COLLEGE OF
ENGINEERING, ARCHITECTURE AND TECHNOLOGY

SENIOR DESIGN EXPO

Spring 2023 Team & Projects Guide

Tulsa Senior Design Expo
Thursday, April 27
3:00p.m.-8:00p.m.
Helmerich Research Center
526 N. Elgin Avenue, Tulsa, OK

Stillwater Senior Design Expo
Friday, April 28
8:00a.m.-5:00p.m.
ENDEAVOR Lab
215 N. Hester Street, Stillwater, OK

Speedfest
Saturday, April 29
7:00a.m.-7:00p.m.
OSU Unmanned Aircraft Flight Station
4015 N. Clay Road Glencoe, OK

BAE Senior Design Final Presentations
Thursday, May 4
225 AG Hall
298-164 N. Monroe Street
Stillwater, OK

Presentation Schedule

OSU-TULSA PROJECTS

This expo will take place on Thursday, April 27 from 3:00 PM-8:00 PM at the Helmerich Research Center Atrium (Tulsa, OK). Each team will also have an individual team presentation time that is listed below. Individual presentations will be held in room HRC 153.

(MAE) Thermoformed PET Bottle Caps 3:00 PM-3:40 PM
(MAE) Sustainable 3D Printer Filament 3:40 PM-4:20 PM
(MAE) Enhanced Sustainable Blow Molding 4:20 PM-5:00 PM
(MAE) Stereo Underwater Acoustics 5:00 PM-5:40 PM
(MAE) Wearable UVC Air Purifier 5:40 PM-6:20 PM
(MAE) Wearable Oxygen Concentrator 6:20 PM-7:00 PM
(MAE) X-Ray Personal Protection Device 7:00 PM-7:40 PM

OSU-STILLWATER PROJECTS

Friday, April 28 from 8:00 AM - 5:00 PM

AERO 8:00 AM-5:00 PM Classroom Building Northeast Lawn

(MAE) A Retrofit Kit to the Exhaust of a JetCat P100 for Electrical Power Generation (APOP-Black Team)
(MAE) Turbojet Electrical Power Generation (APOP-Orange Team)
(MAE) Rocket-Assisted Take-off System for Small Unmanned Aircraft (RATO)

ARCH 8:00 AM-5:00 PM in the Architecture Gallery (1st floor of the Donald W. Reynolds School of Architecture).

Come see our architecture student's exhibition "The Legend of Town Center: Ordinary Form, Radical Ideologies." The exhibition uses architecture as a lens of inquiry to explore, analyze and critique the structures found in Oklahoma towns. The exhibition works to create new speculative artifacts-in the form of models and drawings-that imagine how these towns and their communities shaped these social spaces. The goal is to find new ways these architectural narratives and forms can contribute to architectural discourse on the city.

BAE 8:00 AM-5:00 PM (Posters will be available for viewing on the 3rd floor common spaces of ENDEAVOR)

(BAE) Cake Feeder Control/Monitor System and App
(BAE) Design of a UAV "crop duster" or drone sprayer
(BAE) Lake McMurtry site restoration and development
(BAE) Management of rainwater collection in its ammonia storage tank area
(BAE) Remediating contaminated sediment off the bottom of a lake
(BAE) Temperature control on a burr coffee grinder

CIVE 8:30 AM-10:30 AM (Posters will be available for viewing on the 2nd floor common spaces of ENDEAVOR)

(CIVE) Civil Collegiate Wind Competition Design
(CIVE) Detecting and Quantifying Microplastics in Reservoirs
(CIVE) Mander Creek Trash Removal System Design
(CIVE) Perkins Water Tower and Water System Improvements Design
(CIVE) Powerhouse Design
(CIVE) Town of Tatums Renovation Design
(CIVE) Washington School Rehabilitation Design

ECE 8:00 AM-5:00 PM (Project locations are on the 1st 2nd and 3rd floor of ENDEAVOR)

(ECE) CymSTAR Ethernet-to-Synchro Transmitter (ENDV 220)
(ECE) FAA Power Tower (ENDV 370)
(ECE) Phoenix (ENDV 220)
(ECE) Smart Pill Box (ENDV 105, Test Arena)

FPSET 9:30 AM-4:00 PM (Projects are located on the 1st floor of ENDEAVOR)

(FPSET) Conceptual Model Development for Wildland Urban Interface Fire Safety Performance Analysis | Presenting from 10:00 AM-12:00 PM
(FPSET) Impacts of Door Construction on Occupant Tenability | Presenting from 9:30 AM-11:30 AM
(FPSET) Limited Area Sprinkler System | Presenting from 2:00 PM-4:00 PM
(FPSET) OSU Water Treatment Plan | Presenting from 10:00 AM-12:00 PM

IEM 1:30 PM-3:30 PM (Presenting in Engineering North rooms 305, 310, 315)

(IEM) ArcBest Less Than Truckload Brokerage Analysis
(IEM) Creating an Overall Equipment Effectiveness (OEE) Dashboard for Webco Industries, Inc.
(IEM) Developing a VBA Program for Automated Recovery Scheduling
(IEM) Hip Fracture Care Path Development
(IEM) Improving Prioritization of Inbound Trailers for ABF
(IEM) Improving Quality and Efficiency Through Better Tool Selection
(IEM) Inventory Management and Facility Layout Design for AXEL Americas
(IEM) Investigation and Analysis of Inventory Practices for Habakkuk Health
(IEM) Safe and Efficient: Advancing Human Factors and Safety at Thermal Specialties
(IEM) Storage System Improvement for NSP Quality Meats

MAE 8:00 AM-5:00 PM (Project located on the 1st floor of ENDEAVOR)

(MAE) Team OTTO Cycle Dyna-mite (ENDV 105, Test Arena and ENDEAVOR front walk)

MET 10:00 AM-11:00 AM and 2:00 PM-3:00 PM (ENDEAVOR room 302)

(MET) Cycle of Landing Gear | Presenting at 10:00 AM-11:00 AM
(MET) Solar Panel Cleaner Glider | Presenting at 2:00 PM-3:00 PM

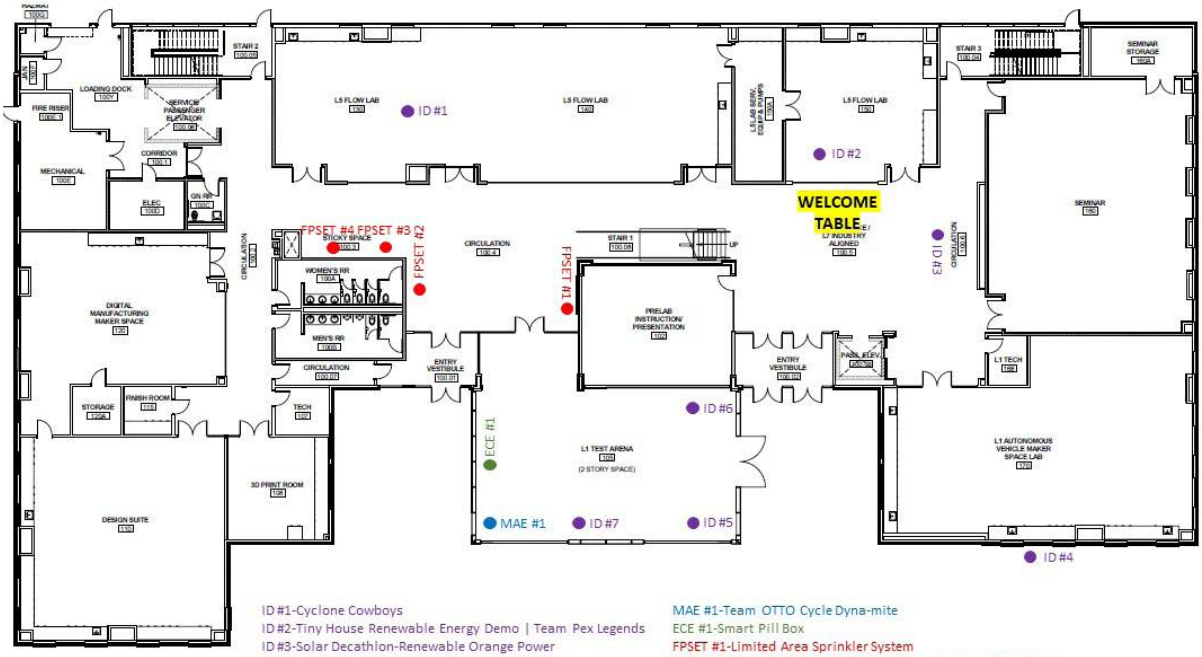
Interdisciplinary Projects 8:00 AM-5:00 PM (Project locations are on the ENDEAVOR 1st, 2nd and 3rd Floor and at Classroom Building Northeast Lawn)

(ID) AI Foosbots (ENDV 340)
(ID) Autonomous Firefighting Vehicle, Lights and Sirens (Classroom Building Northeast Lawn)
(ID) CEAT Parade Float (ENDV 105, Test Arena and ENDEAVOR front walk)
(ID) Cyclone Cowboys (ENDV 140)
(ID) Vmax FSAE Variable Runner Length Intake (ENDV 220)
(ID) Iron Phoenix (ENDV 105, Test Arena)
(ID) Locomotors (ENDV 220)
(ID) Solar Decathlon-Renewable Orange Power (ENDV 1st Floor, South Foyer)
(ID) Revenge of BB-8 (ENDV 340)
(ID) Team Joyride: IGVC Self Driving Car (ENDV 105, Test Arena and ENDEAVOR front walk)
(ID) Thermal Solutions (Thermal Energy Storage Tank) (ENDV 105, Test Arena)
(ID) Tiny House Renewable Energy Demo (Team Building ENDV 220 foyer, Team Pex Legends ENDV 150)
(ID) Weld Test/Beads on Beads (ENDV 240)

Awards Presentation for team's involved in Interdisciplinary Design to take place after the Expo in ENDV 160. Estimated start time 4:30 PM.

Project Locations

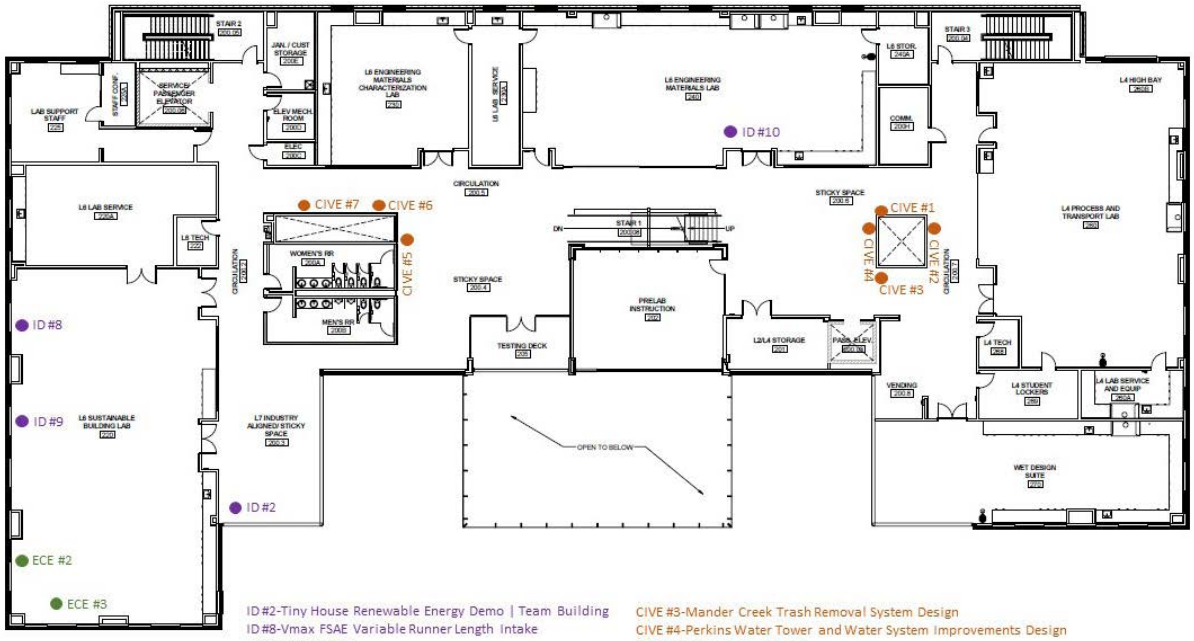
1st Floor



ID #1-Cyclone Cowboys
ID #2-Tiny House Renewable Energy Demo | Team Pex Legends
ID #3-Solar Decathlon-Renewable Orange Power
ID #4-CEAT Parade Float
ID #5-Team Joyride: IGVC Self Driving Car
ID #6-Thermal Solutions (Thermal Energy Storage Tank)
ID #7-Iron Phoenix

MAE #1-Team OTTO Cycle Dyna-mite
ECE #1-Smart Pill Box
FPSET #1-Limited Area Sprinkler System
FPSET #2-Impacts of Door Construction on Occupant Tenability
FPSET #3-Conceptual Model Development for Wildland Urban Interface Fire Safety Performance Analysis
FPSET #4-OSU Water Treatment Plant

2nd Floor



ID #2-Tiny House Renewable Energy Demo | Team Building
ID #8-Vmax FSAE Variable Runner Length Intake
ID #9-Locomotors
ID #10-Weld Test/Beads on Beads
ECE #2-CymSTAR Ethernet-to-Synchro Transmitter
ECE #3-Phoenix
CIVE #1-Civil Collegiate Wind Competition Design
CIVE #2-Detecting and Quantifying Microplastics in Reservoirs

CIVE #3-Mander Creek Trash Removal System Design
CIVE #4-Perkins Water Tower and Water System Improvements Design
CIVE #5-Powerhouse Design
CIVE #6-Town of Tatums Renovation Design
CIVE #7-Washington School Rehabilitation Design

3rd Floor

ID #11-Revenge of BB-8
ID #12-AI FoosBots
BAE #1-Cake Feeder Control/Monitor System and App
BAE #2-Design of a UAV "crop duster" or drone sprayer
BAE #3-Lake McMurtry site restoration and development
BAE #4-Management of rainwater collection in its ammonia storage tank area
BAE #5-Remediating contaminated sediment off the bottom of a lake
BAE #6-Temperature control on a burr coffee grinder

MET #1-Cycle of Landing Gear
MET #2-Solar Panel Cleaner Glider
ECE #4-FAA Power Tower

Other Project Locations

#26-Engineering North
IEM Teams are presenting on the 3rd floor of Engineering North in rooms 305, 310 and 315 from 1:30 PM-3:30 PM
#28-Advanced Technology Research Center (ATRC)
#38-Engineering South (under construction)
#39-ENDEAVOR Lab
#41-School of Architecture
Come see our architecture student's exhibition "The Legend of Town Center: Ordinary Form, Radical Ideologies," in the Architecture Gallery located on the 1st floor of the building. The exhibition uses architecture as a lens of inquiry to explore, analyze and critique the structures found in Oklahoma towns. The exhibition works to create new speculative artifacts-in the form of models and drawings-that imagine how these towns and their communities shaped these social spaces. The goal is to find new ways these architectural narratives and forms can contribute to architectural discourse on the city.

-Location of (MAE) Aerospace Senior Design Projects
Aerospace Propulsion and Power Senior Design Expo
Presenting 8:00 AM-5:00 PM in the Classroom Building Northeast Lawn

Aerospace Design Teams:
- A Retro Fit Kit to the Exhaust of a JetCat P100 for Electrical Power Generation
- Turbojet Electrical Power Generation: Orange Team
- Rocket-Assisted Take-off System For Small Unmanned Aircraft

ID #13 –Autonomous Firefighting Vehicle, Lights and Sirens

A Word from the Dean

The College of Engineering, Architecture and Technology is continuing its transformation as a leading innovator in education, research and extension. Our ENDEAVOR and North Campus labs have become launching points for hands-on, interdisciplinary projects, driven by faculty and student efforts. Looking around the Senior Design Expo today, you will get to experience some of the results of those efforts.

Our faculty are engaged at the cutting edge of energy, aerospace, computing, sustainable building technologies and our nation's future. They are building on a long-established, land-grant university mission of education in the professions of life. We educate our graduates to lead the industries and communities of the 21st century.

CEAT will award over 1000 degrees this semester and have worked with students, Oklahoma industries, public agencies and alumni to continue delivering world-class engineers and design professionals. By expanding our facilities and our undergraduate research opportunities, we are pushing forward in creating intellectual capital for Oklahoma, the nation and the world.

The college could not be at the forefront of innovation without the accomplishments and investments of alumni, friends and industry partners in scholarships, internships, equipment and faculty support. This fall we will be adding the Zink Center for Competitive Innovation that will push our students to work across disciplines to solve technical challenges.

I hope that you enjoy getting a look into the bright young minds of these Oklahoma State seniors. They are preparing to solve the grand challenges that face us and become valuable contributors to their respective industries. Take some time to get to know them; you won't be disappointed.

Go Pokes!

Paul J. Tikalsky
Dean
College of Engineering,
Architecture and Technology

Table of Contents

PROJECT: Cake Feeder Control/Monitor System and App (BAE)
ADVISOR/S: Dr. Paul Weckler

(Left to Right) Brit Luna, Seth Stone, Taos McIntyre

Harper Industries Inc., (HII) has tasked the team with updating the Beefcake cake feeder that HII currently manufactures. As data logging has become more commonplace and affordable in the agricultural industry, HII would like to collect feeding data that could aid producers in reducing their feeding expenses. Studies done by HII and Kansas State University show that over feeding your cattle by as little as 0.25 lbs per head for a 100 cow herd over 150 days can cost more than $500 in feed. Over feeding by 2 lbs per head for the same size cow herd over the same time period can cost producers over $5,000 in feed costs. To aid producers in recording how much they feed their cattle, the team is adding load cells to the cake feeder. The wired remote will be upgraded to a wireless remote to increase the ergonomics of the cake feeder. A mobile phone app will be developed that can control the same functions of the cake feeder as the wireless remote. These functions include turning on and off the auger, raising and lowering the chute, reading the load cells as well as taring the load cells. The phone app also allows producers to input the feed type, feed cost ($/lbs), field they are feeding in, and how many cows are in that particular field. Once the producer is done feeding, a report will be generated that provides their feeding cost in dollars/head/day. All of this data can then be exported as a CSV file to Microsoft Excel, allowing the producer to make feed reports for the entire season. These upgrades to the Beefcake feeder will allow producers to make their operation more economically efficient while making the feeder more versatile and marketable for Harper Industries.

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HARPER INDUSTRIES, INC.

BEEFCAKE by DewEze

PROJECT: Design of a UAV "crop duster" or drone sprayer (BAE)
ADVISOR/S: Dr. Paul Weckler

(Left to Right) Kelly Lewis, Callahan Figgs, Garrison Hall

The focus of this project is centered on the design and development of a tethered sUAV for spraying pecan canopies with fungicide to help combat pecan scab. Pecan scab, or fusicladium effusum, is a fungus that spreads through non-motile fungal spores. Since pecan scab is carried easily by the wind and doesn't move on its own, it's crucial to get near 100% coverage. Ground blast sprayers simply cannot reach the elevations to do this, and consumer products for air blast sprayers are expensive for growers. The design team's goal is stable and controlled flight of the high voltage tethered drone that is suitable for growers.

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Dr. John Long

OSU EXTENSION

OKLAHOMA Pecan Growers Association est. 1927

PROJECT: Lake McMurtry site restoration and development (BAE)
ADVISOR/S: Dr. Paul Weckler

(Left to Right) Benjamin Seaman, Antonio Murillo, Zachary Marshall

The McMurtry Lakers are tasked with designing a vegetable garden to help grow produce, which will help food deserts in the Payne and Noble County area. The team also needs to design a facility that will handle the processing and packaging of the harvested crops, including a cooling room and a storage facility. The team will also research and develop a design for a gravel road to the facility and pumping station. The project's end goal is to minimize food deserts in Payne and Noble County, Oklahoma. Food deserts consist of geographic areas where residents have little or no convenient options for procuring affordable and healthy foods. Food deserts are identified by the following factors: access to food, and household resources. Access to food is measured by the distance to a store or by the number of stores in the area. Household resources includes income and/or vehicle availability. When these factors are taken into consideration, nearly 13% of the United States population, or nearly 40 million people, live in food deserts. Lake McMurtry Friends aims to help aid the dissolution of food deserts by designing and building a large vegetable garden that will supply food to local food banks in Stillwater, Oklahoma.

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Lake McMurtry

The City of Stillwater OKLAHOMA

USDA United States Department of Agriculture
Natural Resources Conservation Service

PROJECT: Management of rainwater collection in its ammonia storage tank area (BAE)
ADVISOR/S: Dr. Paul Weckler

(Left to Right) Rio Bonham, Grace Rembold, Blake Coday

The partners at Koch Fertilizer in Enid, Oklahoma are currently facing flooding problems in their Urea and Ammonium Nitrate tank catchments. Two pumps near these tanks remove water from the area and deposit it into their "middle pond" to recycle it for their cooling towers. Current concerns include deficient pump performance, poor grading of the slopes, and frequent water contamination. The client's requested requirements consist of eliminating the ponding issues in the east catchment due to poor sloping to the pump and keeping water accumulation depth below six inches for whichever design option is chosen. Additionally, the client has specified several additional elements that would be beneficial, but not necessary, including a remote/automatic pump start-up, reduced labor associated with water quality monitoring, reduction of siltation/erosion, and pipe routing to the "zero filter" pond for contaminated stormwater.

Sponsored by:

KOCH FERTILIZER

PROJECT: Remediating contaminated sediment off the bottom of a lake (BAE)
ADVISOR/S: Dr. Paul Weckler


(Left to Right) Emily Ea, Kennerly Holloway, Kimalee Lawrence

This project's required objective is to produce the first part in a pilot study to determine the extent of sediment contamination on the bottom of Empire Lake. This will enable the USACE and EPA to make a report of decision on remediation action. It is most desirable that the report is up to EPA screening standards and gives details, especially concerning sediment thickness and total volume. Other important details include determining methods for sampling and testing the contaminated sediment while accurately mapping the lakebed's surface. It would be ideal to have quantified aspects in the final report, such as the time and cost of lakebed dredging. Remediation efforts will bring great benefit to the community and environment surrounding Riverton, Kansas.

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PROJECT: Temperature control on a burr coffee grinder (BAE)
ADVISOR/S: Dr. Paul Weckler


(Left to Right) Brooke Holt, Cooper Price, Addison Duling

This project's client, U.S. Coffee Roasters, is redesigning their 5-inch burr grinder for coffee beans. The grinder is getting too hot during grinding, which poses problems in the roasting process. It is important that the already roasted coffee beans are not exposed to more heat during the grinding process, as the temperature profile can affect flavor and other aspects of the roast. In addition, the client would prefer the grinder to be larger, so that more coffee beans can be ground at one time.

The goal of this project is twofold:
1. Design a recirculating water system to cool down the grinder to a temperature appropriate for maintaining the quality of the roasted coffee beans.

2. Enlarge the burrs of the grinder to at least 8 inches, if not larger, and enlarge the grinder body housing in correspondence to the bigger burr discs.

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PROJECT: Civil Collegiate Wind Competition Design (CIVE)
ADVISOR/S: Dr. Norb Delatte, Dr. Gregory Wilber, Prof. Nate Lannan

(Left to Right) Mezyad Abusheeba, Isaiah Cotton, Evelyn Baker, Madeline Duncan

The CWC team from Oklahoma State University advanced to Phase 2 of their competition, and needed help from us with two parts of the competition; the site development plan, and the prototype turbine design. For site development, the team needed help looking into environmental life and impacts, soil types, and other codes and standards to develop a wind farm on the plots available; this year's competition location is offshore in the Gulf of Mexico near Louisiana. For the prototype turbine design, the team needed a stable foundation that could withstand the testing conditions in the wind tunnel while being as lightweight as possible.

PROJECT: Detecting and Quantifying Microplastics in Reservoirs (CIVE)
ADVISOR/S: Dr. Norb Delatte, Dr. Jorge Gonzalez Estrella, Dr. Gregory Wilber

(Left to Right) Bethany Trammell, Christian Maldonado, Madi Wilson, Wyatt Barrier

We are to design a portable process that identifies and quantifies microplastics in lake and reservoir field samples within the target time of 30 minutes.

PROJECT: Mander Creek Trash Removal System Design (CIVE)
ADVISOR/S: Dr. Norb Delatte, Dr. Jaime Schussler, Dr. Gregory Wilber

(Left to Right) Sloane Johnston, Joey Schmitt, Megan Howerton, Barak Alkhaledi

The Mander Creek Regional Detention Facility in Edmond, Oklahoma is experiencing an inflow of large amounts of trash from the downtown area. Floating trash carried by stormwater to the detention pond is reducing aesthetic amenity value and harming the ecosystems within the drainage area. As the litter enters the detention facility, it becomes scattered throughout the area and gets stuck in shrubbery, trees, and drainage structures. The potential to impede flows and clog stormwater elements could result in a backwater effect that raises the flood risk within the area. There needs to be a way to diverge the trash from the flow entering the pond without damming the inflow of water. The objective of the project was to implement a practice downstream or upstream of the flow to collect the trash and debris before it enters the pond. The practice shall capture floatable litter being carried in stormwater for disposal. Ease of access for collection and removal of detained trash is also considered. This is a unique application in an open channel and must function without interfering with the railroad system on site. The drainage area is currently efficient for draining after storms and the addition of a trash collector shall not hinder detention functionality. The types of trash coming into the detention pond shall be noted and planned for.

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HUITT HZ ZOLLARS

Edmond A GREAT PLACE TO GROW

Rob Armstrong

Keith Beatty

PROJECT: Perkins Water Tower and Water System Improvements Design (CIVE)
ADVISOR/S: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Ali Alfadhli, Christian Pikett, Philip Thompson, Josephine Lee, Lela Merkel

The Iowa Tribe is planning on constructing a new health center in western Perkins, Oklahoma. The proposed location is in an undeveloped area of the city, so a new water tower must be installed to provide adequate fire flow. In addition to the new water tower, the City of Perkins has expressed concerns about the existing water infrastructure conditions. Therefore, the water system was analyzed in order to propose a design option that will improve overall water system performance in the city.

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IOWA TRIBE OF OKLAHOMA

CITY OF Perkins

PROJECT: Powerhouse Design (CIVE)
ADVISOR/S: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Mahdy Alsaqay, Maryam Modhaffr, Zander Acuna, Chance Sportsman

Our team was tasked with converting an old WPA building into an emergency service building to house the police, fire, dispatch and ambulance services. It is an old armory and has an underground shooting range. There are no known plans of the building's structure nor an as built. We will provide a blueprint of the building. We will provide a structural analysis to determine if the structure is suitable for emergency services and subsequent additions. Finally, we will give them a detailed design for the placement of rooms and spaces as an integrated system.

PROJECT: Town of Tatums Renovation Design (CIVE)
ADVISOR/S: Dr. Laura Arata, Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Faisal Alkandari, Camden Patovisti, Lawson Stout, Kayla Lyons

Our client was the town of Tatums, located in Oklahoma. The city of Tatums wanted to improve the existing building and site conditions located on a plot of land in Tatums, Oklahoma. There were a total of three separate buildings on this site. Two buildings needed to be assessed for future renovations. After a site visit and a thorough assessment, Anchor Engineering developed a renovation and site plan for the 6,204 square foot multi-purpose building and the 3,150 square foot RSVP building. The extent of the damage for each building varied, so each renovation design was unique. The utilities and site conditions were poor and needed to be addressed in the solution. Anchor Engineering came up with three different design alternatives. All design options included the structural analysis of the RSVP building, which assessed whether or not the building was structurally deficient and functionally obsolete. The design option recommended, based on our design matrix, was alternative 1. Alternative 1 included a smaller asphalt lot of about 10-15 parking stalls in front of the RSVP building, with new drive-ins/entrances. This design included 13-foot, two-way lanes, new entrances and pavement striping. Grading and other site improvements will be implemented with the parking lot addition. The existing asphalt will be rehabilitated with a 2-inch mill overlay of the existing asphalt. Alternative 1 was less expensive, took less time to design and construct, and met the basic needs of the client compared to the other alternatives.

PROJECT: Washington School Rehabilitation Design (CIVE)
ADVISOR/S: Dr. Laura Arata, Dr. Norb Delatte, Dr. Jaime Schussler, Dr. Gregory Wilber

(Left to Right) Salman Alfarhan, Dr. Laura Arata, Hannah Bruce, Hailey Tyler, Kassidy Powell

The Washington School is located in a major flood zone and at a low point in the Stillwater area. This caused frequent flooding; the most significant being in 1956 and 2019. The main goal was not to avoid flooding, but how to deal with the eventual, unavoidable flooding. The group needed to find solutions that allow flooding to occur without major damages to the infrastructure or anything that would inhibit the structure's usage. The wings of the building have already been approved for demolition, which provided more space for alternative uses. Their main goal was figuring out a community-oriented solution to revive this now abandoned historical building. The end result needed to not only please the City of Stillwater, but also the Washington School Alumni and community members that wish to recognize and remember their precious school.

PROJECT: CymSTAR Ethernet-to-Synchro Transmitter (ECE)
ADVISOR/S: Dr. John O'Hara, Prof. Nate Lannan

(Left to Right) Justin Brown, Dylan Gore, Remington Ward, Christian Moser

Our team's goal was to design and create a device that can digitally control a synchro-type motor over ethernet communication. Commercially available devices that exist are expensive and esoteric, despite relatively simple and cheap part availability.

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CymSTAR

PROJECT: FAA Power Tower (ECE)
ADVISOR/S: Dr. Hamidreza Nazaripouya

(Left to Right) Othman Ahmad, John Doudican, Jaymy Foister

The FAA utilizes Relocatable Power Towers that operate independent of the power grids. The issue with the current system is the management system on these towers is proprietary so when the system fails, the FAA must pay the vendor to repair it. The goal of this project is to reduce costs by designing a replacement Relocatable Tower for the FAA using non-proprietary, commercial, off-the-shelf, products including generators, chargers, inverters and a 48V bank of batteries. Our team will provide a more sustainable and efficient replacement power tower that will have the capability to provide up to 3000W continuously and be quickly installed.

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PROJECT: Phoenix (ECE)
ADVISOR/S: Dr. Tyler Ley, Dr. Gary Yen

(Left to Right) Brendan Schwickerath, Jade Gullic, Joshua Skillings

Our project is the automation of the Phoenix. The Phoenix is a test that helps determine the water/cement ratio in concrete mixes and aggregates. By automating the Phoenix, we hope to standardize concrete mixes and create more quality concrete for public use, more efficiently.

PROJECT: Smart Pill Box (ECE)
ADVISOR/S: Dr. Weihua Sheng, Joel Quarnstrom, Zhidong Su

(Left to Right) Zarek Rooker, Zahra Alnahwi, Daniel Jacobs, Stephen Fransen

The main vision of this project is to provide an efficient and safe way to manage medication for elderly patients, especially those with cognitive decline, memory loss and visual impairments. The Smart Pill Box (SPB) can help them to take medication correctly and on time, reduce medication errors and provide a better way for caregivers to monitor the medication adherence. The SPB can also provide a more convenient, user-friendly and cost-effective solution compared to other existing solutions.

PROJECT: Conceptual Model Development for Wildland Urban Interface Fire Safety Performance Analysis (FPSET)
ADVISOR/S: Dr. Diana Rodriguez Coca, Dr. Haejun Park, Prof. Tim Wilson

(Left to Right) Steven Cui, Jack Wu, Lily Wang, Ziheng Fang, Kejie Zhou

Wildland Urban Interface (WUI) fires adversely damage people's lives and properties in various ways. Human activities and natural conditions in WUI areas increase the risk of fires in those areas. Therefore, evaluating factors that influence WUI fire outcomes to control the fire and ensure fire safety in such areas and prevent catastrophic consequences is crucial.

The factors affecting WUI fires are diverse and complex. However, previous studies have mainly focused on examining certain factors that influence WUI fire outcomes, without providing the inter-relationship among each factor and a clear quantification of the degree of impact that each factor has on the occurrence or severity of WUI fires. This study aims to develop a model that effectively captures the inter-relationships among WUI fire factors, providing a clear and quantifiable way of assessing WUI fires in various situations. The applied content analysis identifies the inter-relationships and the weighted-sum method to evaluate their relative importance. Sensitivity analysis was also conducted to identify the factors that have a huge impact on real fires. Our research found that wind has the greatest impact on the WUI fire among the founded fire risk factors.

The number of fire factors that affect fire spread in the WUI region is greater than the number of factors that affect fire ignition. The relationship among fire factors affecting fire spread is also more complex than that among fire factors affecting fire ignition. The model established in this project and the findings in this research can provide an effective and specific standard for human building and fire prevention code in WUI areas, helping to better assess the local WUI fire risk, and provide an effective guarantee for local personal safety and building.

Project Video

PROJECT: Impacts of Door Construction on Occupant Tenability (FPSET)
ADVISOR/S: Dr. Virginia Charter, Dr. Bryan Hoskins

(Left to Right) Dane Matthews, Jacob Walker, Michael Kubicki, Baylor Cobb, Nick Scialdone, Ehab Saleh

For several years, one of the major fire prevention campaigns, spearheaded by Underwriters' Laboratories (UL), has been the "Close Before You Doze" (CBYD) campaign which encourages people to sleep with their doors closed to help their survival chances during a residential fire. However, research has not been conducted into how solid core and hollow core doors affect fire spread into rooms. Previous research from UL indicates that closed doors do have a positive impact on occupant tenability in bedrooms, but that study does not address the effects of door construction on tenability. This thesis explores the impact of closed solid core and hollow core doors on occupant tenability in bedrooms and door failure time. To determine tenability, three rooms with different door configurations were constructed and temperature measurements at different heights were taken during a compartment fire. Door failure was determined according to criteria established in NFPA 252 - Standard Methods of Fire Tests of Door Assemblies as well as occupant temperature tenability calculations. Our research validated UL's claim that a closed door supports tenable conditions for a longer time than an open door. We also observed that a solid core provided significantly more protection from heat and smoke than a hollow core door. We expect this research to influence home builders' choice of interior doors and support the "Close Before You Doze" campaign.

FIRE SERVICE TRAINING
College of Engineering, Architecture and Technology

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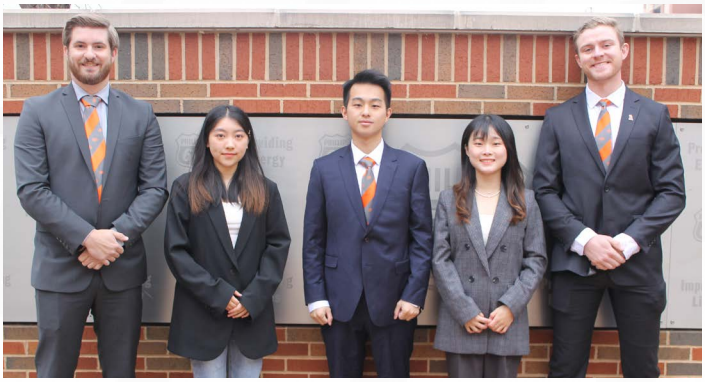
AUTOMATIC FIRE CONTROL™
"40 YEARS OF FIRE PROTECTION"

PROJECT: Limited Area Sprinkler System (FPSET)
ADVISOR/S: Dr. Virginia Charter, Dr. Bryan Hoskins



(Left to Right) Derek Deyarmin, Shiyi Zhu, Michael Wang, Yesom Gong, Mason Nichols

The research of this paper is a live burn experiment to test a limited area sprinkler system, which is a partial-coverage sprinkler system used as a retrofit in existing high-rise apartment buildings according to NFPA 13. This research is vital because limited area systems could significantly contribute to the balance of cost and safety, but there has yet to be previous testing or research on them. A fire modeling program named Pyrosim was used to predict the fire scenario before the burn. The primary method of this research is using thermocouples and cameras to monitor the temperature changes and flame scenery during a live burn in a structure designed after an apartment building dwelling unit. The results show that the limited area system controlled the temperature to below 40 °C (104 °F) at human head height level and 140 °C (284 °F) at ceiling level after the activation of the sprinkler system. The limited area system greatly resisted the spread of flame. It protected the structure from any fire damage, and the flames never spread beyond the sofa that it was started on. By comparing the results with another burn in the same structure without the sprinkler system, we concluded that the limited area system was a success because the burn without the system grew very large and caused lots of fire damage to the interior of the structure before it was stopped.

PROJECT: OSU Water Treatment Plant (FPSET)
ADVISOR/S: Prof. Leslie Stockel, Prof. Tim Wilson


(Left to Right) Ruiyi Tang, Cooper Stanbery, Dahae Lee

OSHA (Occupational Safety and Health Administration) requires a process hazard analysis (PHA) to identify, reduce, and manage operational hazards associated with more than a specified number of hazardous chemicals. In this study, a process risk analysis was conducted for the Oklahoma State University (OSU) water treatment plant. Through qualitative risk assessment techniques such as preliminary risk list (PHL), preliminary risk analysis (PHA), Hazard and Operability (HAZOP) analysis, and Bowtie analysis, the most hazardous scenario was identified: chlorine gas leaks. Furthermore, in combination with a semi-quantitative analysis, a fault tree analysis (FTA) was performed to calculate the probability of a chlorine leak within 106 operating hours. In conducting the process risk analysis, this study also provided a variety of mitigation recommendations to ensure worker and public safety and improve the safety of the water treatment plant facilities.

PROJECT: ArcBest Less Than Truckload Brokerage Analysis (IEM)
ADVISOR/S: Dr. Paritosh Ramanan, Tyler Moore


(Left to Right) Drew Williams, Ricky Reed, Jeff Stockel

ArcBest is a global integrated logistics company that impacts the world by solving logistics challenges. Within ArcBest's Asset Light Division, they offer a Less Than Truckload Brokerage service, which acts as a broker between customers and other carriers. Customers utilize this brokerage service to find quotes from various carriers to make their desired shipment. The goal of this project is to analyze historical LTLB quoting data to make a data driven recommendation to improve margins or increase revenue of the LTLB business.

Sponsored by:

ArcBest

PROJECT: Creating an Overall Equipment Effectiveness (OEE) Dashboard for Webco Industries Inc. (IEM)
ADVISOR/S: Dr. Jennifer Glenn, Brenda Shumate

(Left to Right) Braden White, Chas Wright, Kent Slater

Webco Industries is one of North America's leading manufacturers of precision welded tubing, producing stainless and specialty steel, nickel, titanium, and other alloy tube products for a variety of applications. In recent years, Webco has begun looking into implementing OEE into their manufacturing plants at the request of clients to report an OEE score. The Senior Design Team was tasked with defining how Webco will measure performance, availability, and quality at a single workstation to create a scalable OEE dashboard that can be implemented across their manufacturing operations. Implementing such a metric will help identify areas of improvement by providing a tool to measure the effectiveness of their workstations.

PROJECT: Developing a VBA Program for Automated Recovery Scheduling (IEM)
ADVISOR/S: Dr. Akash Deep

(Left to Right) Chloe Jones, David Schwartz, Caitlin Mantooth

Textron Aviation bases production scheduling for their Independence, KS facility off a yearly master production schedule (MPS). Conditions such as the late arrival of parts, lack of staff, etc. cause variation from this MPS. When this occurs, the Textron team must generate a recovery schedule by hand to the point of return to the MPS. We have created a VBA based tool in Excel to automate the recovery scheduling process, saving approximately $23,000 annually based on implementation in the facilities single engine line.

Sponsored by:

Cessna Beechcraft BY TEXTRON AVIATION

Talor Morris

PROJECT: Hip Fracture Care Path Development (IEM)
ADVISOR/S: Dr. Katie Jurewicz

(Left to Right) Ian Penney, Ricky Cook, Jackson Linson

INTEGRIS Health is the largest Oklahoma-based not-for-profit healthcare system. The focus of our project is around hip fractures presenting in the Emergency Department at the Central Orthopedics location in Oklahoma City. At this facility, they are currently experiencing inconsistencies in the care process which lead to patients spending more time in the hospital than is necessary. Hip fractures are particularly life-altering for geriatric patients, who make up the vast majority of our population. Our team has developed a standardized hip fracture care path to streamline patient care to get them on the road to recovery and into a skilled nursing facility in a timely manner.

Sponsored by:

INTEGRIS HEALTH

PROJECT: Improving Prioritization of Inbound Trailers for ABF (IEM)
ADVISOR/S: Dr. Juan Borrero

(Left to Right) Reece Hamar, Vamsee Sunkar, Nathan Whitehead

For this project, we set out to determine whether an improved method can be found to prioritize the unloading of inbound trailers at ABF distribution centers. This project was necessary because ABF wished to improve on-time compliance for shipments and determined that trailer prioritization was an area in which more strategic methods could be employed. We accomplished this using computer simulation and testing different priority methods based on variables such as shipment deadlines. We evaluated model accuracy by comparing the on-time performance of our alternative method and the current model.

Sponsored by:

ABF Freight

PROJECT: Improving Quality and Efficiency Through Better Tool Selection (IEM)
ADVISOR/S: Dr. Sri Ramesh, Frank Groenteman

(Left to Right) Keegan Cook, Gabriel Bisogno, Chris Dyer

Our team worked with Arrow Engine and Compression to help address quality issues with their engine and compression assembly process, specifically tightening bolts and nuts to correct torque. This problem leads to a decrease in customer satisfaction and overall product quality. We discovered a digital, battery-powered torque wrench will increase accuracy and reduce assembly times. Additionally, we developed a tool organization station and mapped the places in the facility where these tools should be placed. Our project was able to address the quality issues and will improve efficiency overall.

PROJECT: Inventory Management and Facility Layout Design for AXEL Americas (IEM)
ADVISOR/S: Dr. Austin Buchanan

(Left to Right) Cole Durkee, Keaton Carter, Iris Martinez, Cameron Groenteman

AXEL Americas is a leading privately held grease and lubricant manufacturer in the United States. In AXEL's Tulsa, OK facility, they want to improve their inventory levels and current facility layout. The inventory management strategies need to be updated due to changes in demand. The space available in their storage facility directly affects the amount of inventory that can be stored. This inventory is placed in spaces that are available instead of having a standard system for each placement. Our team has been tasked with determining when AXEL needs to reorder materials, how much backup inventory should be available, and the maximum and minimum materials in storage. Additionally, we have also been tasked with improving the facility layout which increases accessibility for operators and decreases the time it takes to find where items are located.

Sponsored by:

AXEL
AXEL AMERICAS, LLC

PROJECT: Investigation and Analysis of Inventory Practices for Habakkuk Health (IEM)
ADVISOR/S: Dr. Camille DeYong, Mark Lewis


(Left to Right) Ainsley Kyle, Jackson Green, Raegen Daigle

Habakkuk Health is an orthopedic device distributor located in Oklahoma City, Oklahoma. They serve as the middleman between manufacturers of orthopedic devices and orthopedic surgeons in the OKC area. The orthopedic devices are sold in two parts - the implant, such as a knee replacement, and a kit containing all instruments (consumable and reusable) required to perform the specific surgery. Currently, Habakkuk Health can track implants, but does not have an inventory tracking system for the associated instruments. There are times when instruments are missing when the kit arrives in the operation room, which can delay surgeries and cause customer dissatisfaction. The team has completed a detailed current state analysis based on historical data, sales information, process flow and interviews with subject matter experts. The team will provide a list of recommendations for the standardization of procedures, which will increase the chances of early detection of a missing instrument, decrease lead time in making a replacement, and improve overall information flow.

Sponsored by:

HABAKKUK

PROJECT: Safe & Efficient: Advancing Human Factors & Safety at Thermal Specialties (IEM)
ADVISOR/S: Dr. Joseph Nuamah, Steve Kiester


(Left to Right) Sarah Bishop, Charlie Hatfield, Hope Goodwin

Thermal Specialties is a privately owned custom manufacturer and service organization. The company specializes in three mean services: heat treatment, industrial furnace and refractory solutions, and insulation supply. Currently, human factors-related safety incidents are negatively impacting employee well-being and business efficiency. The team has been tasked to use industrial engineering related concepts and tools to prevent injuries, promote safety, and reduce insurance premiums.

Sponsored by:

THERMAL SPECIALTIES

Mitch Myers

PROJECT: Storage System Improvement for NSP Quality Meats (IEM)
ADVISOR/S: Dr. Tieming Liu, Ashlynn New

(Left to Right) Aymen Charmi, Emma Wilson, Jayden Grilliette

National Steak and Poultry (NSP) Quality Meats is a meat processor and wholesaler based in Owasso, Oklahoma. NSP uses its 80 years of experience to produce customized meat products for its clients. The current organization and storage procedures of the cooler space result in limited space availability, increased searching time, and first-in-first-out (FIFO) violations, ultimately hindering the efficiency of the company's storage system. The goals of the project are to develop solutions to improve space utilization, tracking ability, inter-departmental communication, and reduce FIFO violations.

Sponsored by:

NSP QUALITY MEATS

Sybille Gallardo

Project Video

PROJECT: A Retro Fit Kit to the Exhaust of a JetCat P100 for Electrical Power Generation (MAE)
ADVISOR/S: Dr. Kurt Rouser, Cade Christison

(Left to Right) Jake Swanson, Joshua Cozzoni, Zachary DeFrees, Joseph Vita, Collin Wycoff, Zachary Wattenbarger

This project presents the design and analysis of a power generator retro fit kit that bolts on a JetCat P100 in place of the stock nozzle. The project is part of a multi-university competition sponsored by the U.S. Air Force with two teams competing from Oklahoma State University. The motivation for this study is for small, high-speed aircraft that would benefit from a power supply to their payload. The approach to this study was to first create a cycle analysis to determine the restraints and characteristics of the flow through the stock JetCat P100. From this analysis, it was determined that the best place to extract power is from the exhaust since the exhaust has the highest mass flow rate potential to be harvested from. Finally, detailed drawings of each component were made and analyzed. The final design is a power turbine in the nozzle that is connected to a generator through a gear box. When the exhaust flow spools up the turbine, the generator will produce an AC current. This current will go through a rectifier converting it into DC current that can be stored in a battery. This set up will produce an excess of 500 watts of power when the engine is running at full throttle. Observation from this study can inform potential aircraft and engine designers for small, high-speed aircraft.

Sponsored by:

AIR FORCE RESEARCH LABORATORY

Project Video

PROJECT: Turbojet Electrical Power Generation: Orange Team (MAE)
ADVISOR/S: Dr. Kurt Rouser, Cade Christison

(Left to Right) Patrick Hull, Dylan Mitchell, Ethan Liddell, James Masoner, Temitope Olopade, Zack Mitchell

This project presents the design and evaluation of a system which is capable of generating a minimum of 500 W of electrical power from a JetCat P100 turbojet engine. Considerations were also made for maximizing the system thrust to weight ratio. The United States Air Force requires onboard power generation for small, unmanned aircraft. Design steps include the creation of a "digital twin" which consists of both geometric and thermodynamic modeling. Engine cycle analysis is conducted on the unaltered engine to confirm that the model matches test results. Proposed changes are then added to the model to predict how the design will affect key performance parameters. The stock starter motor will be replaced with a motor capable of producing the required power when driven by the engine shaft. A gearbox is designed with a 1:2.6 gear ratio to reduce the rpm load on the motor. The selected motor is rated for 100,000 rpm while the engine shaft runs at 150,000 rpm at full throttle. To improve the thrust to weight ratio of the system, a new exhaust nozzle was designed using mass flow parameter to significantly increase engine thrust. This mitigates the effect of the added weight from the electrical power generation system.

Sponsored by:

Project Video

PROJECT: Rocket-Assisted Take-off System For Small Unmanned Aircraft (MAE)
ADVISOR/S: Dr. Kurt Rouser, Caleb Besmer, Cade Christison

(Left to Right) Nolan Blueback, Quentin Webster, Kyle Hassett, Jared Greif, Fernando Moran, Drew Cooley, Mason Glover, Noah Quinnett

This project examines the design and integration of a rocket-assisted take-off system with a fixed-wing, jet-powered unmanned aerial vehicle to provide a short to zero-length launch capability. This study analyzes the commercial viability of future rocket-assisted take-off retrofit systems and assesses primary considerations and dynamic implications of integrating such launch mechanisms to existing small aircraft. The subject of this project is a 33-pound, 7.5-foot Predator aircraft with a 6.5-foot wingspan. This aircraft is fitted with a JetCat turbojet engine that produces 22.5 pounds of thrust. Preliminary analysis of aircraft characteristics, performance parameters and launch dynamics inform the design of the retrofit system as well as the composition and specifications of the in-house developed solid rocket motor. The final rocket motor design generates a peak thrust of 235 pounds to rapidly accelerate the aircraft to a speed of 150 miles per hour, minimizing the fuel consumption of the engine. This study serves as a benchmark for the future exploration of launch systems in the unmanned systems market to streamline the design process for accelerated advancement of high-speed launch systems for commercial and military applications.

Project Video | Project Image

PROJECT: Speedfest XII, Vulcan (Black Team) (MAE)
ADVISOR/S: Dr. Andy Arena, Mason Jernigan, Levi Johnson

(Front Row Left to Right) Ashley Anderson, Haleigh Woodbridge, Justin Sam, Tom O'Connor, Newton Quach, Trey Mandrell, Tuyen Nguyen, Blake Tonquest, Xamran Shamsi, Killian Kane, Molly Lammes, (Back Row Left to Right) Mark Ovsyannikov, Michael Cuthbertson, Timothy Nelson, Garrett Smith, Clint Weathers, Tyler Funk, Andrew Acupan, Austin Green, Skyler Cuthbertson, Isaiah Richmond (Not Pictured) Thomas Nine

Speedfest XII has tasked two teams of 22 students (Black Team and Orange Team) with designing, and manufacturing a high-speed, rocket and electric powered racing aircraft. Both team's planes must not only demonstrate speed, efficiency, and pylon-racing capabilities, but they must also be reliable, durable, and cost effective. This year's competition has three phases: a rocket glide paired with a pylon race, a max speed competition, and an endurance challenge. To complete each mission successfully, Vulcan (Black Team's plane) was created with a very unique design. The most notable design feature of Vulcan is its cathedral tail. This design will allow the team to not have to worry about the tail burning during rocket launch while also not having to worry about sacrificing stability. Vulcan's design has allowed it to be made in Speedfest's first-ever non-planar mold. This feat has decreased manufacturing time for Vulcan so that the team can integrate multiple aircraft at once. Black Team has also designed Vulcan with the mission of achieving a max speed of over 200 miles per hour with hopes of breaking the Speedfest record. With Vulcan's unique design, Black Team is optimistic about being able to successfully complete all the missions. Scan the QR code below and check out our LinkTree. Here, you will be able to find all our social media, our app, and further information about the Speedfest competition.

Project Video

PROJECT: Speedfest XII, Phoenix (Orange Team) (MAE)
ADVISOR/S: Dr. Andy Arena

Phoenix is one of the two Alpha Class teams for 2023 Speedfest XII. Phoenix is comprised of 22 Aerospace Engineering students at Oklahoma State University. This years competition will have three main missions which are a pylon race, obtaining a top speed, and flying for four minutes continuously. Phoenix is a composite RC airplane with rocket assisted take-off capabilities and high max speeds. Competition day is set for 4/29/23 at the Oklahoma State University Unmanned Aircraft Flight Station.

Project Video

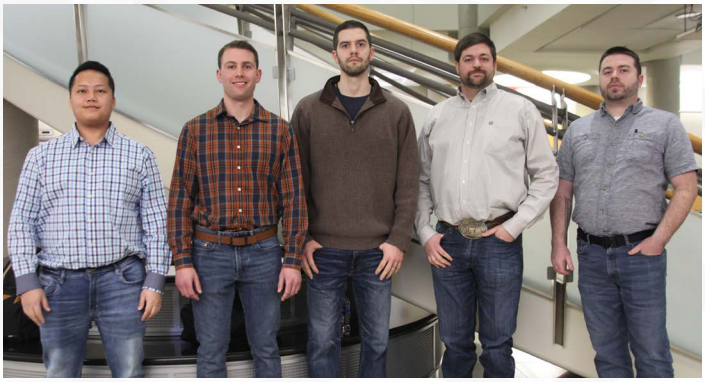
PROJECT: Team OTTO Cycle Dyna-mite (MAE)
ADVISOR/S: Dr. Brad Rowland

(Left to Right) Erik Guerrero, Nick Savage, Andres Chapa, Preston Deon, Hunter Nance

CEAT's Thermodynamic and Heat Transfer lab has an operational homemade Otto Cycle engine. The design was simple and used an existing engine and parts found in CEAT. However, no stress can be put on the engine. Students can not analyze the Otto Cycle under varying loads. Our team will address this limitation by improving upon the current Otto Cycle design and adding improved instrumentation, a data acquisitions system, fuel consumption tracking and a hydraulic dynameter that will provide system loads.

Project Video

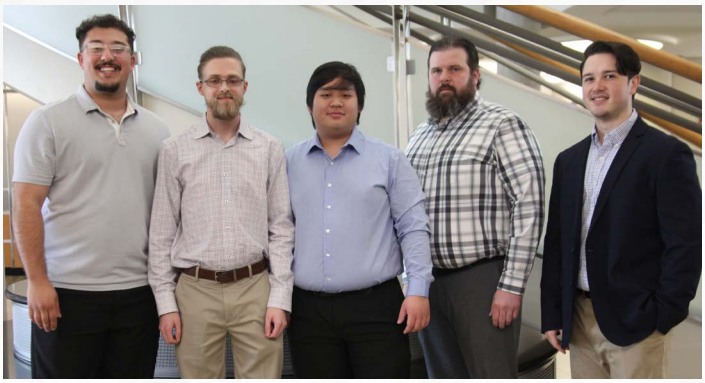
PROJECT: BlowHards (MAE-Tulsa)
ADVISOR/S: Dr. Masoud Allahkarami, Dr. Jay Hanan



(Left to Right) Keven Her, Shane Considine, Eric Pacicca, Pat Underwood, Weston Wilson

The Blow Molding Team's objectives are to optimize PET bottle manufacturing with engineering principles by performing standard manufacturing processes of blowing PET preforms using the Manual Blow Molding Machine. After processes have been standardized, we will determine the area of the preform components that correlate with the blown bottle areas. Next, we target an area with a cooling modification that will be integrated into the blow molding process. The addition of this cooling modification will optimize the foot thickness of a bottle, and improves the sustainability goals of our sponsor. Better material distribution will lessen the amount of material used and ease the ability to create more complex shapes in the manufacturing processes.

PROJECT: Busta Cap (MAE-Tulsa)
ADVISOR/S: Dr. Jay Hanan



(Left to Right) Rafek Alkhatib, Alex Nunley, Nicholas Subrata, Cory Smith, Stephen Obayashi

The current industry standard HDPE PCO 1881 bottle cap is commonly used for carbonated beverages and water bottles. These caps can be accurately and economically produced using injection molding. However, plastic bottle caps are a significant source of small plastic waste pollution. As many as 1 in 5 items found during beach clean-ups are bottle caps. Part of this problem is because they cannot be recycled with the bottle due to a difference in material, and part of it is because the caps are not tethered to the bottle.

A cap made from the same material, PET plastic, was designed to counteract this problem. Manufacturing this cap requires five primary steps:

1.) the first being to thermoform the sheet plastic to a cap,
2.) the second being trimming the plastic for next step
3.) the third being slitting the boundary between cap and tamper-evident (TE) band to form bridges
4.) the fourth step being folding the TE band material
5.) the fifth and final step being adding knurls to the cap allowing better grip to consumers.

This leads to our groups primary goal, which is to design and test methods to fold varying mold designs that meet industry standards. Our second goal is to design and test application and handling methods that meet industry standards, such as knurling, mentioned before.

Project Video

PROJECT: O2GO (MAE-Tulsa)
ADVISOR/S: Dr. Masoud Allahkarami, Dr. Jay Hanan

(Left to Right) Dalton Turner, Bryce Davis, Kerman Williams, Eli Lamb, Christy Cravens

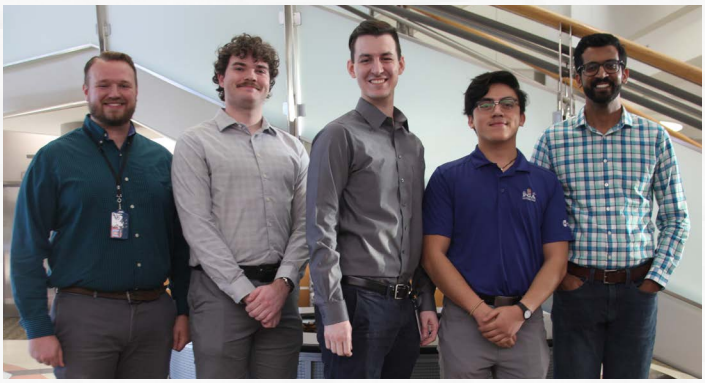
The main objective of this project is to prove the pressure cylinder concept can be utilized to create a small, wearable oxygen concentrator that intakes atmospheric air and outputs concentrated oxygen to the user. If proven, the concept can be used to improve the efficiency, weight and size of oxygen concentrators. The project goals include an output of >80% concentrated oxygen, an output flow rate of 1-5 liters per minute, the device must be lightweight and compact and operate at a safe noise level, all while keeping user safety as the highest priority. We will accomplish this by mechanically altering a Senco nail gun to operate on a 4-stroke cycle concept. Stroke 1, the first upstroke, forces compressed air through the zeolite, initiating the adsorption process, and sends concentrated O2 to the product tank. Stroke 2, the first downstroke, pulls air back into the system, regenerating the zeolite, and initiating the desorption process. Stroke 3, the second upstroke, exhausts the nitrogen rich air into the environment. Stroke 4, the second downstroke, pulls atmospheric air back into the system and prepares to restart the cycle. As a team, we recognize trying to meet every design requirement for this oxygen concentrator is a significant challenge. We have spoken with project mentors regarding limitations including time and scope. In doing so, we have formulated a list of what to prioritize to consider this project a success. Our first goal is to prove the pressure cylinder concept can be utilized to concentrate oxygen. Once this is achieved, the next steps are to synchronize and optimize our design, then tie it into the Fall 2022's team's delivery system.

Sponsored by:

Bamidele Ali, CCO-Innovative Safety and Performance Solutions (ISPS)

Online Presentation

PROJECT: Re-Print (MAE-Tulsa)
ADVISOR/S: Dr. Masoud Allahkarami, Dr. Jay Hanan, Erick Pepick

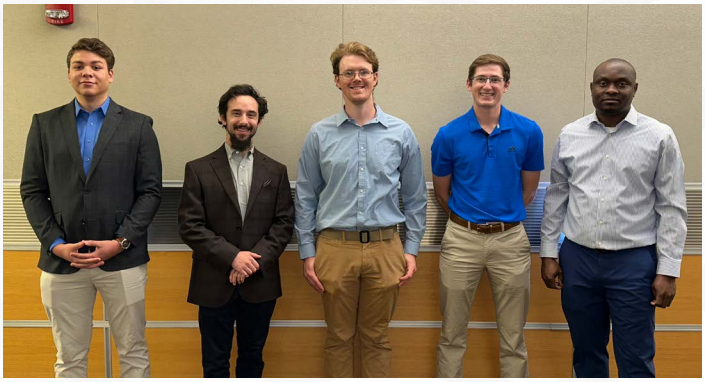


(Left to Right) Ben Harris, Noah Skaistis, Colton Bicknell, Anahuac Contreras, Jash Sood

In recent years, 3D printing has become increasingly popular, both in commercial and home use. Combined with growing public support for environmentally friendly manufacturing, the production of sustainable 3D printing material is more important than ever. As a continuation from the previous two semesters' design project, the current group will focus on improving filament production and testing. Multiple proprietary materials will be turned into filament, 3D printed and compared quantitatively to known materials such as PETG.

Project Video

PROJECT: Omnidirectional Aquatic Acoustics (MAE-Tulsa)
ADVISOR/S: Dr. Jay Hanan



(Left to Right) Joshua Chappell, Reagan Mpadi, Braxton Moseman, Joshua Kroll, Bryan Davis

It is understood that because of several factors, including the increased speed of sound, that it is more difficult for an individual to locate the direction of an incoming sound while they are underwater versus when they are in air. In our project, we sought to create a means to remedy this, as knowing the direction of a sound can assist divers in maintaining awareness of their surroundings. Having more awareness of one's surroundings can often be beneficial to one's safety, as well as one's general enjoyment of the experience of diving.

PROJECT: UV-C Air Purifiers (ProAir Cleaners) (MAE-Tulsa)
ADVISOR/S: Dr. Masoud Allahkarami, Dr. Jay Hanan, Chris Scott

Project Video

(Left to Right) Chase McCall, Chris Columbus, John Pescar, Muhammad Khan

Our team is working on designing an air purifier that will utilize Ultra Violet-C type to disinfect the air. We will modify the existing device called "Coolify 2" to incorporate a UV-C air purification system. We are working on this project to modify the existing air flow design system so that the user can get an efficient amount of air flow towards their face. We are trying to get an efficient amount of air flow to the user by adding two 3-inch extensions on each side of our device. It will extend the length of our device giving the user maximum treated air.

Sponsored by:

Innovative Safety and Performance Solutions

PROJECT: X-Ray Vision (MAE-Tulsa)
ADVISOR/S: Dr. Masoud Allahkarami, Dr. Jay Hanan

Project Video

(Left to Right) Zachary Batterton, Nicholas Saltmarsh, Bryttnie Turner, Lauren Zimmer, Ahmad Ismail

The primary objective for this design is to fabricate an easily replicable set of safety glasses/ lenses, which will provide the user with advanced protection against harmful ionizing radiation caused by X-rays. Our team's design employs a soller slit technology, which acts as a shield to incoming X-rays. Utilizing the soller slit method that allows the glasses to be lightweight, durable and low cost. We provide an alternative way to protect users from radiation than the current market of wearable protection devices with our unparalleled grassroots soller slit design.

Sponsored by:

MetCel, LLC

Bamidele Ali, CCO-Innovative Safety and Performance Solutions (ISPS)

PROJECT: Cycle of Landing Gear (MET)
ADVISOR/S: Dr. Amanda de Oliveira, Rebecca Welsch, Matthew Guy

(Left to Right) Carly Bloom, Jordan Buhler, David Cannan, Caleb Tuley, Chance Krumsiek

The engineering team at Boeing tasked us with a project over their 747-200 aircraft. The aircraft has a spare set of landing gear that stays in storage between two and four years. The shock struts on the landing gear need to cycle every six months to lubricate the seals to prevent a multi-million dollar overhaul. In this project, the team will design frames for the body, wing and nose landing gears. The purpose of the frames is to support the gears for shipping and storage, and also allow them to compress and extend the strut to lubricate the internal moving parts.

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BOEING

PROJECT: Solar Panel Cleaner Glider (MET)
ADVISOR/S: Dr. Amanda de Oliveira, Mike Loeser, Kyle Hatcher

(Left to Right) SarahBeth Sabetti, Garet Standridge, Jordan Carter, Cody Werner

Solar panel cleaning can be costly and take long hours of physical labor to complete. There is growing interest in finding ways to decrease the labor costs of solar panel cleaning through minimizing manpower. One current challenge identified by the project sponsors is that current autonomous systems find difficulty cleaning tilted panels at higher angles without slippage and moving from panel to panel within a row. The goal of this project is to design, prototype, and test a glider device that allows current commercially available cleaning robotic systems to perform cleaning at higher tilt angles and allows for support when shifting from panel to panel within a row.

Sponsored by:

CES CLEAN ENERGY SERVICES

SolarCleano

Project Video

PROJECT: AI FoosBots (ECE, MET)
ADVISOR/S: Dr. Aaron Alexander, Dr. Joe Conner, Dr. Gary Yen, Prof. Laura Southard

(Left to Right) Cade Bailey, Alex Gaines, Cozette Dyer, Nathan Johns, Riley Howell, Jalen Grier, Daniel Everheart, Garrison Locke

This project is a continuation of the Fall 2022 AI Foosball table project. The primary objective of this project was to further improve upon the mechanical and electrical systems of the table, while primarily focusing on integrating the artificial intelligence (AI) onto the table. The mechanical system was re-engineered to be contained within the table itself, while the electrical system was redesigned for reliability. The AI was trained using millions of steps within a Unity simulation and now can react dynamically to game conditions on the physical table. This table will be used as a teaching tool for students in STEM fields, as well as a platform for further development of the table by future OSU design teams.

Project Video

PROJECT: Autonomous Firefighting Vehicle Team Name: Lights and Sirens (FPSET, MAE, MET)
ADVISOR/S: Dr. Rob Agnew, Dr. Aaron Alexander, Dr. Joe Conner

(Left to Right) Josh Black, Seth Robbins, Dillon Schmidt, Megan Brown, Samuel Weber, Andi Tice, Mark Dodson, Blake Adam Moore, Alex Aispuro, Bryce White

On August 20, 2007, China Airlines Flight 120 landed in Naha Airport in Okinawa, Japan. Only moments after taxiing to its gate, the Boeing 737-800 burst into flames and subsequently exploded as a result of a loose bolt, which had punctured one of the aircraft's fuel tanks. Fortunately, all passengers and crew survived, but four people sustained injuries. The overall objective of the Autonomous Firefighting Vehicle project is to design and build a vehicle that can locate and fully extinguish a scaled-down version of this fire autonomously, eliminating the need for a human being to put their life on the line to fight a fire. This project is a continuation of the project from the Fall 2022 semester, so the team's goal this semester was to improve the existing design. In the previous semester, the vehicle proved its autonomous drive capabilities, and it was able to fully extinguish the pan fire through the use of remote controls. However, it showed significant issues with motor startup, steering, range of motion of the nozzle, and operator-vehicle communication. As such, this semester, the team sought out to address these issues by implementing a split-axle drive system (which includes more efficient motors than the previous model), installing a pan-tilt nozzle mount, integrating a FLIR thermal camera, and switching to a power over ethernet (PoE) communications system for more consistent operator-vehicle communication.

PROJECT: CEAT Parade Float (ME, MET)
ADVISOR/S: Dr. Joe Conner, John Gage

Project Video

Project Video 2

(Left to Right) Luis Brito, Cameron Ayers, Brittany Kelley, Sean Bouchery, Jake Rice, Parker Clarida, Benjamin Jones, Kyle Lucas, Nathan Albro, Travis Thomas, William Randall

In this project, a modified American in Motion hauling unit is transitioned into a fully operational parade float. This process involves designing, fabricating, and building onto the machine's frame to make a superstructure. Some other features on the float are a sound system and lights, that will be exciting to an audience and provide noticeable visibility for safety. Additionally, a smaller swerve drive unit robot is programmed to demonstrate ideal motion capabilities for the machine to perform in the future. Once fully rendered the parade float will represent the CEAT and Mechatronics programs in homecoming parades and events.

PROJECT: Cyclone Cowboys (CIVE, ECE, IEM, MAE, MET)
ADVISOR/S: Dr. Aaron Alexander, Dr. Dan Fisher, Dr. Chenang Liu, Dr. Kurt Rouser, Prof. Laura Southard, Prof. Nate Lannan

Project Video

(Left to right, front row to back row)
Front row (holding the sign): Sahir Virani, Tristan Kohn
Row 2: Lauren Millis
Row 3: Lenna Abouzahr, Carinna Marling
Row 4: Adrianna Cheverie, Mary Urias
Row 5: Kaden Clemmer, Maggie English, Annie Grace Irlbeck
Row 6: John-Todd Wallace, Wes Dodson, Brady Amox
Row 7: Prof. Laura Southard, Austin Elliott, Calvin Ward
Row 8: Alyssa Miller, Bret Vaughn
Row 9: Ryan Lawson, Hunter Reitze
Row 10: Peter Tikalsky, Ben Marquis
Row 11: Dawson Kinser, Prof. Nate Lannan

Cyclone Cowboys is participating in the Collegiate Wind Competition that is being sponsored by the Department of Energy. The outreach team has made connections with professionals who have worked in the wind industry and have introduced elementary and college students to wind energy. The project development team has researched and planned an ideal offshore wind farm to compete in the competition. The turbine design team has designed, fabricated and tested a turbine to compete in the competition.

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Project Video

PROJECT: Vmax FSAE Variable Runner Length Intake (ECE, MAE)
ADVISOR/S: Dr. Dan Fisher, Dr. James West, Prof. Laura Southard

(Left to Right) Logan Brandvold, Aaron Rosen, Jonathan Buskirk, Grant Woods, Bryce Wilmeth, Patrick Begnaud, (Not Pictured) Dayton Masters

The objective of the project is to create an intake system for the Oklahoma State University Formula SAE Racecar that maximizes output torque by utilizing a variable length runner intake system that is compatible with a 2019 Kawasaki ZX6R engine. The project has been allocated a budget of $2,000 and must comply with all relevant FSAE regulations, including but not limited to, the intake system being mounted with fasteners that feature positive locking mechanisms, and the plenum having a 19 mm intake restriction. In addition, the intake system must fall within the tire envelope of the racecar. The project team is also tasked with minimizing the overall weight of the system while optimizing the intake runner length for maximum power/torque output at full range of engine RPM.

Project Video

PROJECT: Iron Phoenix (FPEST, MAE)
ADVISOR/S: Dr. Rob Agnew, Dr. Joe Conner

(Left to Right) Connor Martin, Tyler Lane, Alec Bailey, Andrew Hart, Aileen Converse, Sammy Dykes

In order to train for putting out fires of various types, firefighting teams use burn-prop replicas of vehicles or structures in training exercises designed to mimic real-life emergencies. To this end, in order to accurately reflect airstrip fire conditions seen in case studies of jet-fuel fires such as China Airlines Flight 120, we've constructed a 1:6 scale model of a Boeing 737-800, to be burned in live fire exercises. Our model is actively cooled, designed for eight minutes of burn time, and is intended for use by firefighting teams such as OSU's Autonomous Firefighting Vehicle team to develop and test protocols for the efficient fighting of airstrip fires.

Project Video

PROJECT: Locomotors (MAE, MET)
ADVISOR/S: Dr. Aurelie Azoug, Dr. Amanda de Oliveira, Jacob Brown

(Left to Right) Brock Rouser, Hayden Collins, Chris Galvan, Mohamed Diawara

Soft robotics is a relatively new subfield of robotics that utilizes soft materials such as silicone to create robots with unique properties and abilities. Soft robots have many advantages compared to traditional robots, such as safer human interactions and the ability to change shape to adapt to their environment. The objective of this project is to fabricate and control a pneumatic soft robot that is capable of moving itself and passing underneath a 3 centimeter high obstacle. This robot will be used in STEM outreach activities for OSU to engage with middle school children.

Online Presentation

Project Video

PROJECT: Solar Decathlon - Renewable Orange Power (ARCH, DHM, MAE)
ADVISOR/S: Dr. Christian Bach, Dr. Khaled Mansy, Dr. Hebatalla Nazmy

Front Row: Madison Dukes, Cheyanne Lee, Aliyah England
Back Row: Madison Rotramel, Eric Keilbarth, Brin Hague, Gracie Granberry,(Not Pictured) Molly Hoback

The goal for our team, Renewable Orange Power, is to design a zero-energy residential house in Stillwater, Oklahoma. Our team is partnered with Stillwater's Habitat for Humanity to design a zero-energy residential house for an anticipated neighborhood establishment. Habitat for Humanity works with local businesses and national partners to receive cost effective and donated materials to build houses for low to moderate income families in need. While the upfront cost is a priority for our design team, we are also mindful that the long-term maintenance and general usage costs must also be reasonable for the family we are accommodating. For this reason, it is important that the systems we select be very efficient and dependable. Creating a zero-energy home will reduce the recurring financial stress for this family by minimizing its consumption of resources and supplying them with their own means of energy generation. Despite the cost effectiveness and energy efficiency, the home is still aesthetic and highly functional making it a great home for a family. Our design and specifications were also entered into the DOE Solar Decathlon competition, which has given us the opportunity to get valuable feedback from experts in the zero net energy field.

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PROJECT: Revenge of BB-8 (ECE, MAE, MET)
ADVISOR/S: Dr. Joe Conner

Project Video

(Left to Right) Jake Hayward, Ryan Eubanks, Wyatt Smith, Brendan Ingram, Jared Campbell, Brandon Coppedge, Trent Williams, Drake Wooldridge

The Revenge of BB-8 senior design project is the culmination of the mechanical and electrical knowledge and skills we've learned to build a functional BB-8 droid from Star Wars. Our end goals for BB-8 this semester are for it to be semi-autonomous, be used as a marketing tool for OSU/ENDEAVOR, to be strong enough to allow for consistent use, and to have a duplicate model to allow for presentations of BB-8's inner workings. We took the functional drivetrain that was completed last semester and improved the frame, while also adding a shell and head to create a more cosmetically complete droid. We also upgraded the electronics with the addition of two micro-controllers to allow for better/easier control and will aid towards the goal of BB-8 being semiautonomous.

Project Video

PROJECT: Team Joyride: IGVC Self Driving Car (CS, ECE, EET, MAE)
ADVISOR/S: Dr. He Bai, Dr. Rushikesh Kamalapurkar, Dr. Weihua Sheng, Diego Colón, Samuel Fipps

(Left to Right) Brendan Wickman, Christopher Shropshire, Max DeSantis, Zeke Lappe, Jack Funderburgh, Isaac Castilleja, Bailey Despain, Isabell Cook, Troy Willoughby, Kelvin Tran, Nathan Wilson, Jason Aquino, Kale Downing

The overarching objective of the Intelligent Ground Vehicle Competition (IGVC) capstone project is to develop a self-driving vehicle capable of competing in the annual IGVC Self-Drive challenge. In order to do so, the team must develop a fully-functional drive-by-wire (DBW) package on the vehicle and a complex software suite to enable autonomous operation. These modifications are being made to a GEM e2 small electric car, and have been in progress for three semesters - Spring 22, Fall 22, Spring 23. This semester's goal is to fully integrate all sensor subsystems using the Robot Operating System, including LIDAR, cameras, GPS, inertial measurements, wheel encoders, and more. Furthermore, the team aims to implement a waypoint-following navigation system so that the vehicle will be able to obey lane markers, avoid obstacles, and travel towards its destination.

Project Video

PROJECT: Thermal Solutions (Thermal Energy Storage Tank) (MAE, MET)
ADVISOR/S: Dr. Christian Bach, Dr. Pouria Moghimi, Dr. Jeffrey Spitler

(Left to Right) Cooper Serup, Mason Simmons, Franchesca Young, Jack Fling, Jackson Downing, Tyler Riley, Aaron Clark, Sean Rieger, Jase Pippenger, Joel Smart

The purpose of this project is to develop and optimize a test bed for a thermal energy storage (TES) tank. Many renewable energy systems exist, such as solar and wind, but each of these come with inconsistencies and dependencies on outside forces. Additionally, many of the current renewable solutions have no way of storing excess energy, therefore it dissipates and is lost. This is where our project comes in! The goal of our TES tank is to store that excess energy in a tank of water. This heated (or cooled) water can then be used for heating or cooling a space. This creates a new bridge for renewable energy when solar or wind energy is inconsistent. Our TES tank works by converting this energy into hot or cool air via water circulating through a heat pump loop. In order to be most effective in a single-tank system like ours, the "hot" and "cold" portions of the fluid in the tank need to be separated and the thermocline (the line separating hot and cold water) needs to be as small as possible. This stratification is achieved in several different ways, but our project will utilize baffles in the tank as well as an efficient diffuser design. The baffles and diffusers will help keep the hot and cold water from mixing, thus maximizing the amount of energy we can extrude.

Automation Integrated
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Damon McClure
Mark Shaw

Project Video

PROJECT: Tiny House Renewable Energy Demo (ECE, EET, MAE)
ADVISOR/S: Dr. Craig Bradshaw, Dr. Christian Bach, Dr. Jeffrey Spitler

(Left to Right Front Row) Luke Allen, Ali Alamri, Madison Holberg, Bryan Pizana, Hayden Hilst, Sydney Northcutt, Gabriel Parker, Avery Hamilton, (Left to Right Back Row) Israel Alabi, Will Ranson, Wade Lopp, Jared Youngblood, Collin Fields, Thomas Freet, Parker Raney, Zac Claiborne

The end goal of our project, in future semesters, is to create a mobile exhibit that shows off the capabilities of the Center for Integrated Building Systems (CIBS). This includes renewable energy technology to help mitigate utility problems and can be used by OSU to attract potential engineering students. This semester, our group was tasked with designing a simulation and four prototypes. The simulation calculates the building loads throughout the year, determines the amount of energy produced by the solar panels every hour, finds if the heat pump or Thermal Energy Storage (TES) tank can run, determines the state of the battery at the end of every hour, and finally tells the user how many hours of the year the building loads are unmet. The first prototype is a sample section of the wall and roof of the tiny house designed by our team this semester. The layers of the wall and roof were designed to maximize thermal resistance. Our prototypes were tested to find the actual thermal resistance of our test sections and see how they compared to the theoretical calculations. The second prototype is a solar energy system that contains solar panels, a charge controller and batteries, and was designed so that it can be upscaled in future semesters and meet the actual building energy demands. The testing of this prototype allows us to validate and improve our simulation of the system. The third prototype is a mini-split air-to-air system that was modified to be an air-to-water system by replacing the indoor unit with a brazed plate heat exchanger to produce hot and cold water. The prototype was then tested to see how it performs after modification and what water temperatures and heat transfer of the system we could expect to see. The last prototype was a testing apparatus so we can see how our radiator performs, since we are expecting to operate at temperatures lower than what the manufacturer provides data for.

CENTER FOR INTEGRATED BUILDING SYSTEMS
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Project Video

PROJECT: Weld Test/Beads on Beads (MAE, MET)
ADVISOR/S: Dr. Joe Conner, Prof. Warren Lewis, Jacob Brown

(Left to Right) Tom Davis, Garret Shields, Zachary Patterson, Wyatt Peters, Joshua Marvin, Cameron Thomas

This proposal will be used for the ENSC 2141 strengths lab. The goal is to have a turn key lab, covering the design and testing of different weldments. Our senior design team will design and test coupons to be used to show different weld placements and how they perform under shear, bending and torsion loads. The team will also design and fabricate mounts for the bending and torsion coupons, so they can be tested with the Shimadzu machine. Finally, the team will develop lab sheets for the students to collect data and walk them through the procedure.