This program automatically provides and presents transcripts of audio logs using artificial intelligence, saving hundreds of hours of labor reviewing audio data manually. Can be used in other applications that generate audio data, such as disaster response.

Predicting Security Vulnerabilities in Software Projects
HEC Table 7
System provides software developers early detection of security vulnerabilities by running a statistical model against a user's code repository, where correlations with previously detected faults can be made with the current software project. This tool will simplify the development cycle and allow developers to spend more time making software programs better.

Capital-Free CryptoCurrency Exchange and Machine Learning Price Predictor
HEC Table 9
Enables real-time trading of virtualized cryptocurrency assets among users using data pulled from external sources and exchanges without the associated financial risk. Can be used by users of all experience levels, from novice to experienced traders. This program's machine learning algorithms are intended to assist in predicting and analyzing market trends.

Photo Selection: A Deep Learning Approach
HEC Table 10
This application intends to reduce the time and tedious effort it takes to select quality photos when a user takes a high quantity of photos. The user offers the program their personal feedback on how they would rate the quality of photographs and, through machine learning, the program learns how to select based on the user's point of view and personal preferences for choosing ideal photos.

Sherlock: An Interactive Media Research Tool
HEC Table 11
For game designers, behavioral researchers, news media, and content creators. This database-backed, open source web application allows researchers to learn how an end-user's emotional and physical state affects the decision-making process when using interactive media. It provides a way for researchers to assemble and analyze various biometric data sources, and to annotate points of interest in the data.

Theorem Proving with Deep Reinforcement Learning
HEC Table 12
The ability to prove mathematical theorems automatically has long been a goal of mathematicians and computer scientists. This project uses deep learning to interact with a software-based proof assistant to produce proofs without the need for human supervision. An accessible, interactive guide for students and researchers to easily explore new theorem-proving methods.

"Echelon Tour" Fitness Game for a Smart Exercise Bike
HEC Table 39 (outdoors)
Echelon Tour is a multi-player fitness game that encourages people to be more active through a mobile game app that connects to the Echelon Smart Connect Bike. Uses Bluetooth and is implemented with the Unity game engine with a cloud-based backend in Amazon Web Services.

Reflect Mirror for Echelon Fit
HEC Table 13
Uses computer vision to analyze a user's form during a workout and delivers a message with a specific instruction on how to improve the form. The mirror has capabilities for repetition counting. Will also have Google Home/ Alexa capabilities. Intended to be implemented into a touch-screen mirror, to eliminate the need for a smart phone app as the remote control.

Smart RV Vision for RV Intelligence
HEC Table 14
A low-cost all-in-one camera system for RVs with a twofold purpose: a surveillance system and a rear-view camera. Surveillance mode will provide a way to locally view what is occurring at the exterior of the RV and to remotely view the interior. This project is different as it allows users to switch between the two modes.

Verifying Concurrent Transactions in Ethereum Cryptocurrency
HEC Table 15
This project's goal is to improve the hardware utilization of the Ethereum cryptocurrency by parallelizing transaction processing, then verifying the correctness of the concurrent history it generates.

ProctorHub 2.0 for UCF's Center for Distributed Learning
HEC Table 16
Builds on the current ProctorHub program, an online open-source quiz proctoring tool used by UCF faculty to prevent cheating during online quizzes and exams. This project introduces new features such as full video recording support, multiple face detection, tab switching detection, and a mobile app that allows students to use their phone in place of a webcam.

To-Scale VR Galaxy Viewer
HEC Table 17
Provides an immersive way for students, teachers and enthusiasts to experience how large our galaxy is with an accurate perspective through virtual reality. Uses a VR headset and two motion-tracking controllers to allow users to navigate and learn about real celestial bodies.

American Sign Language Tutor for watchOS and iOS
HEC Table 18
Helps users learn ASL with several progressive learning modules that users can complete, with quizzes and the end of each module to measure progress. It contains a dictionary that users can access to look up any translations and create their own study list. This project aims to fill the conversation gap between deaf and hard-of-hearing people and verbal communicators.

UCFar: Mobile Augmented Reality Campus Navigation
HEC Table 19
Helps people navigate UCF's main campus to find a specific building. Improves on typical navigational methods such as Google Maps by giving users orientation. This augmented reality program allows users to actually see exactly the path they need to follow. Users can select from a list of popular UCF campus locations. The augmented path will lead the way to the destination and provide an estimated arrival time.

Using AI to Play "Slay the Spire"
HEC Table 20
This algorithm helps users play the game "Slay the Spire" optimally. The team implemented and tested several algorithms to determine which one plays most effectively. Several aspects of the game have made this project a challenge and have invalidated many pre-existing techniques. This team modified existing methods to enable and optimize game performance.

"Auto-Scribe" Medical Notetaking Assistant
HEC Table 21
Intended to help medical professionals, this program provides a solution to medical notetaking and paperwork. Auto-Scribe automates the process of taking Subjective Objective Assessment Plan (SOAP) format notes. A tablet application records patient-doctor interviews and parses the interaction for noteworthy information.

"Graham Selector" Tool for Fundamental Stock Analysis
HEC Table 22
Quantitatively evaluates the vast amount of data held in company financial statements in the S&P 500. Helps users of all experience levels make sound long-term investments in specific stocks. The Graham Selector helps make investment decisions based on principles of sustainability for principal return plus profit. It determines an approximate valuation and then its robust filtering process detects red flags in the corporate financial statements. Companies are then ranked by the "Margin of Safety" value/price ratio. By scanning the entire index, the program can detect hidden gems.

ELECTRICAL AND COMPUTER ENGINEERING

"Laser Target Gallery" Optical Target Practice Trainer
HEC Table 24
To provide more options to the limited market of optical target boards. This project involves the laser, the target board and the phone app. The system gives users challenges to train their proficiency at target practice. Data is recorded and transferred to the phone app and offer a performance score.

Hand-Gesture-Operated Drone
HEC Table 25
Operated by hand signals, this remote-controlled drone performs a variety of maneuvers. The drone was built from scratch using computer vision to train a neural network to learn hand gestures that prompts the computer to communicate the corresponding command.

"Keur-Keg" Automated Beer Brewer
HEC Table 40 (outdoors)
The perfect beer brew can be difficult to achieve because the timing, temperature, and processes need to be precise. This project allows users to input the recipe, place the ingredients in the containers, and brew five gallons of a consistent recipe every time. This project provides a "happy medium" between industrial brewers and small home brewers.

Mushroom Nursery: Grow-At-Home Gourmet Mushrooms
Engineering II Table 84
Easy, at-home gourmet mushroom farming is the goal of this project that simplifies the growing process while enhancing size, flavor and color of the mushrooms. Gourmet varieties tend to be difficult to grow and have a short shelf-life. The Mushroom Nursery allows for 2 to 3 varieties at a time, using "seed cake" starters and water placed in the nursery. Harvest in 3 - 5 days. Most will fully re-grow up to three times.

"Smart Lock" Secure Home-Locking System
Engineering I Table 63
Unlock your home using your finger print, door code or RFID chip. The goal of this project is to allow for easier and secure keyless entry to a home.

Vital Watch: Remote Patient Vital Monitoring System
HEC Table 26
Gives caregivers a constant way to monitor their loved ones remotely. The device is worn on the patient's wrist and monitors several vitals including heart rate, pulse oximetry and temperature. The vitals are relayed via WiFi to a mobile application for easy viewing by the caregiver on a minute-by-minute basis.

"Plant Nanny" Automated Plant Growth System
HEC Table 27
Automates the time it takes to grow plants and herbs. The system gathers information on the plant and its environment via sensors that is then sent to a microcontroller, which can decide to water the plant, dim or intensify lighting, or alert the user. Intended for people who want to grow small indoor plants or herbs.

Robot Basketball Entertainment System
HEC Table 28A
An arcade-style entertainment system that employs small-scale robots that collect and launch a 2-inch basketball in a small scale basketball arena. Players of all ages will enjoy controlling this exciting display of robot athleticism. Highly interactive and dynamic for each game player.

Smart Tabletop Gaming
HEC Table 28B
A two-part device that can bridge players and their group when they cannot meet in person. While there are a number of virtual tabletops available, this version uses a physical board and a virtual board concurrently. The game is based on Dungeons and Dragons gaming which is a favorite among gamers.

"Keyless Entry" Smart Security System for the Home
Engineering II Table 64
A lock that allows the user to enter their home using RFID, fingerprint, Bluetooth pairing and a keypad. This lock offers more options at a lower cost than similar products available.

SmartLeaf Indoor Greenhouse System
Engineering II Table 91
An in-home gardening system that self-regulates its environment to provide perfect growing conditions. Allows for user control, as well as data visualization and storage over WiFi through a web application. Can be scaled up for farmers and more ambitious gardeners. Uses battery-operated sensor nodes that take soil moisture, temperature and humidity readings from the plant bed. A water-pump system activates when moisture level is low or at user-specified intervals. Also has a fan system and humidifier. A pH sensor can measure nutrient levels in the runoff water.

Sunshade Smart Blinds
Engineering II Table 65
Internet Of Things home appliance designed for daily use. Cordless, solar-powered window blinds are controlled with manual control pad, Alexa personal assistant, or the mobile application. It can tilt shades, lift or lower blinds, and has numerous other technical features. It manipulates the corded blinds mechanism with servos, and is controlled by a microcontroller, with feedback from various light, temperature and humidity sensors.

H-2-Ohm: Smart Water Bottle
Engineering II Table 66
A smart, low-cost water bottle that accurately tracks the amount of water that the user consumes. Helps people who need to drink more water, or who may have liquid restrictive diets and need to drink less water. A pressure sensor takes measurements after each time the user removes and then places the cap back on the bottle. The information is sent to a microcontroller to process and send to a mobile application via Bluetooth. The bottle features a UV-C sanitation cycle that runs on timed intervals.

Recreational Vehicle Air Conditioning Diagnostics for RV Intelligence
HEC Table 30 (outdoors)
Gives the customer the ability to check on their RV's air conditioning unit's health and to diagnose any problem areas that the A/C might have now or in the future. Gives the user up-to-the-minute data on their AC and the ability to control the thermostat.

INDUSTRIAL ENGINEERING AND MANAGEMENT SYSTEMS

Turtle Track Database for Marine Turtle Research Group*
Engineering II Table 67
**This interdisciplinary project sponsored by Northrop Grumman involves Industrial Engineering and Computer Science students. Only the IE team is showcasing for Fall 2019.*

A new database system to support UCF's Marine Turtle Research Group, replacing the current system that's been used for 40 years and is only available on two computers in the lab. This is a flexible and extensive platform that supports continuous data collection throughout the lifespan of sea turtles (50 to 80 years). Information collected can be shared with different federal agencies and other research groups around the world. Sponsor hopes to use the concept in other settings such as zoos.

Surviving Sepsis at Parrish Medical Center: Improving Patient Outcomes
Engineering II Table 68
This team proposed ways to optimize and streamline sepsis patient care after analyzing data related to the care of patients experiencing severe sepsis. Saving time caring for these patients improves the patient experience and reduces the cost of care.

Process Optimization for ScreenWorks
Engineering II Table 69
The client makes clothes – such as shirts, hoodies and hats – for entertainment companies. The garments must go through the labeling section first, by law, to convey size, place of manufacture and company. The labeling section can often delay production. This team will apply LEAN manufacturing concepts to streamline operations of the labeling section, to reduce wasted time. The team created a simulation model and proposed a more effective facility layout, especially for the tag sewing area.

Virtual Reality Switchgear HoloLens for ABB
Engineering II Table 70
This team set out to provide a convenient way for ABB to showcase their Switchgear at trade shows using virtual reality to provide customers with an interactive model of the Switchgear so that ABB would not have to transport the actual product around. Customers can view the Switchgear at all angles, and take apart the product, with an interactive menu of descriptions to learn about the different parts.

Advent Health Ground Floor Pharmacy Operations Improvement
Engineering II Table 71
This team was tasked with proposing ways to reduce the time the ground pharmacist spends on tasks deemed non-value-added to their role. Currently, the pharmacist spends a large amount of time sending medication through the tubing system, pre-packaging medication, or tracking down delivery staff. This team identified process and labor utilization improvements to increase the time the pharmacist spends on the primary task: ensuring the correct medicine is dispensed for more than 1,000 patients a day.

Increasing Manufacturing Line Efficiency for Boston Whaler, Inc.
Engineering II Table 72
With the goal of improving efficiency of client's Value Stream 8 assembly line by 2 percent, this team followed the Define Measure Analyze Improve Control (DMAIC) process to increase efficiency. The DMAIC process is a Lean Six Sigma tool that can be applied to many different problems to pinpoint where issues are, root causes and more. This particular project is being applied to a manufacturing line with low volume and high variability.

Optimization of the Blending Process for Coca-Cola
Engineering II Table 73
The Apopka plant for Coca-Cola North America sources raw ingredients and creates concentrates for all Coca-Cola beverages. This team identified a solution to improve manufacturing throughput and eliminate the downtime between the processes of blending and filling into drums to be shipped to bottling plants.

Facility and Workflow Efficiency in a Quality Lab for Hydro Aluminum
Engineering II Table 74
The two goals of this project are to create an online database for work orders, and space management. The database allows the client to virtually track and store the work orders rather than relying on paper tracking. With more employees, the workspace needs to be reorganized to accommodate more staff and improve workflow. The client's storage space needed a system for storing and finding product samples.

AI Perception of Analog Gauges for Siemens*
Engineering II Table 76
**This interdisciplinary project involves Industrial Engineering and Computer Science students. Only the IE team is showcasing for Fall 2019.*
This project seeks to solve the problem created by manual inspection and recording of readings (length of time and errors). The IE team's role was to develop a one-year plan for the CS students to build software to convert images of analog gauges around a power plant into a digital value that can be easily transmitted to a database. This project seeks to reduce labor, and to create an optimal path to maximize efficiency.

MAARS Project for United Launch Alliance*

Engineering II Table 75

**This interdisciplinary project involves Industrial Engineering and Computer Science students. Only the IE team is showcasing for Fall 2019.*

MAARS = Modern-Age Augmented Reality Systems. The ULA team has highlighted four challenges for the team to analyze and overcome, including: Procedure Generation (demonstrate AR's ability to aid someone in the assembly of an object); Maintenance (demonstrate AR's ability to track and identify maintenance/replacement/retesting needs over regular intervals); Design and Modification; and Training engineers and technicians on large-scale/complex tasks.

Supply Chain Optimization and Design of a New Assembly Line for Steelcase

Engineering II Table 77

**This interdisciplinary project involves Industrial Engineering and Mechanical Engineering students. Only the IE team is showcasing for Fall 2019.*

This team has worked to optimize the assembly of six product lines by having sub-assemblies in two distinct facilities and finalizing the products in Michigan. By doing this analysis, the team's goal is to save the client more than $700,000 in shipping costs and labor costs.

MECHANICAL AND AEROSPACE ENGINEERING

Autonomous Delivery Drone

Intended to reduce the use of road vehicles to prevent delays caused by congestion and be a greener method of delivery. It also supplements the job of a delivery worker. The 15-pound drone features a hexirotor design to provide more thrust than a quadrotor, and can carry packages up to five pounds. The drone uses GPS and proximity sensors to safely and autonomously navigate to its programmed destination, release the package once landed in the target area, and return to its starting point.

Gold Team: **Engineering II Table 90** Black Team: **HEC Tent Table 43 (outdoors)**

Distributed Electric Propulsion Aircraft

The DEP design uses multiple propellers along the wings' surface to increase aerodynamic efficiency while reducing power consumption. The increased lift allows for shorter takeoff distances – even vertical takeoff and landing capabilities, smaller wings or slower flying speeds. In addition, a DEP aircraft can continue flying in the event of the loss of a motor.

Blue Team: **Eng II Idea Lab Table 95** Black Team: **Eng II Idea Lab Table 98**
Green Team: **Eng II Idea Lab Table 96** Gold Team: **Eng II Idea Lab Table 99**
Red Team: **Eng II Idea Lab Table 97**

Micro Unmanned Aerial Vehicle with Push Propeller

Teams were tasked to create drones designed to fly at low altitude while carrying a small payload – a 32 ounce bottle. The aircraft must meet FAA regulations while completing a specific number of laps in a circular, 100-foot-diameter track.

Gold Team: **HEC Tent Table 54 (outdoors)** Black Team: **HEC Tent Table 56 (outdoors)**
Blue Team: **HEC Tent Table 55 (outdoors)** Red Team: **HEC Tent Table 57 (outdoors)**

Gasket Fixture Design & Automation for Total Refrigeration Gaskets

Engineering II Table 82

This team was tasked with creating an improved gasket splicing machine that can replace manual splicing stations. The new machine's requirements include the ability to interchange gasket profile, an airflow pin for inflating the gasket during the process, and alignment fixture for the operator to place gasket pieces precisely. This team is improving upon a previous senior design team's design.

Irrigation System for Guard Dog Valves

Designed to reduce water waste during irrigation, the system can communicate with in-ground moisture sensors to more accurately distribute water to lawns and plants. This will ensure that only areas that require water will receive it. Operates from user commands through a controller. Intended to mitigate past systems' high cost of construction, installation and maintenance.

Black Team: **HEC Tent Table 52 (outdoors)** Blue Team: **HEC Tent Table 45 (outdoors)**
Gold Team: **HEC Tent Table 46 (outdoors)**

Mixing System for Concrete 3D Printing

HEC Tent Table 47 (outdoors)

3D printing concrete structures has advantages over traditional construction techniques but requires a continuous flow of the highly viscous mixed concrete. This system autonomously mixes the correct ratios of cement, water and additives. The mixture must be strong enough to keep its shape after extrusion while having the workability to allow a pump to move the material from the mixing system to the extrusion nozzle. The goal is to lower labor costs, and to operate during all hours of the day.

Microgravity Drop Vehicle for Florida Space Institute

Teams were tasked with designing a highly aerodynamic airborne vehicle capable of achieving microgravity during free-fall, to make STEM education and research more accessible and affordable. The goal is to design portable vehicles that can sustain multiple drops from 400 feet above ground, and maintain the safety of the payload.

Black Team: **Engineering II Table 92** Blue Team: **Engineering II Table 94**
Gold Team: **Engineering II Table 93**

Low-Cost Microgravity Drop Vehicle

Engineering II Table 88

This team was tasked with creating a drop vehicle that is obtainable by researchers at a price point that is competitive to more commercialized alternatives. This Microgravity Drop Flight Vehicle is a single use composite structure that houses the test payload as well as an onboard sensor package, used to verify the quality of the data collected.

High-Performance Racing Drone

Teams were tasked with creating cost-effective designs intended for the growing X-class drone racing community. The goal is to find the balance between endurance and speed, and between improved performance and additional weight of large racing drones. Uses lightweight materials that can survive more impacts before failure.

Gold Team: **Engineering I Table 60**
Black Team: **Engineering I Table 61**
Blue Team: **Engineering I Table 62**

Recycling Sorter for UCF

Supports UCF's goal to be a zero-waste campus by recycling nearly all of its recyclables. Teams were tasked with creating a low-cost, fully functional device that will sort the campus recyclables efficiently, primarily paper and plastic bottles, using optics and a specially designed chute that manipulates airflow and exploits the geometry and physical properties of the recyclables.

Blue Team: **HEC Tent Table 53 (outdoors)**
Gold Team: **HEC Tent Table 59 (outdoors)**
Black Team: **HEC Tent Table 58 (outdoors)**

Vacuum Chamber: Simulates the Stratosphere

HEC Tent Table 42 (outdoors)

This vacuum chamber simulates the conditions of the stratosphere (120,000 feet), requiring extremely low pressure and a large fluctuation of temperature range. The ultimate goal is to support microgravity testing. The UCF Physics Department will house this chamber as a resource provided by the Florida Space Institute. The chamber provides a structure capable of withstanding atmospheric pressure (near-zero internal pressure) as well as access ports to run power and data inside the chamber for experiments. The unique design and manufacturing methods makes it easy to use and significantly lower cost than comparable chambers on the market.

Solar Desalination Device

Teams were tasked with creating a compact, mobile, easy-to-use machine that will take non-palatable water and convert it to clean water via condensation. Uses solar radiation to evaporate contaminated water. The intent is to benefit coastal communities affected by natural disasters. The system at a minimum could create enough clean water daily to support one person, or a small family.

Black Team: **HEC Tent Table 44 (outdoors)**
Gold Team: **HEC Tent Table 51 (outdoors)**
Blue Team: **HEC Tent Table 50 (outdoors)**
Green Team: **HEC Tent Table 48 (outdoors)**
Red Team: **HEC Tent Table 49 (outdoors)**

Portable Wind Turbine

Engineering II Table 83

A cost-effective turbine system that can be installed in areas closer to electrical grids. This turbine is designed to be used in remote, rural and urban environments for commercial or personal use. It differs from conventional vertical axis turbines by using an outer encasing with tapered inlets to increase the wind speed and thus also increase the rotational speed of the blade. Encased to protect the user from direct access to spinning blades.

Industrial Robotic Arm to Maximize Payload Capacity

Two teams were tasked with creating an improved design for "pick and place" industrial robotic arms that would have a higher strength-to-weight ratio over current arms with strength-to-weight ratios of less than 30 percent. The overall purpose is to design a better robotic arm for collaborative applications and for any industry need while being easy to operate, highly productive and cost-effective.

Black Team: **Engineering II Table 80**
Gold Team: **Engineering II Table 81**

Human-Powered Vehicle Competition Team for ASME

HEC Table 41(outdoors)

This team's goal is to create a vehicle for the American Society of Mechanical Engineers' national competition. It must be comfortable for riders, and meet certain criteria including, but not limited to, reaching a competitive top speed, incorporating a rollover protection system for the rider, and adhering to specific turning radius and braking distances. The ultimate goal is to achieve the highest possible speed with the lowest possible budget.

Dual Plenum Intake Manifold for Internal Combustion Engine

HEC Table 31 (outdoors)

This project aims to improve upon an air intake system for an internal combustion engine. The dual plenum intake manifold will efficiently and uniformly supply air to all four cylinders for a BMW M42 engine. The design will focus efficiency and improving the power output. The dual plenum design is different because it allows for air to be distributed equally to all cylinders of the engine, which will provide a power increase that other products cannot offer.

Drum Handling System for Coca-Cola

Engineering II Table 89

This team created a system that reduces the manual labor required to handle empty drums at the client's Auburndale, Florida plant. The system uses a combination of motors and actuators to aid employees in lifting and maneuvering drums across facilities. The system relies on a claw capable of grabbing drums from the inside and then rotating them so that they can be stored in trucks. This system offers a larger range of use and superior maneuvering abilities.

World's Highest Power-to-Weight Ratio 4-Stroke Outboard Engine

HEC Table 29 (outdoors)

This team created a world-class engine for high-performance marine applications by means of turbocharging. The main goal is to increase the horsepower of a 225 HP Honda outboard engine to more than 550 HP and stay within a 650-pound target weight. This will result in the world's second most powerful outboard engine yet weigh nearly half of what any competitors have on the market in power range.