2017 Senior Design

Discovery • Creativity • Refinement

FAMU-FSU
College of Engineering
Welcome. Senior design projects are the capstone of an engineering undergraduate education, and we are proud to highlight the accomplishments of our graduating seniors in the spring of 2017. Each year we are delighted to see more company-sponsored projects because these challenges provide our students the opportunity to explore real-world engineering problems. It is exciting to see increasing numbers of interdisciplinary projects since collaborations between engineering disciplines is the hallmark of many actual products, often involving electronics and mechanical components for example. Our students are demonstrating their collaborative mind-set through projects in which they work with those outside engineering, for example the Ford Motor Company sponsored a project on connected vehicles that involved collaborations with FAMU’s School of Business and Industry. The presentation of several entrepreneurial projects this year is evidence of an area of increasing interest. I thank all of you who sponsored or otherwise helped our student projects – the results are impressive. Senior Design Day is a focal point for the College and we hope that this summary book will pique your interest to work with us and our students in the future.

Best regards,

J. Murray Gibson
Dean
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47 SPONSORS GUIDING THE LEADERS OF TOMORROW
The FAMU-FSU College of Engineering

The FAMU-FSU College of Engineering celebrates its 35th year with a renewed commitment to build on our unique partnership between a leading Historically Black University and one of the nation’s highest research activity institutions. This partnership means that we are amongst top institutions that graduate underrepresented minorities and that we have, in many ways, the most diverse undergraduate population of any ranked college of engineering (20% African American, 20% Hispanic, 26% female).

The pictures of many of the student teams tells the story: our students experience a state-of-the-art engineering and research education while working in teams that represent the outside world in which they will work – an experience of value both to them and to their employers.

We have 2,300 undergraduates, 300 graduate students and offer bachelor’s, masters and doctorate degrees in the major engineering disciplines. With 100 full-time faculty, $20M annual research funding and a half-dozen major research centers led by engineering faculty, we offer research-based engineering education to our diverse student population. Principal engineering research activities within the college include:

**Transportation**
Our transportation research ranges from big data approaches to resilient “smart cities”, to autonomous vehicles, and the transportation challenges of an aging population.

**Aerospace**
The Florida Center for Advanced Aero-Propulsion (FCAAP) encompasses a wide range of research including aerodynamics, aero-acoustics, and flow control techniques. Combined with computational simulations, FCAAP uses wind tunnel and jet facilities to explore flow control methods that aim to reduce noise as well as increase aerodynamic facilities.

**Robotics**
Our Center for Intelligent Systems, Control and Robotics has developed the world’s fastest wall climbing robot and a graduate program that is rated 11th nationwide.

**Power Systems**
The Center for Advanced Power Systems has a $35M grant from the US Navy to develop the electric ship and is a leader in smart grid technologies that integrate renewable energy.

**High-Performance Materials**
This center is recognized nationally as a leader in lightweight strong composites, and is funded by Lockheed Martin and by NASA to work on deep space exploration and the Mars program.

**Energy Storage**
Recently elected to the US National Academy of Inventors, Dr. Jim Zheng has developed a unique carbon nanotechnology that promises to revolutionize super-capacitors for vehicular applications.

**Biomedical Applications of Superconductivity**
The Center for Applied Superconductivity works with the National High Magnetic Field Laboratory, and has developed the highest field compact superconducting magnet. Applications include magnetic resonance imaging to improve our treatment of human disease.

We celebrate our undergrad diversity
20% African American
20% Hispanic
26% Female
Team Megatherium: Fuel Cell Car Powered by Hydrogen from the Catalyzed Hydrolysis of Ammonia Borane

TEAM MEMBERS: (L to R in photo)
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Michael Delisca
Alejandra Ramirez
Ryan Hennessey
Isaiah Rivera

ADVISORS:
E. Eric Kalu, Ph.D.
Yaw D. Yeboah, Ph.D.

SPONSOR:
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College of Engineering

Team Megatherium was tasked with the challenge to build a self-sustaining fuel cell vehicle that can run on hydrogen produced from a catalyzed ammonia borane reaction. This vehicle will run with the help of a fuel cell that uses hydrogen and oxygen to produce electricity to power the vehicle’s motor, allowing it to run and move. The project involved the design and construction of a hydrogen producing reaction system. The project also involved programming controllers to modulate the car’s movements. By integrating the parts, we are able to create a vehicle that, when running, emits nothing but evaporated water and low levels of non-toxic waste.

Fuel Cell Car Using Hydrogen Generated from Catalytic Reaction

TEAM MEMBERS: (L to R in photo)
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SPONSOR:
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Our design project involves a catalytic reaction which produces nearly pure hydrogen gas “on the fly.” Current automobile applications, which use hydrogen fuel cells to generate electricity, utilize a highly compressed source of hydrogen gas. Our goal is to show that our novel reaction system is capable of providing enough hydrogen to power a small toy car as a scaled down proof-of-concept. The major benefit of generating hydrogen on the fly using catalyzed hydrolysis of ammonia borane is that safety concerns regarding stored hydrogen gas are eliminated. Since hydrogen is consumed almost immediately after its production, we are able to use a safer molecule containing hydrogen and convert it to the pure gas required. Furthermore, the hydrolysis of the ammonia borane is promising in its use in full-scale applications since it contains more hydrogen in an easily transportable solid form.
The existing bridge on Dortch Road over Beaver Dam Creek (#484017) has been given a sufficiency rating of 32.8 and is considered Structurally Deficient. The Federal Highway Administration (FHWA) and the Florida Department of Transportation (FDOT) have been tasked with the structural redesign and reconstruction of the existing superstructure and substructure. The scope of this project is strictly limited to analysis and design for the structural aspects of the bridge. We will be using a top down approach when undergoing our design, starting with the bridge superstructure and working our way down to the bridge substructure.

Mendenhall Rainwater Harvesting

The engineering team’s objective is to design a functional gutter system to be attached to the pre-existing Mendenhall building on the Florida State University campus. The gutter design is expected to be aesthetically in tune with previously designed structures on the campus. The clientele requesting the design are interested in sustainability, and therefore the team determined that it would be best to find a use for the water that satisfies their interests. A cistern design is a low maintenance, efficient means to gather and distribute the water to be used for groundskeeping. The aluminum gutters will be attached to the pre-existing spouts, and designed at a 2% slope so that water can properly drain to the cistern. The gutters will be following all standards specified within the proper ASTM for aluminum design. The proposed design will have the cistern capable of storing 1,000 gallons of water and built using polyethylene. The cistern will be situated on a reinforced concrete slab. The elevation is done to be sure water can be collected only using the gravity drain. The final stage of the project is to create a concrete spillway that will serve in the event that the cistern becomes totally full. The concrete spillway is to be made to relocate the water to a nearby drainage basin. This basin will be properly drained into Lake Munson.
Walkway Extension from COE to AME

TEAM MEMBERS: (L to R in photo)
Harrison Korb
Andrew Alderman

ADVISOR:
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SPONSOR:
FAMU-FSU College of Engineering
Donald Hollett

Team A&H Engineering was tasked with the challenge to design an ADA compliant walkway that connects the College of Engineering to Innovation Park. The walkway will run northward from the Building B parking lot to connect with the existing Innovation Park walkway, as well as southward around the volleyball courts in order to join with Building A's existing walkway. The project involved a site survey of the existing conditions, design of a reinforced cantilever retaining wall, and ensuring ADA code compliance. The project also involved a construction bid proposal with opinion of probable cost. Through this design project, A&H was able to submit a finalized construction proposal to the College of Engineering for the development of an ADA compliant walkway that will better serve faculty, students, and the Innovation Park community.

Wallis Street

TEAM MEMBERS:
Oluwanifemi Adegbulugbe
Corey Cresap
Craig Wiggins

ADVISOR:
Salvador Arnaldo, M.E., P.E.

SPONSOR:
Graceful Solutions
Bill Wilson

The Wallis Street Development Team has been assigned the task of developing a 3.89 acre parcel of land to be used for the building of single and multi-family housing. The scope of this project includes the designing of the horizontal improvements needed to support the finished development. These improvements include new roadway and parking lot design, upgraded storm water system design and site grading. Also included in this project is the design layout for housing that is to be built in a later phase of the overall project.
Cascades Pedestrian Bridge

TEAM MEMBERS: (L to R in photo)
Olenka Namuche
Andrew Platt
Susie Fries
Savannah Schaler

ADVISORS:
Michelle Roddenberry, Ph.D., P.E.
Kamal Tawfiq, Ph.D., P.E.

SPONSOR:
RS&H
David Snyder

The Capital Cascades Connector Bridge design project involved developing an alternative design of the current pedestrian bridge located over Monroe Street in Tallahassee, Florida. This alternative design includes the bridge superstructure, substructure, retaining wall abutments, and foundations. Additionally, a cost analysis on the current bridge and our alternative design was performed. The purpose of this study was to show that the aesthetic specifications required by the City of Tallahassee can be maintained while simultaneously reducing the overall cost of the bridge.

Guatemalan Schoolhouse

TEAM MEMBERS: (L to R in photo)
Makese Powe
Silvia Artigas
Jena Martino
Theodore Thomas

ADVISOR:
Raphael Kampmann, Ph.D.

SPONSOR:
Lisa Spainhour, Ph.D., P.E.

The Guatemalan Schoolhouse senior design team was tasked with designing a new schoolhouse facility for the community of La Cantun II in Joyabaj, Guatemala. The community’s current schoolhouse contains one room for all students, grades 1 through 5, and is made of bamboo and plastic tarp. It is very temporary and exposed to the elements, not making for a learning-conducive environment. For this reason, an entirely new structure was designed using confined masonry and reinforced concrete beams and columns; it includes two classrooms, an office, and a kitchen. The community also requested a flushing bathroom facility and hand-washing station. An issue that the site presented when the team assessed it in December was the fact that earth walls bound the left, back, and right side of the site, presenting a safety concern that was addressed by designing three gabion gravity retaining walls to surround and protect the new school. This project was solicited by Engineers Without Borders (EWB), which is an international organization that uses sustainable engineering solutions to help developing communities meet basic human needs. Through EWB’s project process, these designs will be implemented in the community once they have been approved by a board of professional engineers. The team hopes to see the implementation process begin in December 2017 in order to provide the children in La Cantun II with a safe place to learn.
ISHOF Dive Tower

**TEAM MEMBERS:** (L to R in photo)
Reid Thomas
Jose Battikh
Santiago Gonzalez

**ADVISOR:**
Michelle Roddenberry, Ph.D., P.E.

**SPONSOR:**
City of Ft. Lauderdale
Tom Green

Team BGT Engineering, Inc. was tasked with the challenge to design and construct a FINA-compliant diving facility located at the International Swimming Hall of Fame in downtown Fort Lauderdale. The project involved designing a structurally-sound 14 meter tall dive tower along with a complex deep foundation. In addition, the project scope included analyzing the existing drainage conditions and designing a sufficient stormwater retention system. Once finishing the design-build aspect to our project, a complete cost estimate and schedule was completed for our proposed plans. Hopefully, the extent and aesthetics of our project will convince the city of Fort Lauderdale to opt to restore the International Swimming Hall of Fame to its original glory.

Chieftan Way Realignment

**TEAM MEMBERS:** (L to R in photo)
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Kathleen McClenehan
Najee Hunter
Timothy James

**ADVISOR:**
Raphael Kampmann, Ph.D.

**SPONSORS:**
FSU Department of Planning
Mark Bertolami
TAPS FSU
Matt Inman

Florida State University is rebuilding the northwest section of its main campus into a mix of residence halls and science buildings. The first phase of redevelopment involves demolishing old buildings and redoing roads and infrastructure. Our team was tasked with realigning Chieftan Way and updating the stormwater drainage network in the eastern half of the area. We designed the new Chieftan to be multimodal, improving the comfort and safety of pedestrians and bicyclists through shared-use paths, subtle traffic calming, and trees along the street. FSU also requested that we design a bus shelter that meets ADA compliance and can be relocated on demand (to match the flexibility of bus routes.)
The Aquaholic Engineering team was tasked with designing a large scale aquaponic facility that will be used to commercially produce and sell organically grown produce and farm raised fish. The closed loop aquaponic systems distribute the nutrient rich water from the fish tanks to feed the plants in the growing beds adjacent to the tank. A flood and drain process is used to provide the water to the plants while simultaneously filtering the water to be returned to the fish tank. A fully enclosed structure, along with a foundation, will also be designed. The land development, including grading and storm water management, will be designed to withstand the features added to the site. The hydraulic and environmental analysis of the aquaponic systems will also be completed along with a cost estimate. Through the completion of this project we will have a fully functioning aquaponic facility in Tallahassee, Florida.

Midtown Place

Midtown is an area in the heart of Tallahassee that has become increasingly popular over the past several years. This brings a demand for many things, residential communities being one of the most important. An existing 2.64 acre lot is located at the corner of Glenview Dr. and N Meridian Rd. and currently has a 2547 square-foot home on it that was built in 1942. This lot is in a great location in the prospering Midtown area. Our goal is to construct 10 townhomes with individual lots on this property in order to accommodate the increasing demand. Each townhome will be a 2200 square-foot two-story building, and will include a 20-foot driveway and a garage. Aside from townhomes, a 6-foot sidewalk along Glenview Dr. is being put in to promote the “urban walkable neighborhood” theme that fits Midtown.
Orange Avenue Pedestrian Improvements

TEAM MEMBERS: (L to R in photo)
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ADVISOR:
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SPONSOR:
HW Lochner
David Freni

During the year 2014, there were multiple pedestrian related accidents along Orange Avenue within our half mile long area of interest. There were six pedestrian related accidents within a 300 foot radius of the Springhill Road and Orange Avenue intersection, as well as 3 other incidents along the orange avenue roadway. In order to design a safe, well connected, and economical sidewalk and pedestrian bridge, our team plans to utilize existing features and sidewalks, as well as mechanically-stabilized earth walls and retaining walls when unstable slopes are present. Our plans include detail sheets for the construction of our sidewalk and ramps, drainage of the existing roadway and proposed sidewalk, and the structural details for the proposed pedestrian bridge and retaining walls.

Metropolitan Blvd. Duplex

TEAM MEMBERS:
Eduardo Fernandez
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SPONSOR:
Blackhawk Engineering
Mark Cooper

Our team has been requested to design a one story, 32.5 foot x 50 foot two-family structure with a 10 foot walkout basement on the undeveloped site. In accordance with the City of Tallahassee Municipal (PUD Classification) and Florida Building Code, we are proposing a timber structure with concrete floor slabs and a concrete masonry unit basement over a shallow mat foundation. This includes the associated land development and proper drainage to accommodate the proposed design. We are sure that this request could be met through our firm in a cost effective and environmentally friendly manner.
Jackson Urgent Care Center

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Duncan Rady
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ADVISORS:
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Raphael Kampmann, Ph.D.
Primus Mtenga, Ph.D., P.E.
Lisa Spainhour, Ph.D., P.E.

SPONSOR:
Melvin and Associates
Sean Martin

Team Jackson County Urgent Care was tasked with designing a one story flat roof building with parapets, a parking lot and access road that will accommodate traffic flow to and from the building. The building will be made up of a steel roof frame with bearing concrete masonry unit walls to support the load from the roof, as well as the wind loads. A shallow foundation will be designed. The access road will be designed with a geometry best for this site, and drainage is laid out throughout the road and parking lot to accommodate rainwater. A detention pond will support the storm water from pervious and impervious areas after development.

Polk Place Mixed Use

TEAM MEMBERS: (L to R in photo)
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ADVISOR:
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SPONSOR:
Graceful Solutions
Bill Wilson

The project lead by CWZ Consulting consists of a mixed-use facility at the intersection of Polk Dr. and Meridian St. in Tallahassee, Florida. South City Tallahassee is considered an undeveloped area, and our client, Graceful Solutions, has a land available for new projects. The main goal of this project is to build infrastructure between a bus station and a commercial centre. The infrastructure would include residential areas with its own parking lot area. This building will have retail space on the ground level and a three story housing tower built on the roof of the retail level. The areas of the roof of the retail level not covered by the housing towers will serve as outdoor recreational space for the residents. A stormwater retention system will need to be implemented in some way due to FEMA plans that show the property in a floodway zone.
Southeast Con Hardware Competition Robot

TEAM MEMBERS: (L to R in photo)
Colin Fortner
Nicole Perry
Hunter Fitch
Michael Pelletier

ADVISOR:
Bruce Harvey, Ph.D.

SPONSOR:
TeligentEMS

As part of the IEEE Region 3’s annual conference, students are tasked with designing, testing and building a fully autonomous robot to complete several tasks during a four-minute match. This year’s competition consists of several Star Wars themed tasks that include deciphering an unknown circuit, detecting a low magnetic field, manipulating quadrature encoder, and launching three Nerf Brand Projectiles. Throughout the design process, the student team was able to research multiple solutions and after overcoming several design challenges, began to test each portion of the potential final product. During the construction process, the initial design had to be altered and the final design and construction ended with a robot that sits 12”x11”x11”. Using various motors and sensors, the robot can navigate between stages to complete each task. A ratio-metric Hall effect sensor allows the robot to detect the change in the Electromagnetic field, to indicate on or off. Two stepper motors, acting as a conveyer, are used to manipulate the quadrature encoder. Ending the match, the Nerf projectiles are propelled by a deconstructed nerf shooter.
Vehicle-to-Vehicle (V2V) Communications

TEAM MEMBERS: (L to R in photo)
- Dominic Eaton
- Roberts Etumnu
- Kimberly Leandre
- Diandra Prioleau

ADVISORS:
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- Bing Kwan, Ph.D.
- Leonard Tung, Ph.D.

SPONSOR:
- Ford Motor Company

The objective of the vehicle-to-vehicle (V2V) communications project is to design and implement an effective vehicle communication network with the application of collision avoidance. The project aims to serve as a simulation software tool to model real world situations involving V2V communications as it relates to collision avoidance. The simulator tool makes use of current standards related to communications such as the DSRC standard, the IEEE 802.11p WAVE (Wireless Access in Vehicular Communication Environment) as well as the SAE J2735 basic safety message set standard. These standards are utilized to increase the effectiveness and legitimacy of the tool. Through use of the simulation tool, it is hoped that the successful avoidance of collisions can be emulated and accurately verified to a degree of certainty. The results of this tool are expected to be the foundation of physical developments and implementation of a V2V retrofit system that will be able to perform the application of collision avoidance.

LiDAR Cave Mapper

TEAM MEMBERS: (L to R in photo)
- Cesar Rivas
- Spencer Day
- Hunter Hayden
- James Oliveros
- Alisha Hunt
- Jake Ogburn

ADVISORS:
- Shonda Bernadin, Ph.D.
- Victor DeBrunner, Ph.D.
- Rodney Roberts, Ph.D.

SPONSORS:
- FSU Earth, Ocean and Atmospheric Science Department
- Robert Broedel
- Stephen Kish, Ph.D.

The purpose of our project is to create an open source, affordable cave mapping device that can be used to produce rendered cave models. The device uses LiDAR technology to measure cave boundary data points. The data points are then used to construct a 3D model. An inertial measurement unit is incorporated into the design in order to calibrate the LiDAR readings and ensure accurate data measurements. Through the use of horizontal and vertical stepper motors, the device conducts a 360 degree scan of the cave. Once the scan is completed, the data points can be uploaded onto a CAD software and used to construct a virtual 3D model. The ideal budget for this design is 500 dollars or less. However, the total cost for this project can be lowered or raised depending on user customization.
Rescue Drone: Increasing Autonomy and Implementing Computer Vision

Drones used by Florida State University’s Emergency Management and Homeland Security Program can autonomously scan an area, but will provide no feedback regarding image contents, nor do they have a user friendly interface for interprocess communication. This team has been tasked with creating a new, unique drone capable of scanning disaster zones and identifying unique objects of interest. The functional prototype features a powerful onboard computer capable of live image processing for object detection, with distinct algorithms for color filtering and pedestrian tracking. With flight control hardware sponsored by NAVSTIK providing a local geographic overview, the team has further implemented a coordinate conversion algorithm for converting the drone’s latitude and longitude data into USNG format. An IP network governs all communication between the ground station and the drone. In order to accomplish the desired 18-minute flight time and address the sponsor’s request for a portable design, the mechanical structure of the drone consists of a foldable hex frame, with onboard electronics powered by four-cell LiPo batteries. The resulting product increases the ability to conduct reliable and efficient search and rescue missions by eliminating manual processing in favor of increased autonomy for detecting objects in a real-time video feed, and streamlining the coordinate conversion process.

Multi-Array PV Robo Cleaner: Mobile Solar Panel Cleaning Sensor Robot

The purpose of the project is to make a robot that is capable of cleaning a field of solar arrays autonomously. To do this, a two vehicle design concept was approached. The first robot, the cleaning bot, would sit on top of the arrays and clean; the second, the ground robot, would navigate through the field and transport the first around. The ground robot would also carry the power and cleaning solution for the cleaning bot. Due to time and equipment constraints, the team decided to create a prototype for the ground robot. The prototype was designed to use LiDAR and ultrasonic sensors, as well as GPS, to locate solar panels in an area and then get close enough to an array to touch it with a ramp.
Water Tower Generator

TEAM MEMBERS: (L to R in photo)
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Komlan Amesse
Darius Wright-Tippins

ADVISOR:
Hui Li, Ph.D.

SPONSOR:
Talquin Electric Cooperative

The team, sponsored by Talquin Electric Cooperative, is developing an energy storage system that will harness the unused energy from the company’s water towers to offset the cost of storing water and supplying members. Talquin Electric Cooperative is investing in renewable energy resources and wants a system to convert the unused potential/kinetic energy within their water storage towers to electrical energy. The team has a 48V, DC 220 W, solar panel which will be used to power a DC pump. The pump will drive the water into the water pressure tank until the desired pressure is reached. As water falls, the kinetic energy will convert into electrical power through the Water Buddy turbine in place. The electrical power will then be used to light a number of light bulbs, which represent excess power to be connected to the grid. Tests are currently being conducted with the turbine to obtain accurate output readings that can be utilized by our load. Once consistent readings are made, the team will move forward with the construction of the project, including the coding for the microcontroller. By the time of the final presentation, the team plans to have a working model that correctly demonstrates how an energy storage system would benefit companies such as Talquin Electric Cooperative.

Smart Phone Barometric Map

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Robert Minter

ADVISOR:
Victor DeBrunner, Ph.D.

SPONSOR:
Risk Management Solutions

Currently, wind data is difficult to gather, especially for developing countries that don’t have the infrastructure to support large weather stations. The purpose of this project is to provide a cheaper and higher resolution alternative to collecting wind data than currently available. We determined that it is possible to create a model of wind data, for a given area, based on information collected from smart phone sensors. Using this data, a server can run it through a program to produce weather maps.
Incredibowl: RFID Selective Feeder

TEAM MEMBERS: (L to R in photo)
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Eddie Gibson
Maria Perez-Ayure
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Jerris Hooker, Ph.D.

SPONSOR:
FAMU-FSU College of Engineering

The Incredibowl team has proposed a RFID Sensor Selective Feeder to allow pet owners the ability to manage their pet’s food consumption without constant observation. A selective feeder is a device that contains either food or water in a bowl within it. The device protects the contents of the bowl from both invasive animals/pests as well as environmental damages. However, the selective feeder will open the lid to the food bowl upon sensing the presence of a particular radio frequency identification (RFID) chip within a close proximity. The chip will be attached to the consumer’s pet collar, allowing for mobility and constant access to food and water. The identification chip will contain a personal code which will be used to open a specific selective feeder. This gives the consumer the ability to customize their feeding experience to fit the needs of their own pets. Development of the prototype model centered around the integration of several independent components. The bowl is comprised of a durable plastic with a removable top. The top also contains a water-jetted hole to hold the pet bowl. The plastic lid rests above the bowl and is attached to a continuous servo mounted to the container. The servo is controlled by a microcontroller within the container that receives sensory input from the RFID reader peripheral. The Incredibowl team developed a hierarchical approach to identifying the objectives and goals of the design project. The three primary objectives that the feeder satisfies are: portability, functionality, and sustainability.

SAR Imager

TEAM MEMBERS: (L to R in photo)
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ADVISOR:
Jerris Hooker, Ph.D.

SPONSOR:
Northrop Grumman

The synthetic aperture radar (SAR) is a system which is typically used in far field applications on airplanes and naval ships. The radar sends a signal to create an image of the surrounding area by mapping coastlines and other vessels. The aim of this project is to implement this technology on a smaller scale and detect the phase location of a reflective metal object placed in front of the radar. The SAR will simulate multiple input signal perspectives by using a combination of different transmitter and receiver antennas in an array with the phase center for each cycle located along its axis. Signal processing will be used to reduce the noise and filter out unwanted signals.
**Model Missile Defense**

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**SPONSOR:**
Northrop Grumman

This project consists of five main components all working in concert to defend an area from missiles. The first component is a camera system to feed live images into the second component - a machine vision program used to identify any missiles intruding into the defense zone. Once identified, the third component predicts the flight path of the missile and outputs the ideal intercept point. After this point is identified, the fourth component, a turret, aims at the intercept point and then the 5th and final component, a gun, fires the intercept projectile to take down the missile.

As of late March, each component is well underway. The camera system is set up and mounted to our turret base. Both software elements are in their finalization stages and are now being optimized for speed and precision. The turret is built and programming is complete and is being optimized to be able to turn quicker with less vibrations. Finally the gun is functional but is being worked on to increase final accuracy. The group is confident that the project will be done on time and perform to specifications.

**Universal Motor Controller**

**TEAM MEMBERS: (L to R in photo)**
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**ADVISORS:**
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**SPONSOR:**
General Atomics

When dealing with high output power, power electronic industries are moving more towards digital power converters than analog for its increase in performance, flexibility, configurability, and reliability. More specifically, Digital Signal Processing (DSP) offers a longer life cycle with few to no repairs and it’s easier to customize using programmable code. DSP also communicates in real time and provides an array of programmable parameters to analyze the performance efficiently. The downside of using DSP is the complexity of programming the device. The team will use the TMS320F28335 ezDSP controller to implement the DSP motor controller. The DSP controller generates a series of 3-phase DC pulses using Pulse Width Modulation. Each pulse is 120 degrees out of phase from one another. These pulses are sent into the 3-phase Mosfet inverter which is simulated using the Real Time Digital Simulator (RTDS). The Mosfet inverter converts the DC pulses to AC sinusoidal current. This current drives the induction motor, which is also simulated by the RTDS. The team will then use a real motor and document the torque that the load produces as the voltage/hertz ratio increases.
A channel, which transmits objects at high speeds, is susceptible to catastrophic failure if the walls of the channel build up with slag or any other solid deposits. These deposits pose a high risk to both the users and equipment. The purpose of our project was to develop a device capable of traversing a channel laden with slag buildup and retrieve pictures which could be processed by a compatible program to generate a three-dimensional map of the structure, which included identification of harmful buildup and any other possible defects.

This project consisted of two halves in order to create a fully functional system: the cart for image retrieval, and the program for image processing and modeling. The overall function of the cart is to traverse a narrow tunnel roughly 9 meters in length capturing pictures of the channel as it travels. Although a short trip, the project stipulates that each image capture must occur every millimeter, meaning a 9-meter-long journey would take roughly a half hour.

In order to create clear and accurate photos in almost absolute darkness, a laser mounted on the cart, shines through a diffracting lens which illuminates a narrow section of the channel. A camera, also mounted on the cart, captures the image of the laser against the walls of the channel. Once the length of the entire tunnel has been captured, the collection of images will be transferred to a computer program designed in MATLAB. This program uses native MATLAB image processing functions to decipher each image and determine whether the image presents any abnormalities on the channel walls. After each image is processed and cataloged, the program generates a three-dimensional rendering of the tunnel.

This model allows the end user to virtually navigate through the inside of the tunnel and provide information regarding where dangerous buildup has been detected. Using the provided model and information, the client can more efficiently detect, diagnose, and preemptively eliminate buildup.
KidKonnect Child Location and Activity Monitor

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SPONSOR:
FAMU-FSU
College of Engineering

The idea of using GPS technologies to locate a human position is not a new or innovative idea; neither is the concept of tracking and storing health statistics pertaining to an individual. Even with the use of these previous breakthrough technologies, KidKonnect still stands out as unique and groundbreaking. As a team, we are dedicated to creating a sensor that is responsive to location and gathering daily health data through a network of GPS, GSM, accelerometer, and microcontrollers. The main objective focuses on generating a product that combines existing technologies to allow parents/legal guardians to monitor the location of a child and provide real time feedback to the parent’s coordinating smartphone application. This device will be located in the child’s shoe via gel insole and will offer a “hidden” wearable feature that contains a combination of monitoring technologies.

Fuel-Link

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SPONSOR:
Syn-Tech Systems Inc.

Syn-Tech Systems Inc. tasked our team with the challenge of creating an accompanying product to their already successful FuelMaster Unit (FMU). Their current system solves the problem of safely providing a secure fueling transaction process for companies with large vehicle fleets, but the installation time and price are steep. Our goal was to provide fueling transaction security through proximity via a cheaper, easier to install, alternative system. This will be achieved by designing a vehicle identification product that would use Near Field Communications (NFC RFID) and Bluetooth 2.4 GHz communication to deal with transmitting a Unique Identification Number (UID) over both short and long distances, respectively. After experimenting with multiple tags, our group chose NTAG203 tags as they are inexpensive, easy to install, and will rip when tampered after the initial application - providing another layer of security. They are also advertised to perform on metallic surfaces. These will be positioned on the gas lid of the car, and the RFID/NFC Reader will be encased in a sealed housing positioned on top of the gas hose. This will provide the ideal, short-range distance required, and will allow reliable polling of the UID when in range of the tag. The UID will then be relayed to the FMU via the Bluetooth antenna (nRF24L01+), which will then be verified with a fuel management unit emulator for transaction proceedings.
Fault Tolerant Controller System Monitor

A fault tolerant controller is designed to accept data from a source - in this case a 500W BLDC motor - analyze it for tolerance, and control the source in a way to prevent its failure. The use of this fault tolerant controller will ultimately save time and money preventing costly failures of drones during flight. The purpose of this project was to design this fault tolerant controller for General Atomics; however, a smaller motor was used for testing purposes. This fault tolerant controller is expected to collect current and voltage levels from all three phases of the motor, temperature readings from the coils, and accelerometer data from the rotating portion of the motor. The team expects to see the real-time data change based on induced potential motor fault. This data could then be fed into a fault model that would predict the likelihood of motor failure.

Solar Thermal Generator

The purpose of this project is to generate electricity for the myriad of electronic devices used by an average camper aiming to be environmentally responsible. Currently, there is no effective way to generate power in remote locations, like campsites and national parks. In order to supply power to everyday electronic devices, a gas generator is traditionally used; however, due to their weight, noise factor, and environmental impact, it has become problematic to use these generators responsibly in isolated locations. Although photo-voltaic cells were initially considered for the design, a more interesting process involving thermoelectric power generation was sought as the more promising solution. The concept transformed further with a trivial amount of experimentation using a small parabolic dish to concentrate the heat provided by the sun to a fixed point. The system should run autonomously at the push of a button to intelligently track the sun, mechanically aligning itself to charge electric devices as well as the provided battery. The finished product is ideally portable and will be used under such applications as lights and heaters in a relatively remote location where a power grid is unavailable or unreliable. Ideally, the effective design must be simple to use for your average consumer.
Virtual Reality Simulation for Confined Spaces Safety Training

By using virtual reality to simulate any sort of training or exercise, one would avoid the need for thousands of dollars in equipment and make it more accessible to the average person. Overall, the project goal is to demonstrate how virtual reality simulations can be an intuitive and user-friendly experience and add to the safety of training regimens. The three main needs are retrieving an input response from the Virtual Reality (VR) space, generating a physical output, and ensuring the simulation is as accurate as possible. In order to retrieve a virtual input, we are going to need a VR headset, a Graphical User Interface (GUI), a gesture sensor, and headphones. In order to generate an effective GUI, it will need to be user-friendly; however, this is not high on the hierarchy of the project’s needs. For the environment, it is necessary that the simulated space incorporates different types of scenarios. This will require advanced research on the different types of dangers that can be encountered during the assessment of a confined space, as well as inside of a confined space. Finally, for the interaction of the two, the biggest concern is having a functional coding environment.

Solar Powered Eco-Lab

Florida A&M University won The Home Depot’s $30K ‘Retool Your School’ campus improvement grant in the summer of 2016. Funds are being used to create an Eco-Lab that will provide both outdoor working spaces and educational opportunities for the surrounding community. Environmental conservation, food security, and sustainability will be emphasized through teaching and demonstration on site. Our role in this project is to design and implement an off-grid solar-powered system that will be used to distribute energy to various loads at the Eco-lab, such as computers, mobile devices, lights, and a fan.
Resistance Training Skin: Bandz

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SPONSORS:
JaCarr Patrick
Jason Powell

This project follows a group that will design a prototype of a Resistance Training Skin. The skin will be used to enhance physical ability by applying resistance to muscular movements. The first step was to define the project and the overall scope. The team conducted a business analysis, regarding the market opportunity and the risks in creating this product. In previous phases of the project, the group presented all the collected data for the prototype development, and the prototype itself, including free body diagrams. From these diagrams, the moments about specific muscles and joints were determined. The material possibilities were narrowed to six samples upon which further testing would be conducted. In the analyze phase, the group was able to perform tensile tests on various combinations of Thermoplastic Elastomer. The group has also collected “resistance perception” data from prospective customers to establish ranking criteria for various designs. This data will help to establish different difficulty levels for the future prototype. Lastly, an early prototype was designed and built, to better show the design concepts of the elastomer bands in use.

Improving Efficiency of Patient Flow at Tallahassee Memorial Hospital Quincy Clinic

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ADVISOR:
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SPONSORS:
Robert Moss
Karen Quigley

The objective of this project is to improve the efficiency of patient flow through the entire treatment process at Tallahassee Memorial Hospital (TMH) Quincy Clinic. The opportunities of reducing patient wait time can improve the clinic’s reviews and daily patient capacity. The sponsor outlined the scope of the project to focus on the scheduler’s accuracy, and doctor and nurse time flexibility. The team collected more than one-hundred observations measuring patient’s time in the waiting room, time spent with their nurse, time waiting for their doctor, and time spent with their doctor. To measure nurse and doctor time flexibility, the team collected data on what each nurse inputs into their patient charts. In the analyze phase, the team modeled the clinic process with Arena Simulation software and identified that the major bottleneck in the system is doctor availability. Suggestions were provided based on these findings. In the next phase, the control phase, the senior design team will be working to implement the approved changes and write written standards for the nurse charting process and the front staff scheduling system.
In today’s aerospace industries, most aircrafts are composed of hundreds of miles of conductive wiring which account for a large portion of the plane’s weight. The team will attempt to replace the currently used copper cabling with wiring fully composed of buckypaper, reducing the weight of the aircraft.

Copper is the most widely used material in electrical wiring. Half of all the copper that is mined is used for such purposes. It also has the highest electrical conductivity rating of all non-precious metals, other than silver. Buckypaper is an optimal replacement for copper due to its individual and aggregate conductivity properties and weight.

A single nanotube is five times more electrically conductive and six times less dense than copper, making it an ideal candidate for its use in wiring. Buckypaper is composed of thousands of individual nanotubes, randomly aligned on the microscale. It is possible to have these properties throughout the nanomaterial if the nanotubes are aligned. Through a simple stretching process, the non-aligned carbon nanotube buckypaper sheets can be transformed into a material with unilateral strength and mechanical, electrical, and thermal properties that are comparable, if not better, to those of copper.

Having carbon nanotube buckypaper wiring can contribute to the reduction of aircraft weight in both commercial and defense aerospace applications, without jeopardizing the durability and conductivity of the electrical wiring.
Ergonomic Brassiere

Women today experience many issues such as discomfort, chronic pain, wrong sizing, and lack of support when wearing a bra. The “Ergonomic Brassiere” project intends to improve the existing brassiere and develop a more effective sizing system. The team has broken down the project development into two key components, which consist of performing Finite Element Analysis (FEA) for the brassiere design and determining variations of the body for the sizing system. Focus groups were used to understand customer requirements. Based on that input, the team re-designed the sizing system, improving brassiere load displacement, and eliminating pain points to innovate a comfortable and trendy design. A 3D CAD Model served as the basis for the FEA simulations. The team utilized a “teardrop” theory of design to calculate a polynomial equation that relates the forces applied by the breasts on the brassiere. The equation was used for FEA simulations from which the team collected and analyzed results to propose the influential factors. These influential factors were used as inputs for a fractional factorial experiment within Minitab.

City of Tallahassee: Feasibility Study for a Compost Facility

The City of Tallahassee’s Community Beautification and Waste Management Services collects 47,000 residential customers’ yard waste. Yard waste is an organic material produced from the maintenance of landscaped areas. Solid Waste Service’s current process for disposal of mulch does not reap high financial benefits. After the yard waste is turned into mulch, City of Tallahassee must pay vendors around $33,000 per month to deliver the product to other facilities. At the City of Tallahassee’s T.P. Smith Waste Water Treatment Plant, 60 tons of biosolids are created each day. Biosolids are sludge material that comes from the treatment of wastewater, and are subsequently dried in a natural gas fired process and pelletized to create a fertilizer product that is sold to the agricultural market. The cost of the process to dry the biosolids is high because it uses natural gas. City of Tallahassee would like to create a facility that would combine the mulch and the biosolids to create compost. With this method, the two waste streams will be upcycled, creating a higher quality and clean organic product. This compost can then be sold which will increase the revenue to the City of Tallahassee.
**Ultimate Guitar Cases**

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- Austin Moore
- Grant Kleiner
- Jovanny Davila
- Samuel Rubin

**ADVISOR:**
- Okenwa Okoli, Ph.D.

**SPONSOR:**
- Michael Devine, Ph.D.

Guitars come in many shapes and sizes, and so do their cases. Guitarists with multiple instruments will usually need to purchase a new case for each one they own. The goal of this project is to solve this problem by designing a universal guitar case that can fit virtually every body shape of the electric guitar. After conducting initial customer surveys, the team decided to expand the scope of the project to make the case stronger by better protecting guitars from thermal and heat damage, and more marketable by adding convenience features. The team will use foam blocks to protect from impact damage and polyurethane insulation to protect from thermal damage. The team will also include a built-in amplifier with a headphone jack, a portable tool kit with an Allen wrench, string winder, wire cutters, pick dispenser, and an extra storage compartment.

**Danfoss II: Non-Conforming Material Flow**

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**ADVISOR:**
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**SPONSOR:**
- Danfoss Turbocor Inc.
- Heather Kaler
- Eric Proctor

Danfoss Turbocor Inc. has tasked the team to redefine the non-conforming material (NCM) handling process. This has the potential to reduce overhead cost, reduce quality issues affecting production, and increase profit for the company. The NCM process includes several steps that must be completed before disposition of the parts. In the define phase, the team used the House of Quality to conclude that the work area must be redesigned to improve material flow, reduce clutter, and increase organization. In the measure phase, the team conducted time studies of the collection process of the non-conforming materials to determine if this process needs to be optimized. The team also analyzed historical data, which provided information on the amount of time each part spent in the disposition process. This information is the team’s point of reference to identify specific causes of lengthy disposition times. To conclude the measure phase, a layout for the new NCM area was designed to optimize work-flow. During the analyze phase, the team’s focus shifted to establishing key performance indicators (KPIs), which will define a standard for speed, precision, and accuracy in this process. The improve phase focused on refining and expanding the KPIs developed in the measure phase, as well as statistical analysis. The control phase will involve detailing methods of improvement.
The Internet of Things (IoT) is the concept of connecting sensors, devices or machines to the internet, collecting data, and allowing them to communicate with each other. The goal of this project is to create a cyber-physical lab in which all machines can connect to the internet and communicate with each other. By doing this, researchers will be able to remotely monitor their tests and can be notified if something happens to a machine.

In order to achieve communication between machines at the High Performance Materials Institute (HPMI), the machines in the mechanical testing room will be connected to the Civionics Percēv Node system. The nodes will collect the data from the tests and transfer the data online. Two experiments were designed to collect data using the Percēv Node system over discrete and continuous periods of time.

For the continuous experiment, data was collected over an extended period of time, providing data that can be analyzed to reveal trends or root causes. For the discrete experiment, the node was used to monitor a machine and the chiller line, which will allow researchers to stop the machine if the temperature is too high.

Once the data acquisition has been proven to be accurate, the Percēv Node system will be integrated onto each machine and used to connect all machines within the mechanical testing room.
Danfoss Turbocor Return Merchandise Authorization (RMA) Process

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**SPONSORS:**
Danfoss Turbocor Inc.
Kevin Gehrke
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Daniel Simmons

Danfoss Turbocor Inc. has a Return Merchandise Authorization (RMA) process that is lengthy and tedious for both its employees and customers. The senior design team intended to utilize the six-sigma DMAIC improvement cycle on the current process. The team has conducted statistical analyses on time study measurements of each step of the process. It was concluded that the bottleneck areas of the RMA process are the time it takes for the customer to ship in their broken compressor, the time a compressor waits in queue to be investigated, and the time a compressor waits in queue to be repaired. Surveys were also created and sent out to the customers of Danfoss Turbocor Inc., as well as to the employees that work within the process. The purpose of the surveys was to gather qualitative data about the process and also to create baseline of satisfaction for future references. The team was able to come up with a new system for Danfoss Turbocor Inc. to implement at the beginning of their RMA process. This system consists of offering certain service options to the customer about what they want to do with their compressor based on whether it is in warranty or not. This new system would not only decrease the three bottlenecks identified, but would also heavily increase customer satisfaction and standardize the process.

City of Tallahassee: Landscape Beautification Division

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**SPONSORS:**
City of Tallahassee
Sam Geiger
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Cris Revell

The main objective of the project was to work with the Landscape Beautification Division of the City of Tallahassee to reduce their yearly costs, measured in cost per acre, by reallocating current routes and ensuring new routes can be added. This year, they received more acreage to maintain and their budget will be reduced. To accommodate this, the project objective was to observe the department and find areas where there was an opportunity to reduce cost without eliminating any jobs. The primary focus for the group has been to create a more effective scheduling system and a more even route distribution among groups. This will help to create a more productive working environment that will reduce the amount of time each task takes and help the same number of workers complete more tasks. This will, in effect, reduce the cost per acre, due to having the same cost with more acres.
**Revision of Lockheed Martin’s Human Type Target for Manufacturability**

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**SPONSOR:**  
Lockheed Martin

Lockheed Martin desires to produce a target system, resembling a human in size, shape, and appearance. This system is constructed to react appropriately to being hit with small arms fire. This will be done via hit sensors on the target, which will be able to detect vibrations caused by a bullet fired into the target. The target will be a commercially available mannequin, sold for use specifically as a small arms target. The team is tasked with revising the prototype and making improvements in order to bring it to a production-ready state. This includes designing a stand for the target, interface plates between the target and stand, 2x4 adapters, and a test stand to activate the fall mechanism. The final outcome of this project will be an operational human type target which will fall when hit with an appropriate sequence of small arms fire, including ready for manufacturing designs of the aforementioned components.

**Design and Development of Optimized Flow Channels for an Alkaline Membrane Fuel Cell (AMFC) Educational Kit**

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**ADVISOR:**  
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**SPONSOR:**  
FAMU-FSU College of Engineering

The purpose of this project is to research, test, and engineer a functioning alkaline paper membrane fuel cell contained in a portable carrying case. The kit will contain different flow configurations allowing the user to experiment with the efficiency of the fuel cell’s operation. One of the main responsibilities of the team was to research the significance of the specifications of the flow channels. It was concluded that a parallel configuration would produce the most power due to the designs minimal head loss, while also evenly distributing concentrated gases, and maintaining sufficient water vapor removal. The kit will include this configuration, as well as a serpentine and a digital configuration. The goal is to highlight the effect of each flow configuration’s flaw on the fuel cell’s operation. One obstacle was delivering hydrogen to the fuel cell safely. The team concluded that the most reliable, safe method of accomplishing this would be to use the HydroStick Pro, which produces and stores pure hydrogen in a small aluminum cylinder, requiring only water and a power source. Aside from obvious hardware components, the kit also includes equipment and measuring devices that will allow the user to operate and measure the fuel cell’s performance.
This project is organized around designing a mobile robot capable of competing in five athletically-inspired events at the 2017 ASME SPDC Student Design Competition. The competition takes place over five events and places strict limits on the size of the robot and types of energy teams can use, with an emphasis on smaller platforms and renewable energy sources. The Sprint event is a time-trial style race where each machine fights to get the fastest time. The Hit event is an exercise in precision and power which requires competitors to hit a golf ball the furthest off of the ground. The Lift event is an opportunity to demonstrate the pure strength of the robot by lifting an object of the team’s choosing as high as is manageable. The Throw event will see each robot attempt to outperform the other by launching a tennis ball as far as they can. During the last event, the Climb, each robot will showcase its dexterity by climbing up and back down a set of three stairs as quickly as possible. The team determined that the Climb event would be the most difficult challenge and designed the robot for this event. Using the “Chaos Frame” developed by ASI Robotics as the basis for the design, the team can drive the arms of the robot in a full 360° arc while simultaneously moving the tracks on each arm. This design is also useful as it allows the tracks to maintain constant contact with the ground regardless of the configuration. The strength of this design is in its dexterity. As such, the team expects to excel in the Sprint and Climb events.
Design & Verification of Thermal Management for SiC PV Converter

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SPONSORS:
Center for Advanced Power Systems
PowerAmerica

In silicon-carbide photovoltaic converters, it is necessary to manage the thermal by-product of power electronic devices to prevent failure of the system. One of the most common methods to remove heat from the system is to use a heatsink. However, heatsinks are usually not optimized to fit the specific power module and tend to be overdesigned, causing an unnecessary increase in the weight, size, and cost of the system. This project focuses on studying aluminum heatsinks undergoing forced convection with either cylindrical pin fins or rectangular plate fins. Through calculations, simulations, and testing, our team has determined that a bimodular pin fin design provides similar thermal management results as a bimodular plate fin while significantly reducing the overall system weight. An optimized design for the pin fin heatsink was determined to further decrease the system weight. To expand the project to further applications requiring thermal management, a guide was developed for selecting an optimized heatsink design in a general case.

Motor Test Rig: Improving Alignment and Incorporating Torque Transducer

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SPONSOR:
Danfoss Turbocor Inc.
William Sun

Danfoss Turbocor Inc. tasked the team with a project to develop a test rig where two compressors could be connected and tested to determine the efficiency of the compressors, as well as the types of loads occurring with external components attached. One of the main issues that last year’s design team faced was the fact that the compressors would fight each other; each compressor has 9 sensors that correct and adjust the position of the shaft, and if the compressors start adjusting, then the other would mirror the first compressor’s action. This caused a considerable amount of oscillation and eventually would cause the compressors to shut down at higher speeds. The team has come up with a design that would isolate each compressor, and prevent them from “fighting”. This design incorporates a bearing and housing which are mounted to a central stand. The bearing and housing represent what a torque meter would do if it were mounted in between. The goal of the project is to improve the functionality of the rig as well as simplify the alignment process.
Noise Mitigation in an Organic Rankine Cycle (ORC) Turbine Bypass Line

TEAM MEMBERS: (L to R in photo)
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ADVISOR:
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SPONSOR:
Verdicorp

Systems such as Verdicorp’s Organic Rankine Cycles (ORC) produce grid level electricity from otherwise wasted thermal energy. As a result, an ORC system generates cost savings and improves efficiency, but a drawback of the system is excessive noise generation when operating in bypass. When the working fluid of the ORC is not passing through the turbine, the flow is diverted through a bypass line, which is a narrow and congested segment of piping in the system. This in turn produces an undesirable amount of noise which poses health hazards to employees and an annoyance to residential communities. The team was tasked with designing and conducting acoustic measurements on site during steady-state and bypass, determining the noise characteristics and defining the generated noise from the time to frequency domain for mitigation. Results from testing shows an average steady-state noise level of 87dB and a bypass line noise level of 101 dB at maximum operating capacity. The team’s objective will be to analyze and implement a passive noise dampening solution localized to the bypass line to improve workplace comfort and safety.

Electric Vehicle Range Extension

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SPONSOR:
Cummins Inc.
Michael Hayes, Ph.D.

Cummins has tasked this team with extending the range of a recreational electric vehicle by at least 15% using non-traditional power adders, while minimizing the reduction in acceleration or top speed. This must be done without increasing the onboard fuel supply or stripping the vehicle of its four-person capacity. This task was approached first by conducting extensive research on alternative power sources and performing benchmark testing on the vehicle platform as it was received. The theoretical range was then calculated to be 98.6 miles based off the battery power and propane consumption over a set distance. After concluding the research and subsequent analysis, a 280W Solar Roof Replacement Kit was purchased and installed along with an overhaul of the existing generator system implementation. These two major changes will allow the team to reach and surpass the overall goal of a 15% range increase, while also satisfying the constraints. Final testing has begun with early results showing a calculated range of 124.2 miles, giving a 26.0% increase in range.
Development of Power Converting Sub-system of Kite Power Generator

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ADVISOR:
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SPONSOR:
Jeff Phipps

With the growing population and consumption of energy, there is an ever-growing need for clean, renewable energy sources. The purpose of this project is to design, build, and deploy a kite power generator that will power a 40W lightbulb. The design will then be scaled to generate 100kW’s of power. The scaled kite will be a conceptual design. To generate power, the kite will be tethered to a permanent magnet within a housing that contains an electric coil. As the kite is subjected to a wind load, the kite will pull the magnet through the coil. When the kite changes its angle of attack, the springs will help force the magnet back through the coil. Electricity is generated each time the magnet slides through the electric coil via Faraday’s Law. In order to achieve a constant oscillation of the magnet, the kite will be flown in a figure-8 pattern. In an ideal world, the kite would be flown in a straight, up and down motion, in order to maximize the forces seen on the tether that would be tied on to the magnet. The expected forces seen by a 1mx1m kite at the desired altitude of 1000ft are approximated to be 70N-200N, when oscillating between 5-15 degrees.
In 2009, measurements by the U.S. Energy Information Administration determined that nearly 50% of household energy consumption is due to A/C alone. New and innovative ways are constantly being developed in order to obtain the maximum efficiency for chiller systems in the HVAC industry. One possible solution is the addition of an economizer to the standard chiller system, specifically, a flash tank economizer.

In theory, the flash tank economizer has the potential to yield the highest efficiency gain compared to its counterpart, the heat exchanger economizer. Danfoss Turbocor Inc. is one of the companies that have begun implementing economizers in their chiller systems.

In practice, the flash tank economizer is tested in a standard chiller system. However, testing and simulation of such system will be performed through a gas cycled test rig using a mixing chamber. Calculations results reveal that the flash tank economizer has a COP increase of 8.7% and the heat exchanger has a COP increase of 7.9%. Thus, the flash tank economizer is more desirable purely on calculations.

Final testing will be performed in the coming weeks with the addition of CFD analysis. However, it can be concluded that, if performed correctly, the addition of a flash tank economizer will yield the highest efficiency gain of any economizer type. Installation of a flash tank economizer should be a consideration for companies in the HVAC industry looking to improve the performance of their systems.
Design of an Autonomous Ground Vehicle for Intelligent Ground Vehicle Competition

TEAM MEMBERS: (L to R in photo)
Izekiel Copeland
Andres Nodarse
Tajaey Young
Justin Daniel
Matthew Patton

ADVISORS:
Nikhil Gupta, Ph.D.
Matthew Jensen

SPONSOR:
Northrop Grumman

The purpose of this project is to use the process of distributed engineering to partner with Florida Institute of Technology in the design of an autonomous ground vehicle. Distributed engineering is the process where two teams that are geographically separated must work together to accomplish a common goal. This vehicle must be capable of implementing object detection, line following, motion planning, and GPS waypoint navigation. By completing these tasks, the vehicle will be capable of competing in the Intelligent Ground Vehicle Competition taking place on June 2nd 2017. Through project planning and task delegation, the team managed to build the robot platform and made preliminary steps toward line following and object detection. The team concludes that distributed engineering requires constant and effective communication between the entities involved, and that vision and goals for the team have to be established early if timely execution of tasks is to be achieved.

Design of a Compact Pressure Sensor
Multi-Layer Insulation in a Vacuum

TEAM MEMBERS: (L to R in photo)
Stephen Johnson
Jason Carvalho
Michael Kiefer
Sebastian Bellini

ADVISOR:
Wei Guo, Ph.D.

SPONSORS:
NASA Marshall Space Flight Center
James “Jim” Martin

Our team, sponsored by the NASA Marshall Space Flight Center, is tasked with developing a compact pressure sensing device that is capable of measuring the interstitial vacuum pressure between layers of Multi-Layer Insulation (MLI). The additional requirements for the pressure sensor are that it maintain the MLI’s structural integrity, minimize heat flow into the interstitial space, minimize power consumption and take at least one measurement per second. The device must be able to read pressures as low as 10-2 Pa (10-3 torr) and would be beneficial if it can measure up to atmospheric pressures. From a House of Quality, the most important engineering characteristics with respect to customer requirements was determined and considered in designing the concepts. Three main concepts were generated: a capacitor pressure sensor, a multi-stage capacitor pressure sensor and a fiber optics pressure sensor. A decision matrix was used to determine the capacitor as the most viable option with the second choice being the multi-stage capacitor. A prototype of the capacitor pressure sensor is currently being tested.
Design and Development of an Autonomous Surface Watercraft RoboBoat

TEAM MEMBERS: (L to R in photo)
Samuel Nauditt
Teresa Patterson
Kyle Ladyco
Donald Gahres

ADVISORS:
Jonathan Clark, Ph.D.
Damion Dunlap, Ph.D.

SPONSOR:
Naval Surface Warfare Center (Panama City)

The AUVSI RoboBoat Competition is an international event that began in 2010, where teams design, develop, and test a vehicle that meets competition requirements as indicated on the Robonation website. This team is the first team at the FAMU-FSU College of Engineering that has participated in the Roboboat project; however, it does not intend to be the first team to represent the College in the competition. The team set goals to develop an autonomous surface watercraft capable of navigating colored buoys and channel markers, while remaining capable of manual control. The team designed and built the surface watercraft capable of meeting the tasks set before it. The final design embodies versatility and robustness as this will be a multi-year project. The team plans to hand-off a well-integrated and well-tested machine, to be improved upon and taken to the 2018 Roboboat competition the following year.

Designing and Flying an Experimental Sounding Rocket

TEAM MEMBERS: (L to R in photo)
William Pohle
Alex Mire
Tariq Grant
Brandon Gusto

ADVISOR:
Rajan Kumar, Ph.D.

SPONSORS:
Aero-propulsion, Mechatronics, and Energy Center
Daniel Cavender
FAMU-FSU College of Engineering
John Hansel
NASA Florida Space Grant Consortium

The team has committed to designing and building a competitive rocket for the Experimental Sounding Rocket Association’s (ESRA) Intercollegiate Rocket Engineering Competition (IREC). The intent is that this endeavor shall lead to further rocketry related projects at the FAMU-FSU College of Engineering. The ESRA competition requires that a sounding rocket be designed, built, and flown to 10,000 feet above ground level while carrying an 8.8lb experimental payload, with the additional requirement that all components be safely recovered within a predefined radius from the launch site. With these requirements in mind, the team designed a flight vehicle with fixed fins, composed of fiberglass, with propulsion provided via a 4G commercial solid grain rocket motor. Housed inside shall be a dual deployment recovery system, two separate avionic systems, and our payload. The payload will consist of an active flow control aerobraking system to be deployed for stabilization during the initial drogue parachute deployment event.
Capacitor Assembly Automation

TEAM MEMBERS: (L to R in photo)
Folaranmi Adenola
Marissa Foreit
Olayinka Oladosu
Kyler Kazmierski

ADVISORS:
Carl Moore, Ph.D.
Chiang Shih, Ph.D.

SPONSORS:
Unison Industries - GE Aviation
Kevin Walker

The objective of this project, sponsored by Unison Industries - GE Aviation, is to develop a level of automation for the assembly process of capacitors by designing and fabricating working prototypes that can effectively and efficiently carry out at least over 50% of the assembly process, thus, reducing total assembly time from 27 mins to 15 mins. The steps include placing tape on each section of the capacitors, stacking the capacitors, soldering together the electrical tab of the capacitors, wrapping insulation paper around the stacked capacitors, taping the entire package and doing a dimensional check. To accomplish this goal, an automated process has been developed for the wrapping and rolling stage of the assembly process while semi-automated process was developed for the stacking and dimensional check. As a result of the improved processes, the time taken to roll a double-sided insulation tape on each capacitor has been reduced from 2 min 15 sec to 35 sec, stacking and proper alignment of the 4 individual capacitors has been reduced from 25 sec to 12 sec, wrapping of insulation paper around the stacked capacitor was reduced from 2 min 50 sec to 1 min 25 sec, and the one-time dimension check with the aid of the gauge block reduced the time taken to measure the length, breadth and width of the whole assembly from 1 min 4 sec to 15 sec.

Development of a Robust Second-Stage Oil Sealing Device for Heavy-Duty Engines

TEAM MEMBERS: (L to R in photo)
Olaniyi Ogunbanwo
Jonathan Strickland
Sean Casey
Kyle Brooks

ADVISORS:
William Oates, Ph.D.
Terry Shaw

SPONSOR:
Cummins Inc.

The goal of this Cummins Inc. sponsored project is to design a device that will capture oil that leaks out of a crankshaft seal. The collected oil is to be transferred to a holding reservoir, enabling future reinsertion into the crankcase. This objective will be obtained by pressurizing a secondary enclosure around the rear crankshaft seal coupled with a student designed labyrinth seal. The overall effectiveness of this device will be assessed through a 24-hour simulation across various operating regimes proposed by Cummins, and carried out through a custom designed and fabricated test rig. The team has begun to fabricate the custom test rig and has finalized a design for the secondary enclosure, as well as the selected labyrinth seal.
HANSCycle: Reciprocating Lever Transmission

TEAM MEMBERS: (L to R in photo)
Alison Pustelniac
Nicholas Khayata
Michael Roddenberry
Darren Beckford

ADVISOR:
Keith Larson

SPONSOR:
Gordon Hansen

The team is dedicated to developing a working HANSCycle, which implements the Reciprocating Lever Transmission (RLT) designed by Gordon Hansen. The goal of the RLT is to improve upon a few aspects of the traditional bicycle. These include two ‘dead spots’ at the top and bottom of a normal pedal rotation, as well as alleviating joint damage to the user from the ‘dead spots’. If successful, the HANSCycle will be both efficient and ergonomically comfortable for the user. Once a working prototype was developed, the team tested it and compared values such as torque, cadence, work, and speed, with values of a traditional bicycle. Initial testing has been promising, as the data suggests favorable power transfer from the user to the road. However, the current size constraints of the initial prototype have led to premature failures. This has been primarily due to the high levels of torque transferred through the RLT, which caused several components to shear, including most recently, the output shaft.

Second Stage Development of an Autonomous Search and Rescue Unmanned Aerial Vehicle (UAV)

TEAM MEMBERS: (L to R in photo)
Matthias Clarke
Marcus Yarber
Cody Rochford
Gale Yu
Devin Justice
Trent Loboda

ADVISOR:
Farrukh Alvi, Ph.D.

SPONSOR:
Northrop Grumman

Unmanned Aerial Vehicles (UAVs) have become extremely prevalent in today’s society and serve in many capacities from military missions to search and rescue. This project has focused on the second-stage development of a UAV capable of a search and rescue mission of a stranded hiker. The first stage of development included design and manufacturing of the mechanical systems as well as integration with the flight controller and basic flight tests. In the second stage of development a new electronics package was selected and installed, structural modifications were designed and implemented, autonomous flight was achieved, and development of stationary and dynamic target classification was completed. Stationary target detection allows for the system to distinguish between different alphanumeric symbols, detect and classify shapes, and detect and classify colors. The dynamic target detection enables the system to detect the hiker as he/she emerges; this is done utilizing the difference between images. The system is capable of autonomous takeoff, waypoint capturing, and landing while detecting and classifying stationary targets in order to detect the stranded hiker and deliver a water bottle.
Development of a Helical Path Tree Climbing Snake Robot

TEAM MEMBERS: (L to R in photo)
Steve Szalay
Justin Morales
Michelle Maggiore
Jorge Campa

ADVISOR:
Jonathan Clark, Ph.D.

SPONSOR:
Jeff Phipps

To increase the safety and lower costs of the tree removal process, the team will design a remote controlled robotic snake that will replace the climbing worker. The final project goal is for the snake robot to climb the tree (in a helical path), cut the branches on the way up, and then chop the tree down in a safe and efficient manner. The team will solely focus on the climbing aspect for this iteration and will then use a payload to represent the weight of the cutting arm for future iterations. The clamping will be generated by a long cable that runs through the bottom of the robot, which curls the robot when pulled. The helix shape will be generated by using wheel differentials. The wheels on one side will spin slightly faster than the other side’s wheels, allowing the robot to align into a helix shape. This design was tested and confirmed the robot’s ability to climb a tree. The final step is to recreate the design using an aluminum body and locate the optimal position to place the payload.

Design and Development of a Human Powered Vehicle: A NASA Competition

TEAM MEMBERS:
Katherine Estrella
Quentin Hardwick
Luke Maeder
Garrett Rady
Jacob Van Dusen

ADVISORS:
Nikhil Gupta, Ph.D.
Chiang Shih, Ph.D.

SPONSOR:
NASA Florida Space Grant Consortium

The goal is to design a human powered vehicle to compete in the 2017 NASA Human Exploration Rover Challenge in Huntsville, Alabama on March 30-April 1. The competition is a time trial to complete NASA’s extraterrestrial course containing: craters, boulders, ridges, inclines, crevasses and depressions. The vehicle will be powered and operated by one male and female. Major constraints for the vehicle include: cannot have any energy storage devices, must maintain a 15-inch ground clearance to the riders, must collapse and fit into a 5-foot cube, and must be safe and lightweight. This year’s technology challenge is on the wheel design and fabrication. Every part of the wheel must be designed and manufactured except the hubs. The team is on track to compete and gather information on their rover that they can pass on to next year’s design team. Rovers may be used from year to year with a defined 50% of the vehicle being modified. The information gathered this year will be notated and documented for next year’s team.
Design of a Martian Mining Robot

TEAM MEMBERS: (L to R in photo)
Alexandria Woodruff
Andrew Svendsen
Jonathan MacDonald
Zachary Moore

ADVISORS:
Jonathan Clark, Ph.D.
Chiang Shih, Ph.D.

SPONSOR:
NASA Florida Space Grant Consortium

This project will be used to compete in NASA’s 2017 Robotic Mining Competition. This competition entails on-site mining, a systems engineering paper, and an outreach project report. The on-site mining includes building a robot within the given size and weight limitations that will traverse simulated Martian terrain, excavate regolith and ice simulants, and return them to a collector bin. The systems engineering paper will explain in detail the methodology used during the project’s inception, design, build, and testing. The outreach project report will require the team to promote STEM to the community via public outreach as well as social media. This competition is beneficial for NASA because it encourages the development of innovative robotic excavation concepts that possibly could be applied to future excavation missions.

Optimization of the Turning Mechanism of a Maritime Target System

TEAM MEMBERS: (L to R in photo)
Nicolas Salazar
Jonathan Rhoads
Timothy Lootens
Tomas Fajardo
Charles Kelly
Scottie Milton

ADVISOR:
Camilo Ordoñez, Ph.D.

SPONSOR:
Michael Devine, Ph.D.

Sea Target Training Systems has developed a turning target prototype for firearm training in open water. The objective of this product is to provide a more realistic training environment for police and military applications. The purpose of our project is to improve and optimize the electrical and mechanical design of this maritime target system’s turning mechanism, while maintaining the lightweight, affordable and practical functions of the existing design. The most important advancement to be made is that the motion of the target is to be controlled by an iOS and Android compatible smartphone application. This means that wireless communication needs to be achieved given a target distance of at least 100 yards. With this in mind, the team designed an electronic configuration composed of a Bluetooth module, a radio frequency transmitter and receiver pair, two Arduino Uno microcontrollers and a motor driver and DC motor. On the smartphone application, the user will be able to choose from 15+ motor functions they would like the target to perform. These functions include timed delay (the user chooses how long until the target turns), random delay (user does not know how long until and for how long the target shows), and “inspect” (the targets turn 90 degrees until the user clicks “inspect” again causing the targets to rotate back into starting position). Having a wide variety of functions will provide shooters with more realistic training scenarios.
Currently, the market for wearable power measurement devices lacks an all-encompassing product that is both accurate and affordable. PowerTrak seeks to fill that void with an effective method for comparing and progressing competitive athletes over all ranges of sports. PowerTrak has designed a power measurement wristband device using off-the-shelf electrical components that will track the progress of athletes as they train over a period of time. These components include an accelerometer, gyroscope, pulse rate sensor, Bluetooth module, and microcontroller which are assembled and housed in ABS plastic casing. The device collects data based on the motion of your wrist during a workout, and analyzes that data in a program created using Arduino software. After velocity integrations and power calculations are made, results are transferred to a smartphone to be stored and displayed on a mobile app. PowerTrak is revolutionizing the athletic and training world by providing accurate, user-friendly power metrics to track and improve training.

After numerous months of research, the team has concluded the selection and build process of a levitating hoverboard by analyzing the market needs. Using the HOQ and morphological chart, three designs were originally created. Similar to a start-up company, a product is introduced, in which the company has done extensive research before-hand to ensure that no failures will occur. This stage is known as the research and development of the product. The next area that requires analysis is the manufacturing side, and how each sub-component will be made or if the component will be supplied from a vendor. Material calculations based on geometry and forces yielded carbon fiber as the most suitable material, and the power calculations yielded 530 CFM based on a maximum weight of 150 lbs.
2nd Annual FAMU-FSU College of Engineering

Technology Business Pitch Competition

Thursday, April 13, 2017, 2p.m. – 4p.m., Room B221

Prizes include: $1,000 for first place, $750 for second place and $500 for third place and $250 for the People’s Choice Award.

Engineering Shark Tank Finalist Teams 2017

<table>
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<tr>
<th>FLIPS</th>
<th>Horizon Hoverboards</th>
<th>Incredibowl</th>
<th>Power Trak</th>
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<tr>
<td>Karlyn Kennedy, Accounting</td>
<td>Evelyn Bradshaw, IME</td>
<td>Kiernan Farmer, ECE</td>
<td>Fiona Roberson, ME</td>
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<td>Gabriel Woodruff, Economics</td>
<td>Brian Ross, ME</td>
<td>Mateo Quintanilla, ECE</td>
<td>Bradley Bone, ME</td>
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<td>Chidie Otuonye, ECE</td>
<td>Jonathan Levy, ME</td>
<td>Rufus Caple III, ECE</td>
<td>Kendell Parker, ME</td>
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<td>Dylan Bent, ECE</td>
<td>Kevin Sison, ME</td>
<td>Eddie Gibson, ECE</td>
<td>Jorge Cabrera, ME</td>
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<td></td>
<td>Shawn Drawdy, ME</td>
<td>Maria Perez, ECE</td>
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<th>STEM Veterans USA</th>
<th>Teacher’s Pet</th>
<th>Ultimate GuitarCases</th>
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<tr>
<td>Ben Hallstrom, ME</td>
<td>Keith Black, ME</td>
<td>Austin Moore, ME</td>
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<td>Alyna Sanchez-Segura, ME</td>
<td>Meaghan Gamboa, Business</td>
<td>Sam Rubin, ME</td>
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<td>Denzell Jackson, Finance</td>
<td>Grant Kleiner, IME</td>
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<td>Kameron Lewis, CEE</td>
<td>Jovanny Davila, IME</td>
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Finalists will be judged on:

- Idea
- Feasibility
- Business Model
- Entrepreneurship
- Pitch delivery

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- Yaw Yeboah, Ph.D.
  - Senior Design Instructor
- Teng Ma, Ph.D.
  - Chair and Professor

**CIVIL & ENVIRONMENTAL**
- Salvador Arnaldo, M.E., P.E.
  - Senior Design Instructor
- Kamal Tawfiq, Ph.D.
  - Chair and Professor

**ELECTRICAL & COMPUTER**
- Jerris Hooker, Ph.D.
  - Senior Design Instructor
- Simon Foo, Ph.D.
  - Chair and Professor

**INDUSTRIAL & MANUFACTURING**
- Okenwa Okoli, Ph.D.
  - Senior Design Instructor
- Okenwa Okoli, Ph.D.
  - Chair and Professor

**MECHANICAL**
- Chiang Shih, Ph.D.
  - Senior Design Instructor
- Emmanuel Collins, Ph.D.
  - Chair and Professor
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