**UCF College of Engineering & Computer Science**
# Spring 2019
# SENIOR DESIGN SHOWCASE
**Friday, April 19**
**9 a.m. - 3 p.m.**

**Harris Engineering Center, Engineering I & II Buildings,
Business Administration I Building, Research I Building
UCF Main Campus**

## Schedule

**Showcase of Projects**                          **9 a.m. – 3 p.m.**
*Engineering I Atrium & LM Cyber Lab first floor*
*Engineering II Atrium and upper floors*
*Harris Engineering Center (inside/outside)*
*Research I Atrium, Business Administration I Atrium*
Featuring 130+ 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.

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## for Project Summaries

# PROJECTS INVOLVING MULTIPLE DISCIPLINES

### Florida Solar Beach Buggy Challenge by Duke Energy
*Majors: Computer Engineering; Computer Science; Electrical Engineering; Mechanical Engineering*

Each team was challenged to develop an environmentally-safe, autonomous solar-powered beach buggy capable of transporting 120 pounds at a top speed of 5 mph, with the ability to detect and avoid stationary and moving obstacles through a set course, all within a $1,000 budget. A team of computer science/ electrical & computer engineering students supported the other teams.
> *Gold Team; Black Team; Blue Team; CS/ECE Advisory Team

### Tethered Security Drone for Florida Power & Light
*Majors: Aerospace Engineering; Computer Science; Mechanical Engineering*

An unmanned security surveillance system with unlimited runtime to help stakeholders monitor and inspect facilities or powerlines. Drones have 24-hour flight capability and follow an autonomous ground vehicle that it's tethered to. It uses facial recognition software to help identify intruders. Unlimited flight time can be achieved with solar panels or regenerative braking. Current tethered drones systems can cost $45,000; these projects stayed within a $1,000 budget.
> Black Team
> Gold Team
> Blue Team
> CS Advisory Team

### Robotic Flange Assembly for Siemens
*Majors: Aerospace Engineering; Computer Science; Computer Engineering; Electrical Engineering; Industrial Engineering, Mechanical Engineering*

A simulation of the capabilities and limitations of a robotic device, the "Cobot," that works in tandem with a human to speed up the time to assemble a flange. Currently, employees face continuous strain and inefficient assembly time. The Cobot is attached to a pipe, and revolves around the pipe to  tighten bolts on the flange as it goes. The device follows an efficient sequence of torqueing bolts, increasing assembly speed, all while allowing the worker to safely stand by and perform other tasks.

### Drone for Microgravity Experiments
*Majors: Aerospace Engineering; Computer Science; Mechanical Engineering*

A microgravity research environment provides a more feasible, lower-cost alternative to sending research projects to outer space. This system involves a drone that drops a capsule – equipped with cameras and sensors – containing research experiments. As the capsule drops, the experiments are subjected to near-zero gravity, providing valuable test data. The capsule safely decelerates to the ground with a parachute system, allowing for multiple drops.
> Black Team
> Gold Team
> Blue Team

### Silent Electric Aluminum Fishing Boat for Correct Craft/Watershed

*Majors: Computer Engineering; Computer Science; Electrical Engineering; Mechanical Engineering*

This 3-person capacity aluminum boat is innovatively designed to be ultra-quiet to prevent scaring fish while maximizing efficiency and minimizing cost and maintenance. It features 20 HP electric propulsion, and a mobile app-based interface that provides user-friendly features such as GPS trip tracking, barometer, water temperature, and more, that integrates with data collected by a microcontroller unit.

### AVAST: Aerial Vehicle with Autonomous Stealth Tether for Lockheed Martin

*Majors: Aerospace Engineering; Computer Science, Mechanical Engineering*

AVAST challenges teams to design, build and code an autonomously-flying drone that can locate, track and follow a ground target (a moving vehicle) for 10 minutes without sending or receiving signals. It must also detect an object after losing it, and distinguish between actual targets and decoys. A beneficial asset to military reconnaissance missions to gather intelligence safely without detection.
> Black Team
> Blue Team
> Green Team
> Gold Team

### eGOAT: Robotic Solar Farm Grass Cutting System for OUC and Duke Energy

*Majors: Computer Engineering; Computer Science; Electrical Engineering; Mechanical Engineering*
Teams from UCF and USF were challenged with creating a way to reduce the significant costs ($150K to $300K annually) of solar farm grounds maintenance, while reducing the risk of damage to expensive solar arrays. The Electronic Guided Omni-Applicable Trimmer (eGOAT) is a robotic rover-based weed and grass trimmer equipped with sensors to prevent damage to panels, poles or wildlife. Upcoming competition will be judged on criteria including quality of grass cutting; ability to stay within the boundaries; and ability to cut the most grass. *(Black Team and Gold Team listed in Mechanical & Aerospace section, Page 19)*
> Blue Team                     Green Team

### Augmented Reality Product Visualization for ABB

*Majors: Computer Science; Mechanical Engineering*

Sponsor sells large, heavy electrical switchgears which are shown at trade shows. AR can solve the problem of shipping and showing these devices. And for switchgear technicians, AR brings to life switchgear component documentation and diagrams, which currently can be cumbersome to read and interpret in large printed manuals. With AR, technicians access information about different components on a switchgear and see it in lifelike form.

### Portable Microscope

*Majors: Computer Engineering; Computer Science; Electrical Engineering; Photonics*

Can be used in classrooms, workplaces, or even at home. Provides a solution that removes the need for a tethered base and allows sharing to a mobile phone. The ability to take pictures of what's being viewed under the microscope could get kids interested in science.

PROJECTS INVOLVING MULTIPLE DISCIPLINES
*continued*


### "AWDEMOTO" – All Wheel Drive Electric Motorcycle

*Majors: Computer Engineering; Mechanical Engineering*
A novel and unique prototype for the electric motorcycle market. Currently no all-wheel-drive electric motorcycles are produced commercially.  The end product could be sold as a bolt-on conversion for the specific model of motorcycle.


### Unmanned Aerial Systems Competition Drone for UCF Robotics Club

*Majors: Computer Engineering; Electrical Engineering; Mechanical Engineering (the frame is listed under Mechanical and Aerospace projects)*
Designed for competition by the Association for Unmanned Vehicle Systems International. The drone must fly 4 miles through a series of GPS way points while carrying a small ground vehicle that  is released in a drop zone. Then it moves on to search a .125 square mile field for objects or people of interest. It will measure more than 6 feet from tip to tip, with 19.5 inch propellers.

### Empty Drum Waste Stream Optimization for Coca-Cola

*Majors: Industrial Engineering, Mechanical Engineering*
This team created a more efficient drum disposal process to be more cost effective without compromising employee safety. The current system involves manual labor. This project is a multifaceted solution to optimizing the waste stream of the empty drums, allowing for more efficient use of time and space, reducing costs, and providing higher safety standards for factory employees.

# COMPUTER SCIENCE

### JAI Composer: Machine-Learning Assisted MIDI Generator
This new music education tool allows users to run a trained machine-learning model with preferred parameters to generate drum and bass loops in the MIDI (Musical Instrument Digital Interface) format, specifically for different games or electronic dance music. Has multiple instrument output. Composers can use the tool for inspiration; and music students can hear results of their musical ideas and choices. Could be particularly helpful for teaching music theory.

### Synesthetic Music Visualizer
Provides a way to visualize music with a Raspberry Pi – an electronic device that listens to music and reacts to it with LED lights. Project named because "synesthesia" is a neurological condition in which the stimulation of a sense causes a perception in another sense.

### "Bellows" Data Compression Research
This team is researching current data compression methods to create a competitive alternative that improves existing methods. Research will efficiently reduce file size by condensing repeated information. Better data compression allows for cheaper transfer and storage. Even a small improvement translates to substantial cost savings.

### Autonomous Real Estate Drone
Easy-to-use drone for real estate agents to obtain high-quality video footage to sell their properties. Most drones require technical experience and can be difficult to pilot. This project features a user-friendly app for an Android tablet on which users can draw waypoints on a map. The drone will autonomously fly to those locations and record video.

### ELLE (EndLess LEarner) Ultimate
A system of games to enhance learning a second language. Gameplay involves quizzing the user on words in the language they're studying. It records and uploads performance. A web portal is available to facilitate language pack configuration and for viewing statistics, either as a student or a teacher.

### NASA Simulation Exploration Experience (SEE)
A simulated autonomous lunar base that locates and excavates water ice on the Moon's surface. The simulation converts the ice to rocket propellant using realistic, accurate chemical equations. With NASA and industry software, and cloud computing, the team implemented a distributed simulation environment to allow international student groups to run their equipment in the simulation. Applying previous iterations to the lunar environment based on NASA's specifications, this team focused on improving fuel production and accuracy, AI error handling, water ice generation and distribution, and improving simulation functionality.

### Arcade Game Review and Submission System for UCF

The current UCF arcade game system requires manual and local access to each machine to put games on them. This team created a web application that allows for easy submission and review of games; automated parts of the testing phase; provided a remote way to upload games to the arcade machines; and revamped the machines to make them more reliable and responsive.

### Deloitte Agile Central Command Web Application

Requested by the client to create a low-cost, highly customizable web application to easing an Agile sprint for the various development teams. Web application integrates with JIRA and other commonly used application to act as a one-stop-shop for managing an Agile Sprint. Includes a Retrospective Board to enable a team to look back on a sprint and reflect on what can be done better next time.

### Mangrove: Soundscape Ecology Analysis Toolkit

Soundscape ecology is a relatively new research field. The associated tools are not well developed or researcher friendly. This project, custom-made for a sound ecology researcher, is a user-friendly interface for analyzing, organizing and reviewing research data and results.

### MediChain Medical Asset Tracker

When medical assets travel through under-developed countries, they are susceptible to tampering. This project uses blockchain technology to track medical assets from the manufacturer to the customer ensuring transparency and accountability. The customer can also verify integrity of product. Could be applied to products other than medical.

### Middle Passage: Virtual Reality Slave Experience

Designed for the UCF History Department, this VR experience is designed to engage participants beyond what's available in traditional history courses. For educators and students, the project is meant to allow users to experience history as an active participant.

### StarCraft II Reinforcement (deep) Learning for Lockheed Martin

With a goal to discover new approaches for developing more useful artificial intelligence in complicated environments, this team used reinforcement learning to make an AI that can play a subset of the game StarCraft 2 at superhuman levels. The AI learns how to play the game by playing millions of times at extremely fast speeds. From each playthrough it learns how to improve itself.

     Black Team
     Gold Team
     White Team

### Red Lobster Cross-Platform Voice Application

A new way to use voice assistants. Users can find the nearest Red Lobster in their area, check wait times, and add themselves to the wait list without leaving home. The team plans to support both Alexa and Google Home platforms with a single code base, to make it easier for client to gain insights.

### Red Lobster Machine Learning

Goal is to improve client's business with a recommendation engine – using sales data to make recommendations for items of interest such as a dessert or an add-on item. The recommendations will be performed autonomously, and could lead to more sales and profits. A separate Series Forecasting model will be trained on sales data from Red Lobster restaurants to predict menu items and sales. This project will help client leverage machine learning in their data analytics.

### Equipment Detection for Florida Power and Light

This software reduces the time – from hours of work to minutes – to review thousands of images of power lines and utility poles. Given a directory of images, the software will highlight and label each equipment in each image and produce a report that includes equipment location. Object detection uses machine learning to learn each equipment based on a set of training images.

### "Virtually No Tag" UCF Parking Project

This project aims to eliminate the need for a physical parking tag or sticker by assigning the license plate as the sole identification for a parking permit. The computer application would be used by students and parking enforcement.

### Carebit: Cross-Platform Mobile Application for Remote Caregiving

The goal is to provide a convenient way to remotely care for a loved one with minimal privacy invasion to monitor steps, heart rate, and device data. The Carebit app provides the ability to control what health data is recorded and when. It keeps a remote caregiver aware of the person's vitals and notifies them of critical situations. Uses the Fitbit Alta HR tracker and the Fitbit application programming interface.

### "Chronicling America" Parser Web Application

Intended to be a powerful research query tool for academics or people looking for information about historical events or people. It transforms unstructured data into structured data. This tool will split articles from the Chronicling America website and place them on this web app. Also, users will be able to log into the web app and save their queries.

### Reality Flow: Rapid and Collaborative Augmented Reality Prototyping Environment

Users will be able to create AR scenes by adding and manipulating the transforms of 3D geometry, which will include primitives and imported models. The cross-platform app can be used on mobile devices, the web, Microsoft HoloLens, and the Magic Leap AR headset. Reality Flow offers a simple, intuitive user interface and requires no installation, making augmented reality development more accessible to many.

### Athlete Technique Analysis Application

Provides accurate feedback to sports players by analyzing their form and technique. Coaches can record and analyze statistics, and players can receive feedback and watch past game films. App uses computer vision to detect the player's limb motions and technique when executing various actions in their sport. Movement efficiency can be determined by analyzing limb angles relative to each other, speed and location. The tool can then suggest corrections that the player can make to achieve optimal technique.

### "Stream Swipe" Tool to Connect Audiences with Twitch TV Broadcasters

Twitch.tv is a live broadcasting website. Using a mobile application or website, users will be able to find streamers that match their interests via a suggestion-based algorithm. Users are able to like or dislike suggestions. As Twitch has evolved, a need for active content search tools has emerged.

### "Tailored Tours" Application to Create and Follow Self-Guided Tours

This easy-to-use mobile application empowers users to show off their world and explore new ones by creating and following self-guided tours. A web-based application has been created to empower organizations to easily create high-quality self-guided tours to be consumed on the mobile application. Robust enough to create tours for any environment, this project focused on college campus tours.

### Pianotes: Sheet Music Creator

A free web application that receives a music file (.mp3 or .wav), translates it into sheet music and generates the downloadable sheet music. This project improves upon current programs that require a specific size on the computer to download, multiple applications and user fees.

### "Be AR Guest" Application for People with Dietary Restrictions

A mobile augmented reality application for restaurant-goers who have special dietary needs. Research on food offerings was collected from third-party menu information offered by active Facebook groups and bloggers who have special dietary needs and visit theme parks. The app includes all vegan menu items with a comment section for users and an admin dashboard to update items as they change.

### "Lead the Way" Indoor Navigation App for the Visually Impaired

A native iOS application that provides indoor navigation for visually impaired users. It uses sensors built into an iOS device, instead of relying on GPS which often does not work indoors. Rooms, elevators, entry ways, and other points of interest can be located with this application.

### NASA EZ-RASSOR Excavator for Florida Space Institute

An open-sourced, low-cost, smaller replacement of NASA's RASSOR excavator used for mining a planet's regolith to convert it into fuel. The EZ-RASSOR includes multiple artificial intelligence functions for the robot to assist with automatic obstacle avoidance and location detection without GPS. Users can interact with the EZ-RASSOR through the Gazebo simulation environment. Designed for the Kennedy Space Center for demonstrations with the potential to influence future designs of NASA's RASSOR.

**3D Arm Creation: Automating Arm Measurement Process with Computer Vision**
This project aims to make the arm measurement process more efficient for Limbitless Solutions. Uses computer vision and a platform –independent solution to automate the step of getting arm measurements of prosthetic arm recipients. Arm dimensions are necessary to create a 3D model of the arm before it's 3D printed. By using a reference object of known dimensions, the arm's dimensions can be calculated. This solution could be used to generate 3D models of any object.

**Lock Free Transactional Library**
Designed to implement multithreaded algorithms for a UCF professor and his PhD students into an interfaceable library. Modern computers run on not just one computational processor, but several. The algorithms provided by the professor make more efficient use of those multiple cores on computational processes. This project makes those algorithms easier to interface with as a programmer unfamiliar with the algorithms themselves. This project could help companies that rely on parallel processing.

**Knights of a New World: Campus-Based Augmented Reality Game**
Phone app that allows students to peer into an alternate dimension populated by fantastical creatures and beings, hand-crafted by UCF students. Similar to Pokemon Go, Knights of a New World can increase student involvement at on-campus events and virtual incentives that go towards a global leaderboard. Students can submit fantasy writing and if accepted, FIEA students will incorporate the stories into the world. Sponsored by a UCF English assistant professor.

**"Roll with Advantage" Tabletop Roleplaying Video Game**
Improves upon the popular role-playing tabletop game Dungeons & Dragons to address its perceived shortcomings, for example, its complex rules and that it may not be visual enough for most prospective players. "Roll with Advantage" is more approachable for a wide audience by automating many of the tedious rules, as well as making the game more engaging with animations and interactions.

**Outfittr: A Mobile Fashion Assistant**
A mobile and web application that keeps track of the clothes in the user's closet and recommends outfits based off of user's and overall community's stylistic choices. It uses machine learning from a survey given to a community on how to assemble the best possible outfits from the clothing it is given. Helps users recall clothing they may have forgotten; and can also help colorblind people assemble outfits.

# ELECTRICAL AND COMPUTER ENGINEERING

**Daynight Panel: Realistic Artificial Sunlight with Mobile App**
Provides a realistic replica of the sunlight's color, temperature and brightness throughout the day, using super-powerful LEDs. Designed for use in areas with little to no sunlight, such as enclosed work spaces, basements, even space vehicles. Features a microcontroller and the iOS Daynight app for customization.

**Situation-Aware Stop Signal**
A new approach to controlling traffic, this project uses advanced technology to advise and alert drivers. Using sensory data, the Situation-Aware Stop Signal scans for vehicles in its vicinity to organize traffic flow and detect possible threats. Uses solar power to reduce usage cost.

**Smart Plant Pot: Portable Plant Monitoring Environment**
Designed for botanical-based researchers, this is a transportable monitoring environment for a plant's growth and life cycle. Various sensors track important metrics and records the data. To date, the few smart plant growth environments available tend to provide immediate singular data, not data trends. This project's enclosure will provide safety to the plant.

**RecipeTop: Interactive Countertop and Recipe Preparation Assistant**
Affordable, fun, user-friendly and easy-to-clean, this smart countertop includes an embedded wireless scale to weigh ingredients. Other features include automatic timer setting; and a recipe assistant to intuitively guide users and teach new cooking skills.

**"SOPbox" Secure Outside Package Box**
A lockbox that is bolted down on a front porch that holds delivered packages in order to prevent theft. The RFID reader is activated by the delivery person, which unlocks the box. Once the package is placed and the lid is closed, the box locks. A motion camera captures images of everything that moves in front of the box. Improves on a similar product on the market with better technology and security features.

**"M-GU4RD" Medical GPS Unit for First Responders**
First responders often experience high-stress situations where their vitals are heightened, which can result in heart attacks. This project will monitor the vitals and location of a person in real-time. Electrodes are used to detect heart-rate, respiration rate, and body temperature and with radio frequency sends the information to a computer. A more affordable and compact device than what's currently available.

**Laser Tag System**
A low-cost, portable laser tag game for kids of all ages that includes a highly accurate laser gun system for enhanced playability and interactivity for indoor and outdoor play. Employs LEDs, motors for haptic feedback, an OLED display and other features.

## Motion Training Assistant

Provides accurate feedback to the user on whether a particular move was performed correctly, for use in physical therapy, sports or other activities that require a proper form to maintain. It works by allowing the user to define what movement they are about to perform, then they perform the movement. An LED indicator shows if the move was done correctly, and will give feedback on the graphical user interface with a 3D rendering and simple text. System's decision making will allow for a more original design than those of other motion tracking systems.

## Oven-Control Circuit for Thin-Film Piezoelectric-On-Substrate MEMS Oscillator

A temperature control circuit for specific use in electronic devices. Oscillators are the heartbeat of an electronic device, used in timing different circuit signals so that the processor can appropriately respond to and not be overwhelmed by external stimuli. This oscillator has unique and unprecedented temperature properties that ultimately may lead to optimizing oscillator performance.
*(MEMS = microelectromechanical systems)*

## HeadsUP: Mobility Aid for the Blind

The conventional cane that a blind person uses to get around has a limited range of object detection which is approximately 1 meter. Anything that falls outside of this range will not be detected and can have a dangerous outcome. This project employs laser triangulation: when an object enters a certain range, haptic feedback is delivered.

## Smartphone-Powered Laptop

Enabling the ability to use a smartphone like a laptop, this prototype integrates smartphone functionalities into a laptop shell. The consumer will be able to do everything that can be done on a smartphone but on a bigger scale: emails, social media, web browsing and more.

## SAFER Knights: "Safety Autonomous Following Escort Robot"

For those who feel unsafe walking alone on campus at night, this project provides an alternative to university resources. The autonomous, Bluetooth-enabled robot is equipped with sensors, cameras and lights to follow the user while avoiding obstacles and recording the surrounding area for threats. Emergency protocol, video and audio recording, and speakers are included. To enable emergency mode, the user presses a button and the robot will flash lights.

## K.I.T. Knight Interactive Timebox

A new gaming console designed for any age group to enjoy video games – an alternative to overcomplicated gaming consoles sold today. The simplified K.I.T. console benefits novice and experienced game designers, as well as gamers of all ages. Raspberry pi is the main computation component to run game software and has endless open source documentation for game design.

### "Battle of the Bikes" Stationary Bicycle Racing Game

To promote physical cardio health, the two bikes in this stationary system can interact with each other by providing stats to the user of the other bike. One user can increase the tension of the other rider's bike in real-time to make the experience more challenging and entertaining. The first rider to complete the agreed-upon distance is the winner. Various tensions give the feel of riding on different terrain and to challenge users. Cyclists provide the energy to recharge the battery.

### Safety and Rescue Helmet

Made for civilian emergency personnel, this project combines a two-way radio, a camera that enables vision in low-light, and a location tracking feature with GPS. Each feature is built as modules that operate independently. Powered by Lithium ion batteries. Designed to be more effective than similar helmets.

### The Baby Buoy Pool Alarm

Monitors activities around the pool and alerts others via a mobile device or an audible sound. Solar powered with a LiPo battery. Features a two-step verification system: motion sensor and under water.

### "ANT-FR" Autonomous NERF Turret with Facial Recognition

A mounted, non-expanding recreational foam turret equipped with facial recognition software to detect and acquire a designated target within a field of vision.

### Laser Musical Instrument

This instrument's laser beams act like strings, emitting different notes when the user interrupts the beam and moves up or down on the string. For musicians or anyone who likes seeing light merging with sound. The most prominent laser instrument is the laser harp which is difficult to use. This project incorporates multiple notes for a single laser string inside a frame to make it versatile, compact and low-cost.

### CEWN – Comprehensive Embedded Wearable Network

Intended to provide an accurate, cost-effective and unique alternative to smart wearables. Provides an innovative, attractive design with a sensible budget to introduce smart wearables to a wider audience. Applications include outpatient support, youth and elderly health monitoring, and use by athletes.

### MADLIS: Mixed and Distributed Laser Illumination System

A patent-pending way to provide lighting for a vast number of applications. Combines multiple colors of laser and transmits the light over fiber optics to multiple diffused and safe outputs. It generates any color in the visible spectrum and can be modified to generate many other types of light for special applications.

### Directed High Frequency, Open-Air Communication

Provides a safe and direct means of communication of data. Takes data from a particular device and sends it to another device via laser transfer. Other methods of sending data such as Wi-Fi are less secure because they emit radio waves which can be easily viewed by others. For use in aerospace devices, more.

# INDUSTRIAL ENGINEERING AND MANAGEMENT SYSTEMS

## Quality Course Certification Program Development for UCF Ctr of Distributed Learning

A system for the client's quality and high-quality review certification program for its online learning programs. The team is proposing to use a Six-Sigma design methodology to develop and launch a certification program that decreases the current backlog for identifying and selecting eligible faculty members and reduces inefficiencies within the program. The improved final process will enforce a new standard of course excellence which will pave the way for UCF's online education leadership.

## Work Flow Optimization and Digitalization for Hydro's Quality Lab

Hydro provides aluminum parts for automotive companies such as Ford and Tesla. Hydro manually fills out their work orders and ends up with binders full of them, making it difficult to track records. Our project scope is divided into three branches: Process flow, data management, and space & inventory management. The goal is that the solutions will minimize movement and reduce waste in Hydro's Quality Lab and will be used daily.

## Parrish Medical Center Intent to Discharge Process

The hospital uses an "intent to discharge" form in order to alert case management and nursing staff when patients are estimated to be discharged within 24 hours. This allows for transitional tasks to be completed ahead of time, giving the patient's chance of an on-time discharge. A previous UCF senior design group showed that a physician's higher-use of the intent-to-discharge form translated to discharge times being more than an hour earlier than the hospital average. This team set out to increase hospital-wide use of the intent-to-discharge notification through a redesign of the process.

## Blending Process Optimization for Coca-Cola

The problem is a loss of time and product due to the current system of ingredient handling. The solution is to implement a pre-process that handles all ingredients in a controlled environment to reduce time and waste. This is used by Coca-Cola to optimize their product blending line by isolating the issue areas and allowing for a more refined way of mixing, packaging, and transporting ingredients.

## Safety and Workflow Optimization for Metal Essence, Inc.

The team studied two of the client's main processes, the Lifter and the Spiral, and conducted time studies on each step to create a simulation model. Process sheet run times were compared with the time data collected, factoring-in human operator variability, to establish consistency in production workflow and scheduling to help meet customers' on-demand needs. The team also implemented walkway lines on the production floor to meet ADA and OSHA guidelines to reduce injury risk and machine damage.

## M-Class Interior Panel Install Time and Cost Reduction for Piper Aircraft

Piper Aircraft produces more than 50 aircraft a month. Five years ago, Piper began producing the interior panels in-house because of cost, quality and delivery issues from an external supplier, but the expected returns have not actualized. This project aims to decrease the time and cost to manufacture and install the interior panels through the application of data analysis, lean principles, value stream mapping and standard work principles.

## Costume Fabric Cutting Process Analysis for Disney

For Walt Disney World Creative Costuming Character Garment Production, this team was tasked with identifying methods to improve the fabric cutting process that will optimize material, space, and time. The team used the Define, Measure,  Analyze, Improve, and Control (DMAIC) process to improve the fabric cutting process to decrease waste and to increase the process efficiency that will enhance the Character Garment Production overall business value.

## Lean Warehouse Life Cycle for United Launch Alliance

This project applies Lean methods into warehousing. United Launch Alliance employees will be using the final outputs of our project. Our method is specialized for ULA warehouse and in-flight hardware.

## Technician Scheduling System Optimization for United Launch Alliance

This team was tasked with standardizing ULA's technician scheduling process. The team analyzed ULA's technician scheduling system to find inefficiencies and interviewed all the people who interacted with it to understand users' requirements. With current- and future-state process maps and a business case, the team recommended a solution that will be considered by all levels of management in ULA.

## "Chasing the Green" REcycling Improvement for UCF Sustainability Initiatives

This team set out to improve UCF's current recycling rate of 33 percent, and increase the revenue UCF's collected recyclables generate. Using a TQM approach, the team identified inconsistencies in the system and recommended ways to improve and control the process. By detecting and providing new alternatives to the process, a more structured approach could be potentially implemented at UCF.

## Visualization of Manufacturing Facility SAP Data for Coca Cola

Coca Cola's Apopka syrup plant desires to have a visual management tool as a way to monitor Key Performance Indicators, and to aid in effective real-time decision making. Currently, the client spends hours every day retrieving information from within SAP to receive performance feedback. This team created a visual tool – a dashboard – that displays this information in an easy to understand format, saving hours of time and improving efficiency at the plant.

## MHPS Carbon Dioxide Emission Management for Mitsubishi

A low-cost monitoring system that models operating scenarios for plant operators. If a turbine needs to be shut down for maintenance, this system is designed to accurately measure how the turbines should be operated to maintain $CO_2$ emission rates according to permit. Intended for use by plant personnel, this tool can be used on Android or Apple. Ideally, it will measure $CO_2$ emission levels and send a green, yellow and red flag depending on the recommended action to take.

# MECHANICAL AND AEROSPACE ENGINEERING

### Electromyography-Controlled Prosthetic Hand with Wrist Actuation
A 3D-printed prosthetic hand with wrist actuation, for patients with upper-limb amputation 2 to 5 inches below the wrist. Electric signals generated from muscle movements are used to identify the motion the user desires and is executed by a series of motors and actuators. User feedback about gripping strength will be provided through vibro-tactile motors attached to the upper bicep. Easy to maintain and low-cost.

### Integrated Sustainable Building Design for ASHRAE
The annual Association of Heating, Refrigeration and Air Conditioning Engineers competition challenges students to design sustainable, more efficient buildings. These designs are for a net-zero hospital. Hospital system designs are challenging as they use more energy and must follow strict building requirements.
      Blue Team              Black Team

### System Selection for ASHRAE
This team's work focused on optimal HVAC system selection for a hospital, based on the lowest possible life cycle cost. System Selection is a category in ASHRAE's annual competition.
      Gold Team

### ASME Human Powered Vehicle Competition Team
This annual competition of the American Society of Mechanical Engineers challenges teams to design and manufacture an effective human-powered vehicle. These vehicles are especially advantageous in underdeveloped areas with little to no access to reliable energy resources.

### UCF Formula SAE Impact Attenuator Structure
Formula SAE (Society of Automotive Engineers) is an international collegiate program. The team focused on a critical part of the racecar: the impact attenuator, a device used to help decelerate a car, absorb energy and protect the driver during a front-end crash. This team designed, manufactured and tested a smaller, lighter and stronger attenuator with a frontal nose cone design.

### Hydronics System for UCF Facilities
This team evaluated UCF's on-campus hydronics systems: the water tower, chiller tank and reclaimed water system to evaluate where the most energy recovery would be possible, and the best means to extract it. Extensive research of UCF's energy consumption led the team to pursue energy recovery via pump-as-turbine installations throughout the reclaimed water system at specific locations.

### Rocket-Powered Glider
A proof-of-concept designed for a specific industry need for an aircraft that requires minimum space to launch, is autonomously controlled, has near silent flight and maximizes range. It's launched in a single-propulsion stage, reaches its peak altitude, achieves controlled flight using an onboard flight controller, glides to maximum range, and safely lands. Has a top mounted wing, a T style tail, and an airfoil shaped fuselage constructed with foam, balsa wood and 3D printed attachments.
      Green Team              Red Team
      Orange Team            Black Team
      Blue Team              Gold Team

### Hybrid-Motor Rocket for 2,000 ft Altitude Hybrid Rocket Competition

To further the understanding of hybrid rocket engines:  the rocket's oxidizer is in a liquid state while the fuel is in a solid state. Hybrid rockets are mechanically simpler than liquid engines; and safer than solid engines. Hybrids are a more desirable choice for small space crafts that require a large amount of power in a short amount of time.

> Gold Team
> Blue Team
> Black Team

### Mechanomyography Measurement Device

Current MMG devices mainly observe the electric signals taking place during muscle contraction. This design not only observes the electrical signals, but also the mechanical vibrations occurring when motor units are activated during muscle contraction. Non-invasively and inexpensively provides reliable metrics to understand improvement, stabilization or decline of muscular conditions.

### Pusher Style (Rocket Assisted) Micro Unmanned Aerial Vehicle

Fixed wing micro-drone designed to achieve maximum laps around a track given a pusher-style propeller configuration with a payload (a 32-ounce Gatorade bottle). The focus of this project is to resolve the difficult aerodynamic problems that arise in certain conditions. This project aims to innovate pusher style propeller configurations for a more energy efficient and flight enduring drone. Can be used in reconnaissance, image mapping, disaster control and more.

> Blue Team
> Gold Team
> Black Team

### High Altitude Balloon-Based Microgravity Braking System for Florida Space Institute

A braking system that will be integrated into a repeatable high-altitude microgravity experimentation platform. A payload will drop from the platform for 9 seconds before the braking system will bring the payload to a stop. The dual braking system will use electromagnets and friction brakes.

### Optomechanical Lens-Fiber Fusion Splicing

This team was tasked with designing and prototyping a revised manufacturing station used to construct beam delivery optics. This updated station is smaller, faster and produces higher quality devices compared to predecessor. A collaboration between the UCF College of Optics and Photonics and the UCF Department of Mechanical and Aerospace Engineering.

### NASA Distributed Electric Propulsion: Small Scale Application to Remote Controlled Aircraft

Zero-emissions electric aircraft motors provide efficient, scalable and altitude-independent form of propulsion distinct from traditional engines. The aircraft is equipped with eight electric motors distributed across the wingspan. Can be used in aerial surveying as well as recreational flying.

> Gold Team
> Blue Team
> Black Team

## Alternative Rocket Recovery System

An improved system for the amateur rocketry community. Uncontrolled landings pose the biggest risks in terms of less desirable landing location and rocket loss. This system uses a controlled parafoil to navigate the rocket back to a more optimal landing zone. Optimized for different rocket sizes and components streamlined for consumer use. No other similar system exists on the market.

## Prototype Lab-Scale Floating Offshore Wind Turbine

To provide offshore wind turbine stability, this team collected real-time data on the orientation of the prototype floating offshore wind turbine. Stability and recovery time plays a major role in the efficiency of wind energy collection through this large device. This project seeks to improve current devices.

## "Lend a Hand" Physical Therapy Device for Stroke Patients

A soft robotics hand rehabilitation device to recover hand-motor gripping function with help from a physical therapist. Glove-like device employs a cable driven actuation process to slowly and efficiently clench the patient's affected hand. A lower-cost, lighter, and more user-friendly design alternative.

## CO2 Mars Aggregation Test Rig

Collects and measures C02 in a gas mixture in a sealed chamber. The chamber works in a 5-step cycle, which must first reach the appropriate pressure with a vacuum pump. A pre-mixture gas is filled inside the pre-chamber at a specific pressure. An inlet valve opens to have the gas pressure equalize with the chamber. Next, liquid nitrogen will be filled into a Dewar to form a localized freezing point and freeze the CO2 to convert it to dry ice. CO2 concentrations will be recorded during this process. With the ability to collect C02, researchers can continue exploring human survival on the red planet.

      Black Team            Gold Team

## Thin Film Profile of Two-Phase Heat Transfer

The reliability and efficiency of a micro-sized electronic chip can be improved by decreasing the operating temperature, used with two-phase heat transfer. Finding the thickness of the thin film will allow the team to find the heat transfer coefficient – important in convective heat transfer. A bandpass filter is used to create fringes that can be seen through a camera and appear as bright or dark patterns. The spacing of the fringes represents the thickness of the film. For use in research labs to supplement existing setup, this apparatus can be used to capture dynamic features of the thin film and plot the thickness profile. Designed for the UCF Heat Transfer Laboratory.

## ReliaGear ND Narrow Switchgear Breaker Compartment Ratings Extension for ABB

This project is focused the circuit breaker element in a switchgear (a combination of several electrical components including disconnect switches, fuses and circuit breakers). The group is tasked with the redesign of the internal layout and interconnects of the circuit breaker compartment.

## 3D Printer Filament Fuser

An easy-to-use, handheld filament fuser for use with Fused Filament Fabrication machines. This project allows users to fuse filament to an existing print run to provide a seamless switch between filaments.

### "eGOAT" – Robotic Solar Farm Grass Cutting System for OUC and Duke Energy

The Electronic Guided Omni-Applicable Trimmer (eGOAT) project aims to minimize the monthly expense of grounds maintenance around solar arrays. Currently power companies invest $150,000 to $300,000 on solar farm ground maintenance. Teams were challenged to create an autonomous rover-based weed trimmer that effectively trims the grass and ensures minimal interference with the equipment. Robot is equipped with sensors to prevent damage to panels, poles or wildlife. *(See Green Team and Blue Team listed in Multi-Disciplinary Project section, Page 4)*

       Gold Team           Black Team

### Design and Optimization of X Class Drones for Performance Applications

Drone racing is a new competitive racing sport. A class of drone racing growing in popularity is "X-Class Drone," the world's first giant drone racing league. For drones measuring more than 2 ½ feet to nearly 4 feet in size. The two teams are researching and developing optimized drones to exceed current standards in speed and endurance, and to serve as a benchmark for anyone interested in X-Class Drone Racing.

       Black Team           Gold Team

### ProPulse Electric Wheelchair

A system to retrofit a manual wheelchair and transform it into an electric wheelchair. The final product is intended to cost less than $500, making it a more affordable solution than buying an electric wheelchair which can cost anywhere from $1,000 to $30,000.

### Automated Media Preparation for Agri-Starts

Solves the issue of manual chemical dispensing and the associated problems. This is an automatic metering system that can dispense multiple chemicals in a mixing container. Made for sponsor Agri-Starts, an agricultural plant starter company.

### Implementation of an Automatic Control and Data Acquisition System on a Double Induction Gas Atomization Unit

Made to convert the manually-operated ball valves in a gas optimization system into automatically actuated pressure valves. This is achieved by implementing a pressure regulator retrofitted upstream of the existing ball valves on the system. Designed for UCF's Laboratory for Advanced Materials and Additive Manufacturing.

### Knights Racing Baja Drivetrain

A drivetrain for the 2019 UCF Baja Vehicle (SAE) scheduled to race in two international off-road based competitions. The off-road competitions are set up to put student designs through harsh conditions.

### UCF's National Design, Build, Fly Competition Team

To research and develop an unmanned radio-controlled aircraft that must accomplish three missions: complete a timed lap course in 5 minutes; a simulated detachable radome; and a 10-minute mission that involves dropping air-store per lap. Design constraints include taking off from a five-degree inclined ten-foot runway, fitting inside a 2' x 3' x 2' hangar; and feature a minimum of 4-foot foldable wings.