Friday, April 26, 2024 | 8am - 5pm

ENDEAVOR Lab | 215 N. Hester Street, Stillwater, OK 74078

2024 Spring Teams & Project Guide

SENIOR DESIGN EXPO

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A WORD FROM THE DEAN

Greetings!

The Senior Design Expo at OSU CEAT is always one of the most exciting times and the 2024 Spring Senior Design Expo is no exception. In barely a month, I have had the opportunity to see so many amazing projects from our students. I am very much impressed and believe that you will be also. This Expo gives all of us a chance to see the culmination of our student's education in engineering, architecture and technology throughout their time at OSU. During today's event we will see dancing robots, projects in collaboration with cities and tribes in Oklahoma, a pecan cleaner, power-to-gas systems, competition cars, ways to keep our firefighters healthier and safer, tiny homes, wind turbines, 3D printed concrete, procedures to improve revenue and streamline processes, and so much more! One of our teams even had an amazing opportunity to partner with NASA and other colleges from the US for the 2024 Solar Eclipse for specific research.

Following the Expo, we will award 583 bachelor's degrees, 62 master's degrees and 14 doctoral degrees this semester. Our students leave OSU with the ability to lead companies, tackle complicated projects and be valuable contributors in their disciplines. The work our graduates do impacts all of us in some way. As we continue to grow our college, enhance our facilities and take on more collaborative efforts, we will only see this impact grow.

We could not do what we do without the support of OSU's senior leadership and the OSU State Regents for Higher Education, along with help from our many corporate partners, donors and the leadership teams within CEAT.

I hope you enjoy our Senior Design Showcase and getting to know our students. The future is BRIGHT ORANGE with these seniors as they take what they have learned in the classroom and from their internships into the workplace. We expect many great achievements from our graduates as they serve their industries and help address challenges worldwide.

GO POKES!

Dean Hanchen Huang
Donald and Cathey Humphreys Endowed Chair
Professor of Engineering

OSU – STILLWATER PROJECTS

FRIDAY, APRIL 26 FROM 8:00 AM – 4:30 PM IN THE ENDEAVOR LAB
(Stillwater, OK)

BIOSYSTEMS AND AGRICULTURAL ENGINEERING (PROJECTS LOCATED ON THE FIRST AND SECOND FLOOR OF ENDEAVOR)

BAE AquaViva Innovations (2nd Floor)
BAE Compost Duty - The Composting Toilet (2nd Floor)
BAE CRONOS Gen 3 (2nd Floor)
BAE Engineered Pecan Systems (In front of ENDEAVOR and Test Arena)
BAE Great Engineering in Motion - Effluent Reuse (2nd Floor)

CHEMICAL ENGINEERING (PROJECTS LOCATED ON THE SECOND FLOOR OF ENDEAVOR)

CHE Electrical Power Storage by the Capture and Conversion of CO2 into Methane (2nd Floor)
CHE Methanation Process Design (260)
CHE Money Doesn't Smell: Design of a Biogas-Upgrading Plant (2nd Floor)
CHE Power-to-Gas Plant Using Hydrogen (260)
CHE Power-to-Gas Plant Design Utilizing Offshore Wind Farm Electrolysis and Ethanol Plant Emissions (260)
CHE Renewable Energy as Natural Gas Storage (260)
CHE Sustainable Power-to-Gas System Design (260)
CHE Sustainable Power-to-Gas System Design (260)
CHE Sustainable Power-to-Gas System Design: Integrating Renewable Energy Storage (2nd Floor)
CHE Sustainable Power-to-Gas System Design: Integrating Renewable Energy Storage and Environmental Responsibility (260)
CHE The Dawgs (2nd Floor)

CIVIL AND ENVIRONMENTAL ENGINEERING (PROJECTS LOCATED ON THE THIRD FLOOR OF ENDEAVOR)

CIVE City of Edmond Intersection (3rd Floor)
CIVE City of Perkins Flood Mitigation Design (3rd Floor)
CIVE City of Stillwater: "Rail to Trail" Pedestrian Crossing (3rd Floor)
CIVE Perkins Water Tower & Lift Station Design (3rd Floor)
CIVE Northern Oklahoma College Drainage Design (3rd Floor)
CIVE Water Cowboys: Sustainable Flood Mitigation Design (3rd Floor)
CIVE WERC It Design (3rd Floor)

OSU – STILLWATER PROJECTS

ELECTRICAL AND COMPUTER ENGINEERING (PROJECTS LOCATED ON THE SECOND AND THIRD FLOOR OF ENDEAVOR)

ECE Aerial Refueling Gesture and Detection (3rd Floor)
ECE Bio-inspired Guitarist (3rd Floor)
ECE Intelligent Ground Vehicle Competition (220)
ECE Mobile/Reconfigurable DC Magnetics Facility (3rd Floor)
ECE Moon Bounce (3rd floor, Energy Deck)

FIRE PROTECTION AND SAFETY ENGINEERING TECHNOLOGY (PROJECTS LOCATED ON THE FIRST FLOOR OF ENDEAVOR)

FPSET Casual Analysis of Firefighter Line of Duty Deaths (1st Floor)
FPSET Gusset Plate 2 (1st Floor)
FPSET Measuring Temperature Dependence of the Generation of Polycyclic Aromatic Hydrocarbons in Fire Using a Novel Passive Dosimetry Technique (1st Floor)
FPSET Real Life Movement Speed (1st Floor)
FPSET Virtual Reality Movement Speed Project (1st Floor)

INTERDISCIPLINARY (PROJECTS ARE LOCATED ON ALL THREE FLOORS IN ENDEAVOR AND ON THE ENGINEERING SOUTH LAWN)

ID Autonomous Fire Fighting Vehicle Project (Test Arena)
ID BlooKooz Inc. (220)
ID Cyclone Cowboys (Test Arena)
ID Ecofficient Home (370)
ID Heatwave (302)
ID IEEE Robotics (340)
ID Ocean Motion (150)
ID OKSat (Oklahoma CubeSat Initiative) (3rd Floor)
ID Orange Vision (340)
ID RATO Sportjet (Engineering South Lawn)
ID Reinventing the Wheel (1st Floor)
ID Soft Bots (1st Floor)
ID Super Servos (202)
ID Team Robo<>chilles (220)
ID Tractor Beam (Outside ENDEAVOR and Test Arena)
ID Virtual Climate Squad (202)
ID Wire Spool Handling (2nd Floor)

OSU – STILLWATER PROJECTS

INDUSTRIAL ENGINEERING AND MANANGEMENT (PRESENTATIONS WILL BE FROM 1:30 PM - 4 PM IN THE ADVANCED TECHNOLOGY RESEARCH CENTER 101)

IEM Engineering Extension Procedure Analysis
IEM Modeling ArcBest's Cross Docking Time
IEM Pack and Ship Improvement for Excel3PL
IEM Revitalizing MPower and Boosting Revenue
IEM Storage Layout Improvement for Webco Tulsa Distribution Facility

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MECHANICAL AND AEROSPACE ENGINEERING (PROJECTS ARE LOCATED ON ALL THREE FLOORS IN ENDEAVOR AND ON THE ENGINEERING SOUTH LAWN)

MAE Aerospace Propulsion Outreach Program Black Team (Engineering South Lawn)
MAE Beacon for a Universal and Deployable Inflated Exploration System (2nd Floor)
MAE Box Auger Designs: 3D Concrete Printer (Outside ENDEAVOR and Test Arena)
MAE Chiller Commissioning (302)
MAE Cowboy Racing: Front Suspension Design (2nd Floor)
MAE CVD Engine (220)
MAE Dancing Turtle Robot (Test Arena)
MAE Design and Fabrication of a Turbojet Thrust Reverser Modification (Engineering South Lawn)
MAE Force Feedback Yoke Project by the Yoke-A-Holics (220)
MAE Hypogravity Test Bed (220)
MAE Safety Tow - Team Cowboy Hitch (1st Floor)
MAE Space Cowboys Argonia Cup (Test Arena)
MAE The Eclipse From Above the Clouds – Solar Balloon Science During the 2024 Eclipse (2nd Floor and Test Arena)
MAE Vertical Thrust Tester Module (220)

COMPETITION TEAMS (THE COMPETITION TEAMS ARE LOCATED THROUGHOUT ENDEAVOR)

Concrete Canoe (3rd Floor)
Cowboy Racing (2nd Floor)
Cowboy Rocketworks (Test Arena)

ROBOT WARS

Robot Wars will be held in Engineering South in the Zink Center for Competitive Innovation from 10:30 am to noon.

THE AWARDS PRESENTATION FOR ID/MAE/MET/EET AND ECE TEAMS WILL BE HELD IN THE CHICKASAW NATION STEM AUDITORIUM IN ENGINEERING SOUTH AT 4:30 PM

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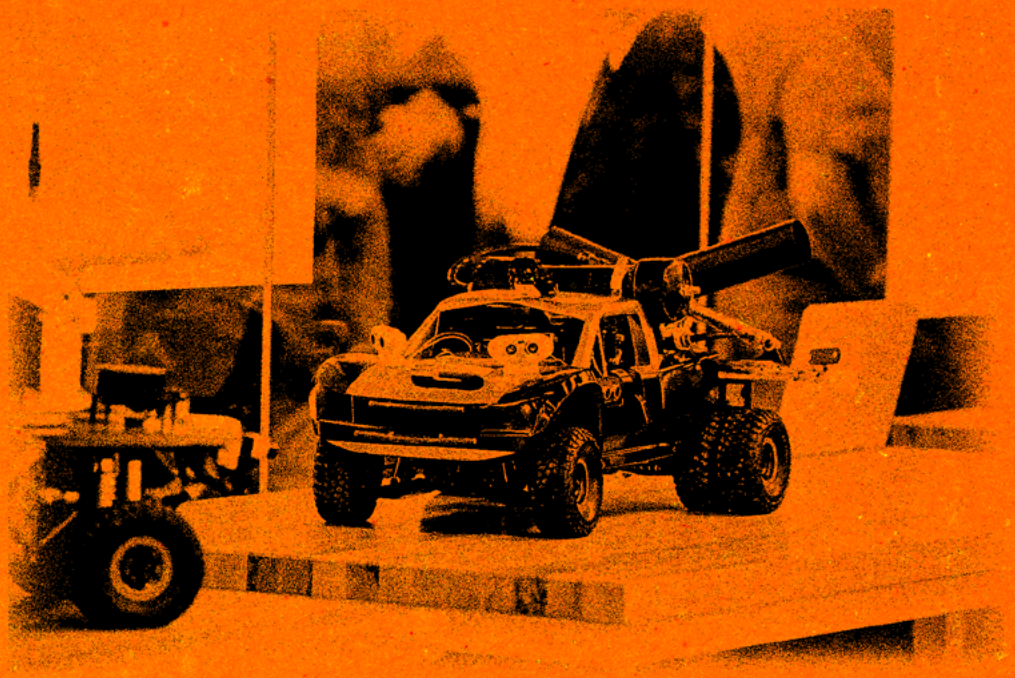


9 **BAE**
Biosystems and Agricultural Engineering

13 **CHE**
Chemical Engineering

20 **CIVE**
Civil and Environmental Engineering

25 **ECE**
Electrical and Computer Engineering

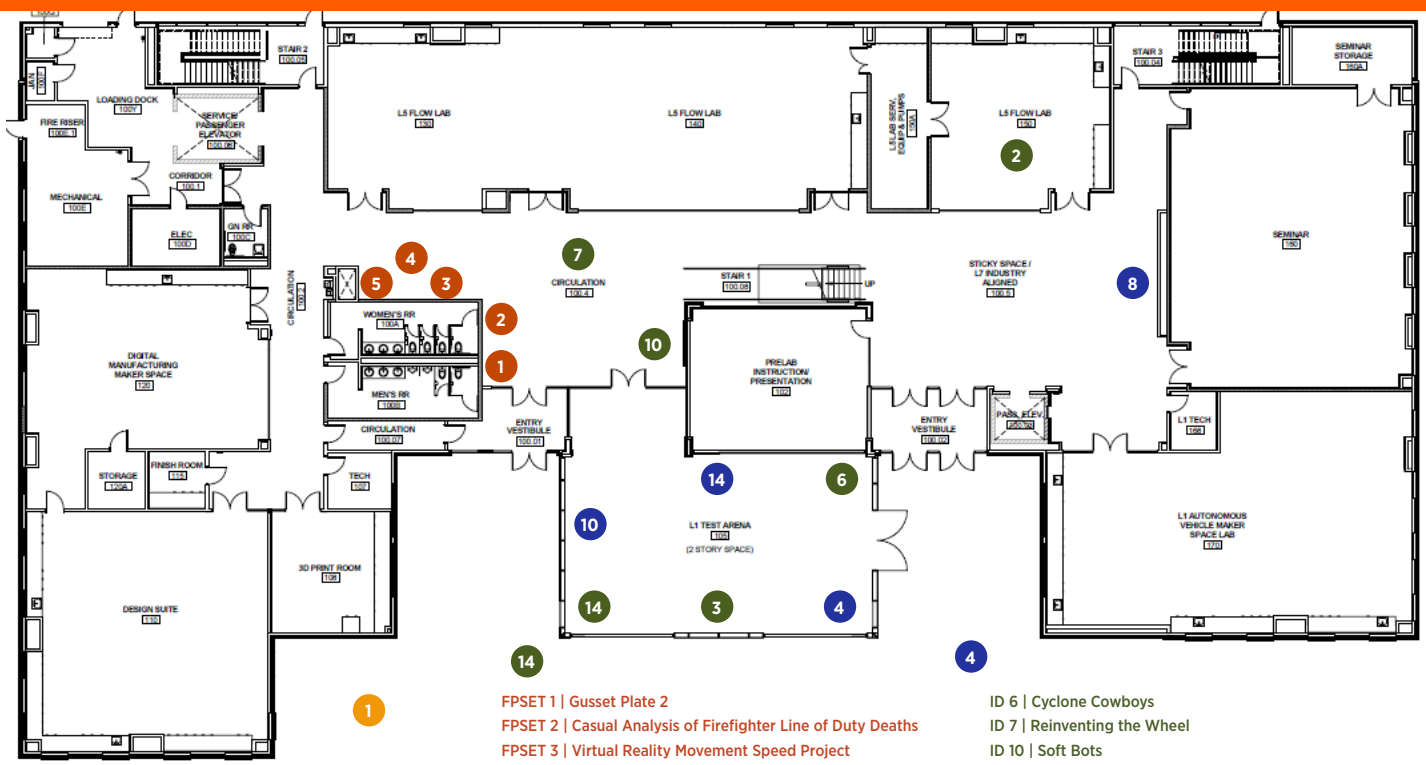
29 **FPSET**
Fire Protection and Safety Engineering Technology

33 **IEM**
Industrial Engineering and Management

37 **ID**
Interdisciplinary

47 **MAE**
Mechanical and Aerospace Engineering

FIRST FLOOR ENDEAVOR



FPSET 1 | Gusset Plate 2
FPSET 2 | Casual Analysis of Firefighter Line of Duty Deaths
FPSET 3 | Virtual Reality Movement Speed Project
FPSET 4 | Real Life Movement Speed
FPSET 5 | Measuring Temperature Dependence of the Generation of Polycyclic Aromatic Hydrocarbons in Fire Using A Novel Passive Dosimetry Technique
ID 2 | Ocean Motion
ID 3 | Autonomous Fire Fighting Vehicle Project
ID 6 | Cyclone Cowboys
ID 7 | Reinventing the Wheel
ID 10 | Soft Bots
ID 14 | Tractor Beam
MAE 4 | Box Auger Designs: 3D Concrete Printer
MAE 8 | Safety Tow - Team Cowboy Hitch
MAE 10 | Dancing Turtle Robot
MAE 14 | Space Cowboys Argonia Cup
BAE 1 | Engineered Pecan Systems (EPS)

SECOND FLOOR ENDEAVOR

MAE 5 | Cowboy Racing: Front Suspension Design
MAE 6 | Beacon for a Universal and Deployable Inflated Exploration System
MAE 9 | CVD Engine
MAE 11 | Force Feedback Yoke Project by the Yoke-A-Holics
MAE 12 | Hypogravity Test Bed
MAE 13 | Vertical Thrust Tester Module
MAE 15 | The Eclipse From Above the Clouds - Solar Balloon Science During the 2024 Eclipse
ID 4 | BlooKooz Inc.
1D 9 | Team Robo<>chilles
ID 11 | Super Servos
1D 12 | Virtual Climate Squad
ID 17 | Wire Spool Handling
BAE 2 | CRONOS Gen 3
BAE 3 | Compost Duty - The Composting Toilet
BAE 4 | Great Engineering in Motion - Effluent Reuse
BAE 5 | AquaViva Innovations
CHE 1 | The Dawgs
CHE 2 |Sustainable Power-to-Gas System Design: Integrating Renewable Energy Storage
CHE 3 | Electrical Power Storage by the Capture and Conversion of CO^2 into Methane
CHE 4 | Money Doesn't Smell: Design of a Biogas-Upgrading Plant
CHE 5 | Sustainable Power-to-Gas System Design: Integrating Renewable Energy Storage and Environmental Responsibility
CHE 6 | Renewable Energy as Natural Gas Storage
CHE 7 | Power-to-Gas Plant Using Hydrogen
CHE 8 | Sustainable Power-to-Gas System Design
CHE 9 | Sustainable Power-to-Gas System Design
CHE 10 | Power-to-Gas Plant Design Utilizing Offshore Wind Farm Electrolysis and Ethanol Plant Emissions
CHE 11 | Methanation Process Design
COMPETITION 1 | Cowboy Racing
ECE 5 | Intelligent Ground Vehicle Competition

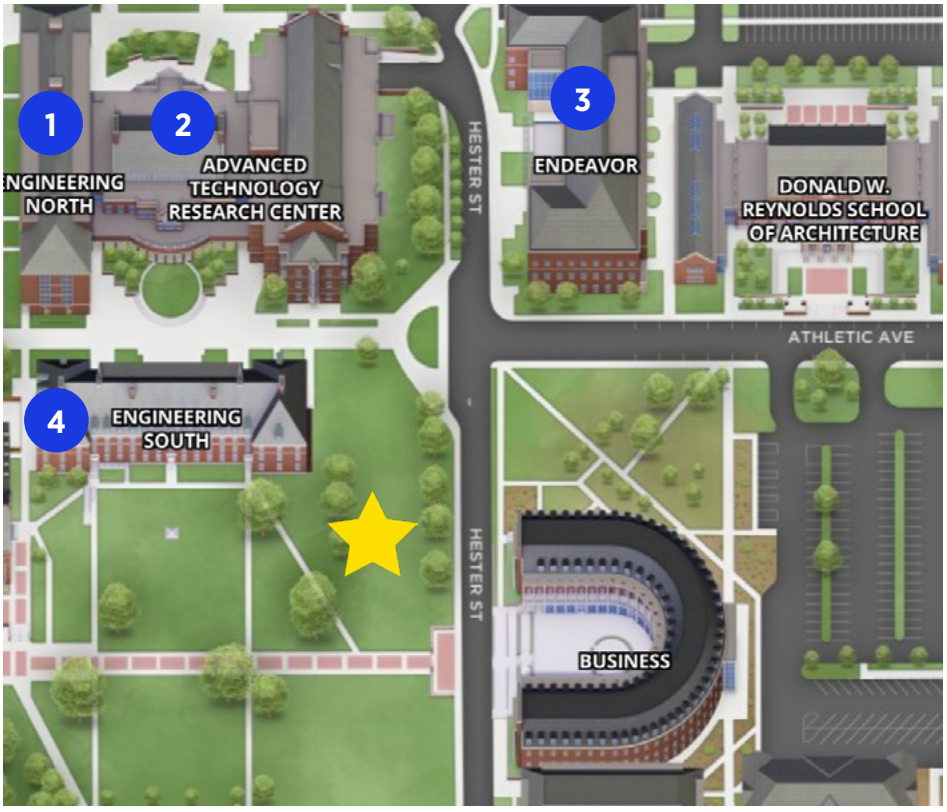
THIRD FLOOR ENDEAVOR

ECE 1 | MoonBounce
ECE 2 | Aerial Refueling Gesture and Detection
ECE 3 | Mobile/Reconfigurable DC Magnetics Facility
ECE 4 | Bio-inspired Guitarist
ID 1 | Heatwave
ID 5 | OKSat (Oklahoma CubeSat Initiative)
ID 8 | IEEE Robotics

ID 13 | Ecofficient Home
ID 15 | Orange Vision
CIVE 1 | Water Cowboys: Sustainable Flood Mitigation Design
CIVE 2 | Northern Oklahoma College Drainage Design
CIVE 3 | City of Stillwater: "Rail to Trail" Pedestrian Crossing
CIVE 4 | Perkins Water Tower & Lift Station Design
CIVE 5 | City of Perkins Flood Mitigation Design

CIVE 6 | City of Edmond Intersection
CIVE 7 | WERC It Design
COMPETITION 2 | Concrete Canoe
MAE 7 | Chiller Commissioning

OTHER LOCATIONS



1. ENGINEERING NORTH

2. ADVANCED TECHNOLOGY RESEARCH CENTER (ATRC)

IEM presentations will be held from 1:30 P.M - 4 P.M in Advanced Technology Research Center 101.

3. ENDEAVOR LAB

4. ENGINEERING SOUTH

LOCATION OF AEROSPACE SENIOR DESIGN PROJECTS

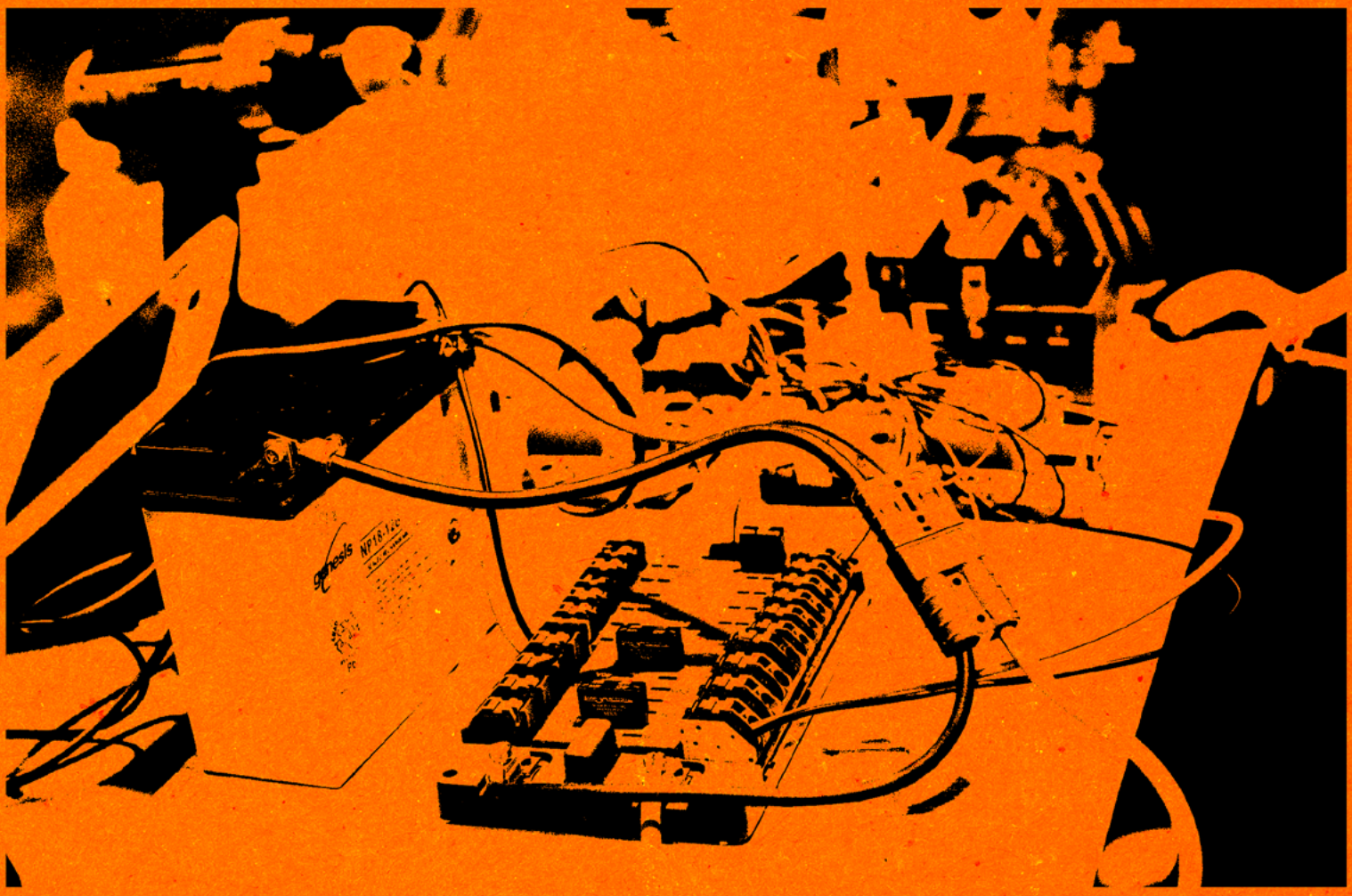
Aerospace Propulsion and Power Senior Design Expo

AEROSPACE DESIGN TEAMS

-Aerospace Propulsion Outreach Program Black Team

-Design & Fabrication of a Turbojet Thrust Reverser Modification

-Rocket-Assisted-Take-off-System for Small Unmanned Aircraft(RATO)



BIOSYSTEMS & AGRICULTURAL ENGINEERING

PROJECT TITLE

AQUAVIVA INNOVATIONS

BAE

Aquaponics, an integrated aquaculture and hydroponics system, offers a sustainable solution to food production by harnessing the symbiotic relationship between fish and plants. This study examines the Osage Nation's endeavor to establish a commercial aquaponics facility to bolster sustainability and self-sufficiency. Amidst global challenges such as the COVID-19 pandemic and supply chain disruptions, the Osage Nation recognized the necessity to cultivate food sovereignty. The expansion of the Osage Nation's aquaponics operation necessitated comprehensive infrastructural and operational enhancements. Aquaviva Innovations, a Biosystems Engineering senior design team, collaborated with the Osage Nation to address challenges and optimize performance. Key issues identified included water elevation management, fish fry procurement reliability, nutrient monitoring precision, and ambient temperature regulation within the facility. In response, innovative solutions were devised: introduction of a gravity-fed catchment system to optimize water distribution and regulate flow dynamics, enhancing system efficiency and stability; design and implementation of a multifunctional fish egg hatching and developmental stage housing system, ensuring consistent and sustainable fish population management; implementation of advanced sensor packages for real-time monitoring of water quality parameters, providing actionable insights and enabling proactive intervention; and between devising strategies for temperature control within the facility, encompassing water and air temperature management approaches to mitigate thermal stress on plants and aquatic organisms. This case study highlights the potential of aquaponics systems as a sustainable and resilient solution for food production, offering indigenous communities like the Osage Nation a pathway towards economic autonomy and food sovereignty.

(Left to RIght) Shelby McMahan, Sam Mason, Henry Warren

ADVISOR(S)

Dr. Kevin Moore, Dr. Paul Weckler

SPONSOR(S)

Cody Vavra
Harleigh Moore
Dawn Wormington

PROJECT TITLE

COMPOST DUTY – THE COMPOSTING TOILET

BAE

The primary inspiration behind the Compost Duty project was to create a fully automated composting toilet. The goal was to have something that could be placed in a remote area and needed minimal human contact. Instead of having to consume vital resources such as water and energy to treat human waste, this project could provide usable fertilizer with minimal water inputs and could be powered with a small solar panel. Compost Duty created a prototype of the mixing and composting piece of this project. A meat mixer with a paddle mixing system was repurposed to house the composting waste. The team used arduino and sensors to monitor weight, fill height, moisture content, temperature, and density. The system used a motor to periodically mix the compost for aeration which was triggered by time of day, if the compost was too hot, or if the system had recently added moisture or a carbon source. A pump was used to add moisture to the system if needed. The team has been successful in keeping partially composted material under the right conditions during testing this semester.

(Left to RIght) Cecilia Jimenez, Kailey O'Connor, Alan Liu

ADVISOR(S)

Dr. Doug Hamilton, Dr. Kevin Moore, Dr. Ning Wang, Dr. Paul Weckler, Joe Preston

SPONSOR(S)

Dr. Jason Vogel, Director, Oklahoma Water Survey

PROJECT TITLE

CRONOS GEN 3

Crop monitoring systems have grown in popularity among researchers and farmers. They help to reduce the use of irrigation and fertilizer needed by analyzing the health of a field. CRONOS (Crop Observatory Nodes) is a joint USDA funded project between Oklahoma State and Kansas State. CRONOS remains in a crop field for the entire growing season and records data such as soil moisture weather conditions, takes pictures of the crop canopy for further evaluation. The Crop Watchers were tasked to assist with the CRONOS project by designing a new housing structure for the entire system. CRONOS was previously built with a tripod base supporting thin aluminum poles and waterproof casing that housed the sensors. It is difficult to move and set up by a single individual; therefore, Generation 3 is desired to be light yet sturdy along with minimal equipment needed for installation. CRONOS Generation 3 steps away from using the tripod setup to using a more all encompassing 12 foot tall aluminum pole. The pole houses the needed sensors; therefore, keeping everything in its own organized space inside the structure. The needed power requirements are still kept and the system can run off of the daily solar generation to record and send data to servers for further processing. This design accomplishes the goal of making the system light and easily movable.

ADVISOR(S)

Dr. Kevin Moore

SPONSOR(S)

Dr. Tyson Ochsner **Cole Diggins**

(Left to RIght) Katie Miller, Colton Ingmire, Emily Hurst

BAE

PROJECT TITLE

ENGINEERED PECAN SOLUTIONS (EPS)

In August, our team was tasked with building a small-scale pecan cleaner for our client. The objective was to create a mobile cleaner that would make the cleaning process easier. It was to be able to fit within a small shop, be ran off 220V 50A power, and include a variable frequency drive to adjust fan velocity and conveyer speed of the cleaner. The cleaner consists of a rotary trommel that allows debris smaller than a pecan to drop out into a catch tray, an air blower that separates the remaining light debris from the pecans by using the materials' different terminal velocities, and a sorting table that succeeds the air duct, where the user can sift through the good pecans to find defects. Our team completed all these objectives with our work throughout the year. We are happy to present a complete final project to the client.

ADVISOR(S)

Dr. Kevin Moore

SPONSOR(S)

Robert "Rocky" Harrington

(Left to RIght) Stephen Fuhrmann, Garrett Seger, Gavin McCullough

PROJECT TITLE

GREAT ENGINEERING IN MOTION – EFFLUENT REUSE

This project explores the economical and environmental impacts on the implementation of effluent water reuse within Koch Fertilizer in Enid, OK. Currently effluent is discharged to Skeleton Creek. The plant would like to become a zero liquid discharge facility. With a focus on enhancing environmental sustainability and optimizing water savings, this study explores various treatment methods to reuse effluent within the plant. With a thorough economic analysis, a comprehensive overview of net present values and savings potential will be presented. The environmental aspect of the project includes a hydrologic study, as well as an analysis of the water quality of Skeleton Creek.

ADVISOR(S)

Dr. Kiranmayi Mangalgiri, Dr. Kevin Moore, Dr. Paul Weckler, John Leighton

SPONSOR(S)

KOCH FERTILIZER

(Left to RIght) Erycka Pretorius, Grace Beiergrohslein, Mason Settle

CHEMICAL ENGINEERING

PROJECT TITLE

ELECTRICAL POWER STORAGE BY THE CAPTURE AND CONVERSION OF CO_2 INTO METHANE

The rising interest in renewable energy has led to research for making existing, renewable energy reliable and available to the public. The issue with intermittent renewable sources such as wind and solar is the inconsistency in output, due to the unpredictability of driving forces. The solution to this is to store produced electricity in a form that can then be turned back into electricity on demand. One proposed methodology for the technology, referred to as power-to-gas (PtG), stores renewably produced electricity and stores it in chemical molecules for long term storage and use. The purpose of this project is to create a process that reacts emitted Carbon Dioxide (CO_2) with Hydrogen (H_2) produced through electrolysis using renewable electricity to create Water (H_2O) and Methane (CH_4). The produced methane can then be easily stored, moved, and used from existing natural gas lines as an energy source.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to RIght) Adam Bryson, Sean Smart, Fatimah Albutayyan, Adrian Miller

PROJECT TITLE

METHANATION PROCESS DESIGN

The project contains the design of a methanation unit where carbon dioxide and carbon monoxide are used to produce methane. Since methane is a source of energy the goal of this project is to have a feasible process that produces methane and focus on ways to store renewable energy sources.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

Anfaal Faraj

PROJECT TITLE

POWER-TO-GAS PLANT DESIGN UTILIZING OFFSHORE WIND FARM ELECTROLYSIS AND ETHANOL PLANT EMISSIONS

The purpose of our project was to preliminarily design a power-to-gas plant, which uses hydrogen produced from hydrolysis and a carbon dioxide source to produce synthetic methane. With the emergence of renewable energy, groups are able to produce hydrogen from water with wind, solar, and other renewable electricity sources. This is the motivation for our power-to-gas plant design. The new availability of renewable hydrogen drives the price of this resource down causing more interest in carbon capture, which converts hydrogen and CO_2 emissions to synthetic methane. This synthetic methane offer two advantages for energy storage. It is more energy dense than hydrogen, and it is more readily stored due to the large capacity of the natural gas grid. This method of energy storage is not without its costs though. Our design requires several reactors, and extensive separation equipment to produce a marketable product. Although we were able to successfully design an efficient plant to produce on-specification synthetic methane, we discovered this would not be a profitable endeavor. This is primarily due to the high cost to produce hydrogen and the relatively low selling price of natural gas. For this project to be profitable, hydrogen prices would need to decrease and/or natural gas prices would need to increase by considerable amounts.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to RIght) Aidan Bersche, Jack Banther, Kyle Nicholson, Cole Dixon

PROJECT TITLE

POWER TO GAS PLANT USING HYDROGEN

The team was tasked with assessing the economic feasibility of a Power-to-Gas plant using hydrogen produced from renewable energy. While determining this, all the high-consequence process safety risks must be managed, and a suitable CO_2 source must be selected that maximizes the economic and environmental performance for the methanization reaction and delivers on-specification CO_2 as a feedstock for the methanization reaction. In addition to these objectives, the delivery of the natural gas following the methanization reaction must be on-specification to ensure that it can be used in the current delivery system.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

(Left to RIght) Top row: Nathan Franklin, Zach Engelken
Bottom Row: Finn Poling, Taylor Foster

PROJECT TITLE

RENEWABLE ENERGY AS NATURAL GAS STORAGE

The project, given by the American Institute of Chemical Engineers, involves a power-to-gas system in which carbon and hydrogen are converted into methane and stored as a form of sustainable renewable energy. The project consisted of selecting a viable carbon capture source, designing methanation units for producing the methane, finding ways to store the methane gas, and analyzing the economic and safety aspects of the project as a whole.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to RIght) Brinkli Abbitt, Duncan Ille, Mejalaa Mega Jayaseelan, Kayla Pham

PROJECT TITLE

SILLY LI'L GUYS

The American Institute of Chemical Engineers has requested a design for a Power-to-Gas (PtG) plant to better utilize renewable energy. In different renewable energy plants, excess energy is difficult to store, and one method for storage is to perform electrolysis on water, creating oxygen and hydrogen gas. A PtG plant then takes the hydrogen gas and reacts it with carbon dioxide in order to generate methane, producing synthetic natural gas. A process was designed to meet this request, with design, economics, safety, and environmental conditions taken into consideration. The carbon capture source utilized was beef cattle manure, using manure and an anaerobic digestion system to extract carbon dioxide and additional methane. After the reaction, a glycol separation system was used to dehydrate the synthetic natural gas in order to meet the provided project specifications and existing gathering pipeline specifications. Gray County, Texas, was chosen as the location due to its large cattle population, intersection of natural gas pipelines, and high wind energy usage. The selection of beef cattle manure as a carbon source was due to its high carbon dioxide throughput, and other economic advantages. The practice of inherent safety principles was heavily exercised throughout the design process. Wherever possible, operating conditions were made less severe, and process vessels were downsized and simplified. All chemicals, equipment, and process conditions used were analyzed for both human and environmental risk factors. Additionally, safety relief devices and controls systems were designed to mitigate upsets and failures and lower the risk of the process. The breakeven price for the synthetic natural gas to be sold was estimated at $24 per MMBtu, which is approximately three-and-a-half times higher than the current market price. The risk involved with this elevated cost must be considered alongside the benefits of the amount of green hydrogen throughput and CO_2 equivalents captured. Trends show that the price of green hydrogen is decreasing, so the manufacturing cost of the process should lower as time goes on. The capital cost estimate is for all equipment, as well as an initial cost for purchasing land and building any necessary facilities. Overall, the design team recommends moving forward with further research and implementation of the PtG system, due to its positive environmental implications and improving economic outlook.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to RIght) Sophia De Luca, Thomas Harris, Spencer Farthing, Megan Lyman

Design Report

PROJECT TITLE

SUSTAINABLE POWER-TO-GAS SYSTEM DESIGN

The purpose of this project is to design and do an economic analysis of converting carbon dioxide to usable methane fuel in a power-to-gas plant.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to RIght) Charlie Cragar, Ebraheem Faraj, Mahdi Ahlabeeb, Mohammed Alkandari

CHE

PROJECT TITLE

SUSTAINABLE POWER-TO-GAS SYSTEM DESIGN

Due to the inevitable increase in renewable energy implementation, excess energy generated through renewables will be lost without the proper storage methods. To recover this excess energy, a sustainable power-to-gas plant was designed, integrating excess renewable energy storage with environmentally responsible carbon dioxide capture. A packed bed methanation reactor with a subsequent triethylene glycol dehydration system was designed. An economic analysis revealed a net present value of $395 million with attractive annual revenue recovery of $85 million. Safety was incorporated into the design, with a HAZOP, P&ID, TNT equivalency, and pressure relief calculations included. Environmental responsibility was also considered, with a determination of carbon dioxide source for feed and calculations of carbon dioxide emissions from this plant.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to RIght) Ellison Denoso, Quinn Stretcher, Johnathon Kemp, and Tyme Taylor

PROJECT TITLE

SUSTAINABLE POWER-TO-GAS SYSTEM DESIGN INTEGRATING RENEWABLE ENERGY STORAGE AND ENVIRONMENTAL RESPONSIBILITY

Power-to-gas exists as a potential solution to the difficulties encountered when storing and utilizing excess renewable energy. In order to evaluate the economic viability of a power-to-gas system as tasked by AIChE, a methanation reactor, purification skid, and storage system were designed. The proposed design utilizes carbon dioxide captured from ammonia production that is processed in combination with hydrogen from renewably powered electrolysis units. The design was constructed with an emphasis on inherent safety principles and overall process safety through simplification of design, proper pressure relief, and minimization of hazardous storage. A Piping and Instrumentation Diagram of the reactors and cooling loop provides a detailed control strategy and accompanies a Process Flow Diagram of the entire process. A discussion of potential ways to make the system economically attractive, including the potential for location dependence and government subsidies, was explored.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey, Saeed Manouchehri, Songpei Xie

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to right) Adonis Gardner, George Sheaff, Lauren Bergman, Dylan Nanney

PROJECT TITLE

SUSTAINABLE POWER-TO-GAS SYSTEM DESIGN: INTEGRATING RENEWABLE ENERGY STORAGE

In response to the unpredictable nature of renewable energy production rates, and the growing demand worldwide for energy from renewable sources, a need is growing for the ability to store renewable energy in the long term. One proposed solution is the Power-to-Gas storage model, which supplements existing power infrastructure. In this model, CO_2 reacts with H_2 produced with renewable energy electrolysis, and forms methane. Methane acts as the energy storage device, as it can be used in the existing power grid. The design produced uses captured CO_2 from coal boiler flue gas, due to its low cost and high concentration. The Power-To-Gas process then consists of three main parts: the methanation reaction, separation of methane from water and impurities, and the compression of the dry methane in preparation for storage. A complete economic analysis has been performed, with startup beginning in 2023 and construction beginning in 2022. In addition, the necessary process safety information, emissions calculations, and all process equipment information have been described in detail. The model proved to have a very positive effect on carbon emmissions, and is an effective means to store energy for an existing renewable energy project; however, required capital investment, fixed, and variable operating costs are extremely high.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to right) Salem Mubarak, Margaux Lavenue, Hamdan Alghamdi, Basel Aldhahri

PROJECT TITLE

THE DAWGS

The Methanation reaction used in this process was first discovered in 1902 by Sabatier and Senderens. The reaction can be performed at 250-600°C and carried over various metal catalysts. Nickel is typically used due to its high selectivity and low cost. As figure 1 details, the reaction requires a COx and an H_2 source. The carbon will be sourced from Labadie coal plant, as they have one of the highest emissions records in the US. Hydrogen will be sourced through the electrolysis of water. One product includes H_2O, which must be subsequently removed in order to purify the methane product. This removal is performed using Triethylene Glycol (TEG) in a trayed absorption column. Lastly, trace impurities such as H_2, CO_2, and CO will be filtered from the methane product stream via molecular sieve adsorption. The pure methane product will then be stored until it is needed by consumers. Assuming an annual hurdle rate of 15%, the formation of methane by this plant is expected to have a Net Present Value of -$121,000,000 with a Discounted Cash Flow Rate of Return of -193%. Based on economics alone, this project does not seem attractive. However, with research invested in optimizing the methanation reaction, this project may potentially be attractive at smaller scales and with emerging technology. As of now, the team recommends it as a service producing project.

ADVISOR(S)

Dr. Clint Aichele, Dr. Josh Ramsey

SPONSOR(S)

AIChE
The Global Home of Chemical Engineers

(Left to RIght) Jose Chavez, Kole Fredrick, Gerald DeRogers, and Alex Miller

CIVIL & ENVIRONMENTAL ENGINEERING

PROJECT TITLE

CITY OF EDMOND ROUNDABOUT DESIGN

The project that OK Legacy Design is working on is an intersection between Covell and Western in the City of Edmond. This area of Edmond has seen an increase in traffic and the current 4-way stop configuration is not adequate for the amount of cars that it sees on a daily basis. The City of Edmond has communicated with us that they are looking for an alternative to the current configuration. Our senior design team has then looked into three potential alternatives: signilized intersection, roundabout, and turbo roudabout. After potential traffic analysis was conducted, the team decided a traditional roundabout will be the most efficient and cost effective option for this intersection. The team has prepared a design for the roundabout intersection in this location.

ADVISOR(S)

Brian Hiney

(Left to RIght) Raphael Wall, Carson Fulton, Nathaniel Bradford, Timothy Bradford

CIVE

PROJECT TITLE

CITY OF PERKINS FLOOD MITIGATION DESIGN

The City of Perkins, Oklahoma, has faced a serious flooding issue on the site of a recent residential development. After experiencing a heavy rain event, the drainage structures in place fail to drain, resulting in standing water up to 15 inches deep, topping the curb, and causing issues for members of the community. This issue may be further complicated due to the uncertainty of the current elevations on site. The City of Perkins has asked MAV Design to create a plan to make these drainages structures function properly and a budget to accomplish this goal.

ADVISOR(S)

Dr. Norb Delatte, Dr. Gregory Wilber

(Left to RIght) America Rangel-Valero, Marisol Aranda, Gabriel Miller

PROJECT TITLE

CITY OF STILLWATER: "RAIL TO TRAIL" PEDESTRIAN CROSSING 6TH AVE/HWY 51 DESIGN

CIVE

The Kameoka Trail is an important part of Stillwater history and culture. However, the new phenomenon known as Rail-to-Trail has taken over to expand this trail and connect more parts of Stillwater for pedestrians to be able to use. However, the problem of pedestrian safety still stands when crossing highways and busy roads around town. The City of Stillwater was awarded a $1.2 million grant by ODOT alternative transportation to install the first mile of trail through the unused rail corridor in town that goes from Lakeview to McElroy. With this expansion another problem arises with pedestrians crossing busy intersections and roads like Highway 51/6th Avenue. The need for a pedestrian crossing there is crucial for the health and safety of the people who want to occupy this trail all over Stillwater. The crossing can go over or under the highway but must allow people to be able to cross in a safe manner. This would take place on Highway 51/6th Avenue over the railroad tracks that are already present, but not currently in use. This is also sitting next to the old mill that is still currently functioning. The overall goal of this design is to be able to provide safe and efficient walking paths and crossings for the people of Stillwater while maintaining the nature and history of the town culture.

(Left to Right) Josh Cowing, Jack McAdams, Ricky Wilson, and Morgan Bynum

Project Video

ADVISOR(S)

Dr. Norb Delatte, Dr. Gregory Wilber

SPONSOR(S) **Brady Moore:**
Deputy City Manager

Travis Small:
Engineering Manager, Transportation & Drainage

PROJECT TITLE

NORTHERN OKLAHOMA COLLEGE DRAINAGE DESIGN

CIVE

The Northern Oklahoma College-Enid campus has a 3-acre pond on campus that captures runoff from a 185-acre drainage area, as determined from a USGS Stream Stats generated report. The drainage area is urban and includes much of NOC's campus and surrounding neighborhoods. Historic photographs depict that the pond was once home to a slide and swimming recreational area, small boat house to accommodate rowing, and green space that students and the community frequented; however, that infrastructure no longer exists and the area, despite being the most open area on NOC-Enid's campus, is underutilized. There is no longer infrastructure in place to support recreation like swimming, rowing, or easily walking around the pond. Changes within the catchment area have led to failing conveyance infrastructure around the pond, significant erosion, and runoff pollution that has altered the water quality in the pond. The overarching goal of the project is to develop an infrastructure plan that will eventually provide a venue for students and the wider community to interact in an intentionally designed green space, promoting mental and physical wellness through outdoor recreation, and increase environmental resiliency and sustainability of NOC-Enid's campus.

(Left to RIght)Samuel Ndiforchu, Daniel Lenox, David D'Arcy, Kenedi Davenport, Dr. Delatte

ADVISOR(S)

Dr. Jaime Schussler, Nisha Bhatta

PROJECT TITLE

PERKINS WATER TOWER & LIFT STATION DESIGN

The Iowa Tribe of Oklahoma has planned to develop land in the City of Perkins, Oklahoma, for the construction of a large medical facility and other general use buildings. The City of Perkins, considering future developments on the west side of town, is expecting up to 30 acres of residential housing to be built. The Iowa Tribe of Oklahoma and the City of Perkins worked together to pay for the design and construction of a new water tower and a wastewater lift station to serve these new developments. Our team took on the task of designing both of these infrastructure projects to support the existing demands of Perkins as well as future demands.

ADVISOR(S)

Dr. Norb Delatte, Dr. Greg Wilber

SPONSOR(S)

CITY OF Perkins OKLAHOMA

IOWA TRIBE OF OKLAHOMA

(Left to Right) Dawson Mock, Chandler Beck, Abdulrahman Alameeri

CIVE

PROJECT TITLE

WATER COWBOYS: SUSTAINABLE FLOOD MITIGATION DESIGN

The City of Tahlequah's Mission Park is undergoing new development, including the addition of concrete sidewalks intended for pedestrian use. However, the introduction of these sidewalks has inadvertently led to increased flooding within the park, raising concerns among stakeholders. In response, a design project has been initiated with the objective of mitigating flooding using green infrastructure and environmentally friendly approaches. To address the flooding issue, retention cells and vegetation swales will be incorporated into Mission Park. These features are intended to reduce flooding by facilitating the infiltration of water into the ground, thus restoring the park's natural hydrological balance disrupted by the concrete pathways. Furthermore, it has been observed that the watershed draining into Mission Park exacerbates erosion and sedimentation issues, particularly around a culvert located in the southeast corner of the park. This culvert allows water to flow beneath a sidewalk path, following its natural course through the area. To address these concerns, an apron will be designed around the culvert's exit to mitigate future erosion and sedimentation problems. The overarching goal of these interventions is to decrease the velocity of water flow within Mission Park. By allowing more water to infiltrate the ground and addressing erosion around critical infrastructure like culverts, the design aims to slow down the movement of water through the park, thereby reducing the adverse impacts of flooding.

ADVISOR(S)

Dr. Jaime Schussler

SPONSOR(S)

TAHLEQUAH OKLAHOMA

Save The Illinois River

GRDA Grand River Dam Authority

(Left to Right) John Fox, Zack Zielinski, Michael Lopez, Allison Storment

PROJECT TITLE

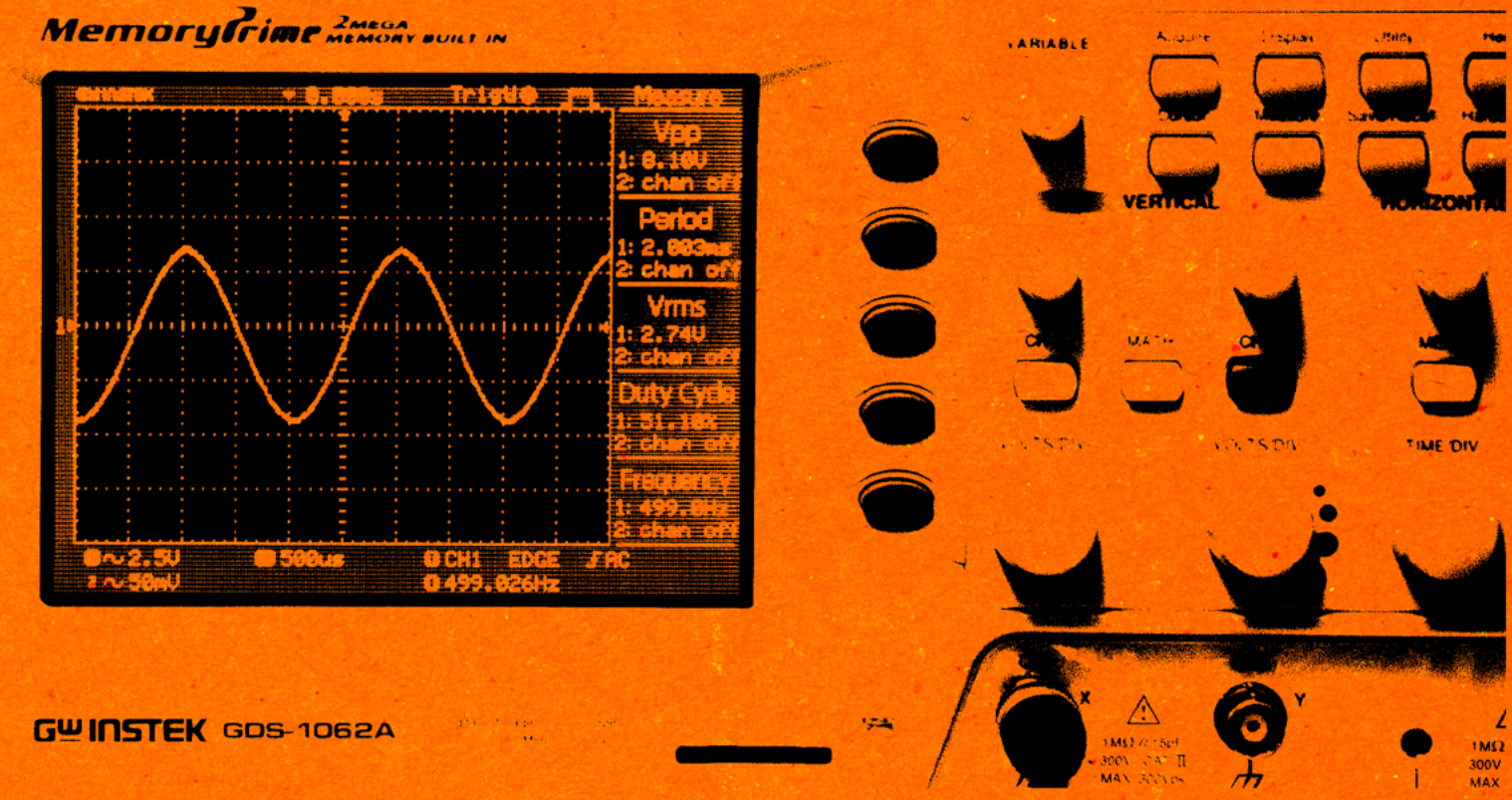
WERC IT DESIGN

This team is tasked with mitigating the impact of rain events on a disadvantaged community. The design chosen should additionally provide social, environmental, and economic benefits. For this task, the team chose the Washington school site in Stillwater, Oklahoma, a once thriving school and community center for many black residents in Stillwater. Since its closure, the school has been weathered and vandalized, leaving it unsafe for use. In partnership with the school's alumni association, the team has designed a combination of low impact stormwater mitigation designs that can benefit the community with other co-benefits. The team used a storm water management model program to compare suface runoff in different development scenarios. Since the site sits in a floodplain, total flood prevention is not attainable, and the team aimed to reduce the flooding from common storms. The team found that the scenario that implemented a bioretention cell, rain gardens, and permable pavement reduced runoff on site by 50%, as compared to current site conditions. While this design reduces runoff significantly, the implemetation of the design would increase the total cost of the current proposed design by 50%.

ADVISOR(S)

Dr. Norb Delatte, Dr. Mary Foltz, Dr. Jaime Schussler, Dr. Greg Wilber, Karen McGuire-Diemer, Maliha Tabassum

(Left to Right) Luke McKenzie, Carly Noone, Victoria Due, and Shelby Maggard



ELECTRICAL & COMPUTER ENGINEERING

PROJECT TITLE

AERIAL REFUELING GESTURE AND DETECTION

ECE

CymSTAR engineers develop and modify military flight simulators for the U.S. Air Force. Aerial refueling is a task that is trained and exercised in these flight simulators. But one portion of the aerial refueling task that is not currently implemented is allowing the receiver pilot to use hand signals to communicate how much fuel is requested. This will make us design a product that consists of hardware and software which can detect and decipher hand signal for the amount of the fuel requested.

ADVISOR(S)

Prof. Nate Lannan

SPONSOR(S)

CymSTAR

(Left to RIght) Mohammad Alkharaz, Madeleine Steele, Jax Jeffries, Chasen Clements

Project Video

PROJECT TITLE

BIO-INSPIRED GUITARIST

ECE

The Bio-inspired Guitarist is a project aimed at creating a low-cost wearable prosthetic device that allows individuals that have experienced the loss of a limb to play an unmodified standard guitar. Currently, the project is in the stages of software development, to read sheet music into movement on a guitar.

ADVISOR(S)

Dr. Scott Mattison

(Left to Right) Aatir Cheema, Tony Mills, Cosette Byte, Thomas Kidd, Hashem Dashti

PROJECT TITLE

INTELLIGENT GROUND VEHICLE COMPETITION

This Senior Design project's goal is to qualify and compete in the annual Intelligent Ground Vehicle Competition. The competition consists of several different challenges including left/right turns, stopping at a stop sign, changing lanes, avoiding obstacles, and various parking situations. This semester our team's efforts have been developing a stop sign detection program using artificial intelligence, enhancing the existing object avoidance system to fix existing issues from previous semesters, adding lanes into the mapping software, and fixing the Drive-By-Wire system so that the golf cart is able to be controlled with a remote controller.

ADVISOR(S)

Dr. He Bai, Dr. Rushikesh Kamalapurkar, Dr. Weihua Sheng, Diego Colón, Mahesh Pulagam

SPONSOR(S)

HYDRASTAR TRAILER BRAKING SYSTEMS

SILSBY MEDIA

phytools

Central Oklahoma Hose INDUSTRIAL SUPPLY DISTRIBUTOR

(Left to RIght) Top Row: Seth Baucum, Carson Sager, Alex Wilburn

Bottom Row: Scot Sigler, Gabe Ferguson, Gage Howard

ECE

PROJECT TITLE

MOBILE RECONFIGURABLE DC MAGNETICS FACILITY

Any sea-going metal-hulled ship or submarine will develop a magnetic signature while traveling. This magnetic signature can be exploited by specific equipment. As a countermeasure the U.S. Navy used a degaussing procedure to counteract the normal magnetic signature of a metallic ship. During the degaussing process, electronic components can be damaged. This project aims to make a fully functional and reconfigurable DC magnetic field, so that electronic components of any shape and size can be tested to ensure they will not fail when exposed to the degaussing process. The Mobile/Reconfigurable DC Magnetics Facility on startup will produce a uniform, and stable DC magnetic field of +-20 Oersteds throughout any given volume in at least 1 second.

ADVISOR(S)

Dr. Daqing (Daching) Piao

SPONSOR(S)

(Left to Right) Luke Taylor, Jon Risner, James Boudreaux, Lee Lor

PROJECT TITLE

MOON BOUNCE

The Moon Bounce project aims to design a radio system capable of making contact with people worldwide by bouncing a signal off of the moon. This is an amateur radio project that requires careful design and operational considerations to overcome key challenges in radio communication such as path loss, antenna design, and noise.

ADVISOR(S)

Dr. Chuck Bunting

(Left to RIght) Abdulrahman Alkandari, Daniel Huls, Derek Holloway, and Mason Adams

FIRE PROTECTION & SAFTEY ENGINEERING TECHNOLOGY

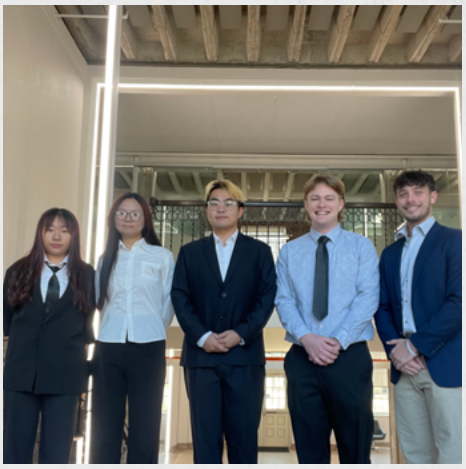
PROJECT TITLE

CASUAL ANALYSIS OF FIREFIGHTER LINE OF DUTY DEATHS

Firefighters are a vital entity to the safety and well-being of the community. Over the last 100 years, firefighter deaths decreased as technology and best practices improved. However, in the past 20 years, firefighter deaths have plateaued at around 100 deaths per year. In order to uncover ways to decrease these casualties, we must understand why these deaths happen. We will use grounded theory to get a better understanding of these deaths. Grounded theory presents the truth to a researcher through coding data points into similar groups. Our data comes from the years 2018 – 2022 in the NIOSH firefighter death counter. We will use Atlas.ti software to help us digitally code the data. Once the whole of the data is coded, it will portray trends in deaths of on duty firefighters. This information can then be presented to fire departments around the nation to help them better understand line of duty deaths. This understanding will pave the way for mitigative measures to be put in place to continue the decrease in firefighter fatalities.

ADVISOR(S)

Dr. Leslie Stockel



(Left to RIght) Yaning Hou, Jennifer Liu, Qingxuan Zhang, Riley Carlin , Simon Landrum

FPSET

PROJECT TITLE

GUSSET PLATE 2

Every year, firefighters are killed due to structural collapse, while working residential structure fires. The use of gusset plates to construct wooden trusses is thought to be the leading culprit for the fatalities. The intent of this report is to illustrate the performance differences between unprotected gusset plate joints and gusset plate joints that had been given a form of protection. In order to show the effects, the team constructed and burned a wooden structure that was constructed with five test specimen to observe. The structure was equipped with thermocouples, video recording cameras, and heat flux recording devices. The team used time and temperature readings to prove the difference in performance while the heat flux recording device provided insight into the environment of attic compartments during residential structure fires. At the completion of the experiment, the data was compared to show which truss performs the best.

ADVISOR(S)

Dr. Haejun Park, Michael Kubicki

(Left to RIght) Top row: Haejun Park PhD, Jingyi Bai, Yifan Wu, Tianshuo Zheng, Jacob Morales, Shuda Wang, Hunter Schadler, Michael Kubicki

Bottom row: left to right: Luke Mohr, Ty Boone, Cody Taylor, Brett Arbuckle, Zhengshen Bai

PROJECT TITLE

MEASURING TEMPERATURE DEPENDENCE OF THE GENERATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN FIRE USING A NOVEL PASSIVE DOSIMETRY TECHNIQUE

Polycyclic Aromatic Hydrocarbons (PAHs) are the byproduct of incomplete combustion and carcinogenic. Firefighters are heavily exposed to PAHs when they go into live fires due to the PAHs passively diffusing into the firefighter's skin. PAHs passively diffuse into silicone in a similar manner. This study aims to determine if silicone wristbands can be used as a passive dosimetry device to collect PAHs and other bioavailable chemicals in a short-exposure time (which would be similar to a firefighter's exposure time). Another aim of this study is to determine how PAHs concentrations are correlated with temperature and distance from the fire. The silicone wristbands used in this experiment were placed inside OSU Fire Service Training's Advanced Fire Behavior box at multiple locations and heights. By analyzing the concentration of PAHs in the silicone wristbands and comparing them to the location of the wristbands it can be determined where PAHs is most heavily concentrated in a room/building; this information can be used by firefighters to increase their safety and the safety of the people they protect. This experiment will also determine the validity of using silicone as a passive dosimetry device in short, high intensity fires, allowing for this method to be used for future PAHs concentration studies.

ADVISOR(S)

Dr. Rob Agnew

(Left to RIght) Cody Bayer, Carson Moler, Ilona Klecka

FPSET

PROJECT TITLE

REAL LIFE MOVEMENT SPEED

Walking on stairs is a normal thing in our daily life. The shape of stairs crucially affects people's movement speed during emergency evacuations. In 1995 (UK), 230,000 injuries and 497 deaths resulted from falls on stairs. To minimize the occurrence of such accidents, previous research used a formula to predict movement speed with an unproved coefficient which is not accurate enough. Therefore, this study aims to find the relationship between riser height, tread depth and movement speed. Experiments are conducted on six different existing stairs with persons descending the stairs. After data processing and graph drawing, the relationship between moving speed and stair geometry can be seen. If the relationship is obvious, an equation will be derived using MATLAB software. The results and methodology can be utilized in stair design and provide guidance or serve as a reference in future research.

ADVISOR(S)

Dr. Diana Rodriguez Coca, Dr. Bryan Hoskins

(Left to RIght) Qihao Li, Junjie He, Siting Chen, Yifei Zhu, Haojun Xu, Yuhao Lin, Cindy Li, Kevin Chen

PROJECT TITLE

VIRTUAL REALITY MOVEMENT SPEED PROJECT

The subject of this study is to compare the measured evacuation speeds of people in VR device with the consulted literature review speeds range and to draw valuable conclusions. This research marks a groundbreaking initiative in the domain of emergency evacuation, as it pioneers the application of VR technology to measure evacuation speed, offering enhanced safety and convenience. This novel approach effectively fills a significant void in the existing literature, as traditional methods often require more time, labor, and material resources. This study aimed to address the problem by enlisting volunteers, dividing them into pre-experimental and experimental groups, using two VR devices to measure their speeds, and comparing the results with established benchmarks. This comprehensive approach not only checks to see if VR is a good tool to estimate the real-world evacuation speeds but also serves as a foundation for optimizing escape routes, guiding individuals towards safe exits, and devising tailored evacuation strategies. The ultimate goal is to guarantee that people can successfully evacuate from a building within a limited time frame during emergency situations, thus enhancing overall safety and preparedness.

ADVISOR(S)

Dr. Diana Rodriguez Coca, Luis Felipe Carreño Urquijo

(Left to RIght) Xudong Dai, Linjian Wei, Linze Li, Yanxu Shi, Shaoyang Zheng

INDUSTRIAL ENGINEERING & MANAGEMENT

PROJECT TITLE

ENGINEERING EXTENSION PROCEDURE ANALYSIS

The project outlines an investigation into the hiring and compensation processes of the Engineering Extension, a professional services organization within the university's College of Engineering, Architecture and Technology. The project's goal is to identify bottlenecks and inefficiencies in the current procedures adhered to by Engineering Extension, particularly those related to HR policies and practices that impact the organization's ability to compete effectively and operate efficiently. Through a comprehensive analysis that includes HR processes and salary compensation, the current position of the company is that due to an inefficient hiring process and uncompetitive pay, they are less competitive as a business operation. These findings will influence the recommendations given to Engineering Extension.

ADVISOR(S)

Dr. Joseph Nuamah

(Left to RIght) Lindsay Sanford, Madison Wilson and Banner Penwell

PROJECT TITLE

MODELING ARCBEST'S CROSS DOCKING TIME

ArcBest is a 4.4 billion dollar integrated logistics company. ArcBest's largest subsidiary, ABF Freight, is a less-than-truckload carrier with a network of over 240 service centers located throughout the nation. One of the largest cost drivers for ABF Freight is dock operations, which account for roughly 18% of their revenue. To refine their cost allocation model, the ArcBest Costing and Profitability team leveraged newly available data on actual cross-docking times from select service centers. The Senior Design Team (SDT) was tasked with analyzing this data to construct a new model that estimated cross-docking time, serving as the basis for dock cost allocation. This improved model provided ArcBest with a more accurate understanding of shipment costs, enabling more informed pricing decisions and ultimately, enhancing profitability. The SDT created models to analyze the data, utilizing RStudio and Python. After multiple models were evaluated and validated and significant drivers were determined, the team presented a reliable model/equation to approximate cross-docking times.

ADVISOR(S)

Dr. Chenang Liu

(Left to Right) Austin Sawyer, Drew Munson, Ananya Singh and Hannah Hazelip

PROJECT TITLE

PACK AND SHIP IMPROVEMENT FOR EXCEL3PL

Excel3PL is a third party logisitics company that ships products for eCommerce companies through online services located in Tulsa, Oklahoma. The team plans to improve the effectiveness and efficiency of the packing station, and if time allows, develop a flexible storage system.

ADVISOR(S)

Dr. Akash Deep

(Left to RIght) Josh Linholm, Landon Lucas, Brenna Rodgers

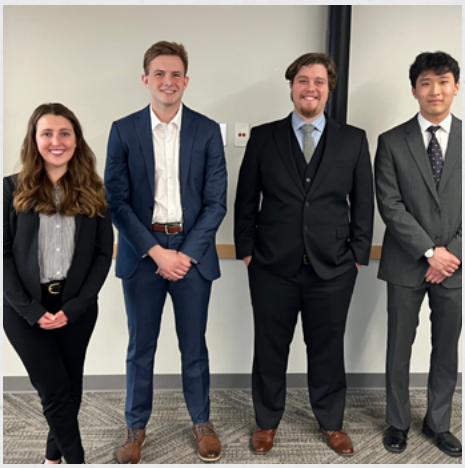
PROJECT TITLE

REVITALIZING MPOWER AND BOOSTING REVENUE

Our senior design team has the privilege of working with the nonprofit organization, MPower, this semester. MPower serves adults with developmental disabilities (who they refer to as clients) through residential services, an adult day center, and vocational services. MPower has asked us to focus most of our efforts on the vocational services, which is where they provide employment for their clients. They receive funding from the Oklahoma Department of Human Services, Payne County United Way, and local thrift store Elite Repeat. After visiting their site and speaking at length with the directors of MPower, we decided to focus our efforts where we think we can make the biggest difference. We want to help them restructure their contract pricing and increase their brand visibility. MPower establishes contracts with government entities and private businesses for the work their clients do. We are going to perform an economic analysis and provide MPower with a pricing formula template (in the form of an Excel sheet) for them to use as a tool when determining how much to charge for their work. A few other issues we observed were lack of work, donors, and overall visibility. We think the root of these issues are due to low brand awareness. We decided to form a marketing plan for MPower and provide them with a new website prototype to boost their outreach and connect them with large donors to provide funding and large companies to provide work.

ADVISOR(S)

Dr. Pratima Saravanan



(Left to Right) : Bella Baker, Zac Hall, Austin Kirk, and Hwanee Hwang

PROJECT TITLE

STORAGE LAYOUT IMPROVEMENT FOR WEBCO TULSA DISTRIBUTION FACILITY

Webco Industries is a leading manufacturer and distributor of steel tubing. Webco's North Tulsa distribution center is seeking a static standardized storage layout design and material handling policy that maintains safety regulations and accessibility, while eliminating the requirement to purchase of a $6-8 million fall protection system. Material handlers currently have difficulty locating tubing, as it might be stored in multiple locations on the distribution center floor. Vertical storage and work access heights also contribute to an inefficient storage system and facility operators are regularly concerned with maintaining safety compliance. Systematic Layout Planning and ABC analysis are employed in developing a more effective and safe storage layout.

ADVISOR(S)

Dr. Manjunath Kamath

(Left to RIght) Savannah Blasi, Erik Inman, Peyton Dayer and Jacob O'Hara

INTERDISCIPLINARY

PROJECT TITLE

AUTONOMOUS FIREFIGHTING VEHICLE PROJECT

The Autonomous Firefighting Vehicle (AFV) has multiple objectives in order for it to meet its goals. First, the AFV must locate the fire. Second, the AFV must create a pathway to the fire, while avoiding buildings, and move along a pathway to the fire that it plans itself. Third, the AFV must approach the fire and be a certain distance from it before dispensing its foam fire retardant. Fourth, the AFV must then safely return to the home position it started at, again avoiding all obstacles. The vehicle must do all of this autonomously. The primary location for the AFV is at airports.

The Rural Autonomous Firefighting Vehicle (RAFV) has a similar frame as the Airport AFV but with rural firefighting in mind. The RAFV is designed to use the Pixhawk controller from the previous AFV Design and use that Pixhawk to fight fires in a rural setting. The RAFV is currently being built and testing should begin after a safety inspection.

ADVISOR(S)

Dr. Rob Agnew, Dr. Joe Conner, Dr. Gary Yen, Prof. Laura Southard

EET | MET | ECE

(Left to Right) Front Row: Zac Bland, Landin Olandese, Alex Maier

Back Row: Zach Wilson, Hudson Caughlin, Jakub Ciechowicz

Not Pictured: Steven Howell, Jager Pifer

Trailer

Project Video

Project Video

Project Video

PROJECT TITLE

BLOOKOOZ INC.

BlooKooz Inc. is tackling a relatable issue: the long wait for a cold drink during our busiest times. This inconvenience is not limited to college students juggling school and work or professionals caught in a cycle of meetings - it affects everyone, regardless of their situation, who is in need of a quick refreshment. Our solution is a prototype for rapid beverage cooling, promising immediate satisfaction. This semester, we're leveraging our mechanical and electrical engineering backgrounds to lay the groundwork for our prototype. By validating the 'proof of concept,' we will assess the product's feasibility for eventual market readiness, a pivotal step toward our broader mission. With these commitments, BlooKooz Inc. dedicates itself to revolutionizing beverage enjoyment, prioritizing convenience and efficiency for our fast-paced lives.

ADVISOR(S)

Dr. Craig Bradshaw, Joel Quarnstrom

MAE | ECE

(Left to Right) Keenan Holsapple, James Hinds, Colton Peery, Chandler Saxon, Kaitlin Kavalec

Project Trailer

PROJECT TITLE

CYCLONE COWBOYS

ECE | EET | MET | MAE

We are the DOE Wind Competition Team here at Oklahoma State University. The Cyclone Cowboys was established in August 2022. In its first year of existence, a team of 18 students from 7 different majors took 11th place out of 30 teams at the May 2023 DOE competition in Boulder, CO. As a team this semester we are designing, building, and testing a prototype wind turbine that is capable of withstanding continuous winds up to 50 mph; building a wind tunnel for testing and development of the wind turbine; and conduct outreach with the wind industry and the local community.

ADVISOR(S)

Prof. Nate Lannan, Diego Colón

SPONSOR(S)

(Left to Right) Top row: Jace Stanley, Jacob Ikeda, Jack Chamberlain, Julian Seida

Middle row: Ian Thomas, Jerryme Mitchell, Ryan Stracener

Bottom row: Max VanAtta, Crew Shortt, Blake Smith, Seraphin Faton, Lizette Nunez

Linktree

PROJECT TITLE

ECOFFICIENT HOME

MAE | ECE | EET | MET

Ecofficient Home presents a zero-energy hydronic heating and cooling system for a tiny house that uses thermal energy storage technology. The idea is to take the energy collected from solar panels and convert it to thermal energy using the system, which is then stored in the thermal storage tank. This thermal energy can then be discharged throughout the house whenever needed. This design will eventually be installed in a mobile tiny house which can be used as a tool to show off the capabilities of the College of Engineering, Architecture, and Technology, and the Center of Integrated Building Systems to future students.

ADVISOR(S)

Dr. Craig Bradshaw, Dr. Jeffrey Spitler, Prof. Ellis Nuckolls, Gabriel Parker, Meesam Raza

SPONSOR(S)

(Left to Right) Kameron Eleftherakis, Matt Palmer, Luke McComb, Hayden Steuart, Thong Phan, Jackson Wilson, Mikey Kane, Greg Lew, Colby Thompson, Sam Many

Project Trailer

PROJECT TITLE

HEATWAVE

The main purpose of this project is to build a moving heat flux generator that simulates actual fire conditions. There has been some debate on whether soot insulates or increases the heat transfer to gusset plates within a household truss in the real world. Currently, there is no way to test the strength of the gusset and truss while heat flux is being applied to it. This project creates a method for heat flux to be applied during a sample test through the heat flux generator. The heat flux generator we are creating consists of two radiant panels to concentrate heat, a propane tank as a power supply, and a Raspberry Pi to control the electrical components and measure data. The heater panel setup moves back and forth on linear rails in the horizontal direction to increase and decrease heat flux. A stepper motor is used to control the horizontal motion and provide the correct separation distance between the test sample and the radiant panel. A foot pedal is used to control the vertical motion of the heater panel setup. With the completion of our prototype, heat flux will be applied to a truss undergoing a structural load test from a machine at Bert Cooper Labs. Typically, this load machine allows for measurements to be made on a test sample undergoing various tension, bending, and compression forces. However, now, it can continue to record these measurements but with the newfound introduction of heating conditions that reflect actual fire values being generated from our prototype.

ADVISOR(S)

Dr. Haejun Park

MAE | FPSET

(Left to Right) Ashley Welch, Nate Wickham, Mason Dobbs

Not Pictured: Brookelyn Conner, Kade Bodily

Project Trailer

PROJECT TITLE

IEEE ROBOTICS

Our project is to design a small autonomous robot for the IEEE student robotics competition. The competitions ruleset lays out several challenges: designing a system to utilize inductive charging, super capacitor energy storage, low power motor and system efficacies, autonomous sensor based navigation, and dynamic obstacle avoidance. Mechanical design limitations included are pressing a button mounted at 6 inches off the ground and supporting the charging coil at that same height as well as supporting all other components.

ADVISOR(S)

Dr. John Hu, Deigo Colón

SPONSOR(S)

CENTER FOR INTEGRATED BUILDING SYSTEMS
College of Engineering, Architecture and Technology

MAE | ECE

(Left to Right) Isaac Devlin, Kevin Thomas, Hunter Green, Emma Cooley, Benjamin McGee

Project Trailer

PROJECT TITLE

OCEAN MOTION

MAE | ECE

The Ocean Motion team is enhancing the ability to test and validate Uncrewed Aerial Systems (UAS) takeoff and landing capabilities on ocean-based raft vehicles. The Ocean Motion platform consists of dual-scissor lifts and operates in coordination with an existing test platform (NOTUS hexapod) to increase the overall heave displacement, resulting in a system-of-systems that is capable of mimicking and simulating realistic deep-sea environments.

ADVISOR(S)

Dr. Alyssa Avery

SPONSOR(S)

Lawrence Livermore National Laboratory

(Left to Right) Molik Reyes Lamorell, Luke Hilton, Trevor Mills, Logan Nipper, Christopher Hale, Jarret Crump

Not shown: Cassandra Hardin, Cole Petrich

Project Trailer

PROJECT TITLE

OKSAT (OKLAHOMA CUBESAT INITIATIVE)

MAE | ECE

This design project focuses on creating a 3U CubeSat with an optical receiver payload for new-age, space laser communications. The satellite aims to revolutionize communication in space by fitting a fully functional optical receiver in a "1U" (10cm) cube. As Oklahoma's first collegiate space mission, this mission is an essential step in making optical communications a more affordable and accessible technology in the rapidly growing small sat industry. This semester's work focuses on the development and integration of key sub-systems, as well as proof of concept of the compact optical system through both simulation and hands-on lab experiments. Other key considerations include power dynamics, orbital mechanics, and thermal management; while addressing challenges related to altitude control, orbit stability, and data uplink strategies. Mission success holds potential for significant advancements in optical communications systems, as well as putting the Oklahoma State Cowboys in space.

ADVISOR(S)

Dr. John O'Hara

SPONSOR(S)

Ansys

(Left to Right) Logan Larsh, Jacob Kay, Jacob Minick, Shawn Bejcek, Tyler Graham

Project Trailer

Online Presentation

PROJECT TITLE

ORANGE VISION

The goal of this project is to design and construct a 360-degree omnidirectional virtual reality (VR) deck that can be used for training, design analysis, and prototyping across multiple industries. An omnidirectional virtual reality deck is a platform in which users can safely, physically move in real time while using virtual reality. Essentially, the user's physical motion is translated into virtual motion while the user is kept in place by the platform. Our device allows users to be able to physically and fluidly walk in any single-plane direction and spin without issues. When using a standard display system for virtual environments, the processor involved is the PC running the virtual environment itself. Along with the PC, the controls in a standard display include the user, mouse, keyboard, and other peripherals. Finally, the output of a standard display is shown on the monitor. For our VR display, the processor is not only the PC running the virtual environment, but also the Arduino microprocessor that communicates with the virtual environment. Our system replaces the peripheral controls with the platform and tracking sensors. Finally, the display of the VR system is the display within the VR headset itself.

ADVISOR(S)

Dr. Pejman Ghasemzadeh, Dr. Jerome Hausselle

MAE | ECE

(Left to Right) Jacob Christian, Madison Eulberg, Kaylee Rolph, Jackson Caves, Pruitt Durham, Korben Cook, Jose Perez

Project Trailer

PROJECT TITLE

RATO (ROCKET-ASSISTED-TAKE-OFF) SYSTEM FOR UNMANNED SPORTJET

This paper presents the design, fabrication, and results from a Rocket-Assisted-Take-Off System for an Unmanned High-Speed aircraft. Some key requirements of the system are to reach 150 mph at rocket burnout, a 10-degree flightpath, no greater than 20-degree launch angle on the rail, RATO, a pitot static instrumentation system, and an incorpation of the stability augmentation system of the aircraft. To design the system, the following will be need to be tested and fabricated: the bracket, the rockets, the retention system to hold the bracket to the rail, and a recovery system. The rockets will be tested to find their burn time, average thrust, and peak thrust. The bracket will be tested to verify if it can hold the load the the rockets will be placing against it. The recovery system will be tested to verify that the parachute will open before the bracket hits the ground. The rockets wil need to burn for 1.5 seconds for an average thrust of 120 lbs. A mass-simulated launch with the mass of the aircraft on the bracket to verify the launch procedure before a full fight with the unmanned sport jet is tested.

ADVISOR(S)

Dr. Kurt Rouser, Caleb Besmer

MAE | MET

(Left to Right) Jackson Blessington, Trevor Lindsey, Nic Cianfrone, Brenden Darcy, Mitchell Murray, Carson McLain, Zach Williams

Project Presentation

PROJECT TITLE

REINVENTING THE WHEEL

ECE | EET | MAE

We are developing an economically viable and reproducible carbon fiber race wheel and tire monitoring system with the capability to show real-time accurate tire pressure and external tire temperature. The system will be adaptable to existing and future FSAE vehicles. Carbon fiber allows for the reduction of weight especially due to rotating masses. The data logged by the monitoring system will increase performance measures as well as validation to assist with the dynamic changes in the tire pressure and temperature. The electronics components in the vehicle are set up to have little to no modifications in the design and structure of the wheel.

ADVISOR(S)

Dr. Dan Fisher

(Left to Right) Tyson Wiens, Logan Brewer, Sherri Lovett, Jasmine Taplin, Holden Kennedy, Marcus Evans. Brendan Hill

Project Trailer

PROJECT TITLE

SOFT BOTS

MAE | ECE

The project aims to construct a tethered soft robot capable of locomotion through pneumatic actuators. The team will fabricate a series of identical robots based on the design developed in this project to introduce middle and high school students to soft robotics, demonstrating its capabilities and limitations. The current team will investigate the power of the pneumatic actuator and the impact of ground friction on the robot's movement. The sequence of activating the soft actuators will control the robot's movement.

ADVISOR(S)

Dr. Aurelie Azoug, Prof. Laura Southard

(Left to Right) Jalon Tiger, Brennon Clem, Alek Nino, Matt Lor

Project Trailer

PROJECT TITLE

SUPER SERVOS

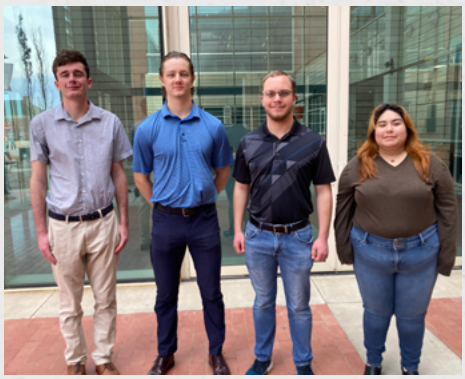
Small throttle cable aircraft servo, must be ultra-fine PID closed loop control to actuate a cable 3.1" of travel. Must output at least 4lbs of force.

ADVISOR(S)

Dr. Aaron Alexander, Dr. Ron Delahoussaye, Prof. Laura Southard, Steve Eddy

SPONSOR(S)

TEXTRON AVIATION



(Left to Right) Matt Cromer, John Seals, Blake Jones, Melanie Freeman-Vivanco

Project Trailer

PROJECT TITLE

TEAM ROBO<>CHILLES

Our senior design team took on the challenging goal of creating a customized limb prototype that can travel at three miles per hour. To provide accurate motion control, this complex project entails building integrated motors and an electronic control system that are enhanced with integrated sensors. Our design aims for smooth movement using three joints: the hip, shoulder, and knee, each housing specially made motors optimized for torque and speed. Using real-time data from integrated sensors, the electronic control system will handle all functions, coordinating movements across joints. We will create a thorough testing procedure and simulate multiple scenarios to evaluate speed, accuracy, stability, and power consumption to validate our control scheme. We're dedicated to improving the leg's performance through iterative design cycles and thorough validation until we are satisfied with the results.

ADVISOR(S)

Dr. Qi Cheng, Dr. "Mike" Xiang, Joel Quarnstrom

SPONSOR(S)

OSU ZINK CENTER FOR COMPETITIVE INNOVATION
College of Engineering, Architecture and Technology

(Left to Right) Robert Owens III, Lloyd Sabino, Ryan Miller, Spencer Majma, Thong Nguyen, Leo Rojas

Project Trailer

PROJECT TITLE

TRACTOR BEAM

MET | MAE

According to the Department of Agriculture, the average age for farmers has increased from 56.3 years in 2012 to 57.5 in 2017. The population of farmers above 65 years of age has also increased by 12 percent. As this trend continues, many of these older farmers risk injury on a daily basis as they struggle with mobility issues when entering their tractor. The goal of the Tractor Beam project is to develop a low-cost lift that will assist limited mobility farmers to access their tractor cab easily and safely. The project is geared towards consumers who still have upward mobility and are not wheelchair bound. The Tractor Beam lift will be mounted directly to the tractor steps and allow consumers to easily enter and exit the tractor cab at their leisure.

(Left to Right) Arham Chowdhury, Henry Montague, Nathan Thomas, Charlie Fraser, Jeswin Thomas

Not Pictured: Walker Chavarria

ADVISOR(S)

Dr. Brad Rowland, Chip Palmer

Project Trailer

PROJECT TITLE

VIRTUAL CLIMATE SQUAD

MAE | CEHS*

** College of Education and Human Sciences*

"[Create] a combination of physical and virtual environments to study occupant behavior." -Dr. Hebatella Nazmy
The purpose of our project is to create an immersive environment, simulating thermal effects such as wind, humidity, and temperature to immerse the user of our pod into the virtual reality world they are experiencing. During the experience, the user will be housed in a small structure inside the pod, wearing a virtual reality headset. Beside the room, connected through ductwork, will be the plenum, a small area where the HVAC unit and humidification unit will be housed. Using the plenum and the equipment inside, we will be able to control the conditions inside the pod where the user is located. Outside the pod will be a substation, consisting of monitors and computers, where the conditions can be controlled according to the virtual reality environment. The goal of this pod is to enhance virtual reality experiences as well as monitor human experience as they interact with their environmental surroundings. This design can be relevant in fields such as building design, behavioral studies, creative design, and education. The end state of this project is to create a climate-controlled area and a substation that is safe, easy to operate, reliable, and fully functioning.

(Left to Right) Travis Hays, Chris Ruggeri, Nic Johnson, Owen Lassahn, Luke Randolph

Not Pictured: Merida Valentin-Mendez

ADVISOR(S)

Dr. Christian Bach, Dr. Hebatalla Nazmy

Project Trailer

Online Presentation

SPONSOR(S)

ASHRAE

PROJECT TITLE

WIRE SPOOL HANDLING

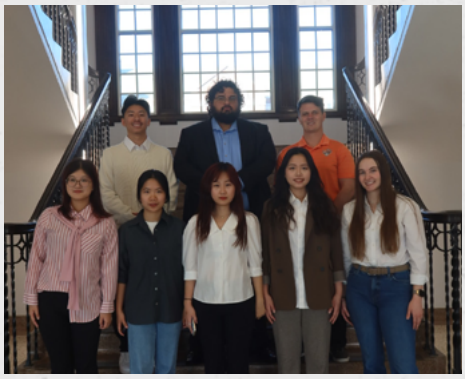
Our team has been focusing on the redesign of a cart utilized by National Standard. Despite the implementation of personal protective equipment and administrative controls, analysis of last year's worker injury data reveals the persistence of injuries among the workforce. In response, we've committed to an engineering control perspective, prioritizing risk control through an ergonomic risk assessment of the entire production line. This assessment identified the mule cart as the highest risk factor necessitating improvement. This redesign aims not only to enhance operational efficiency but also to significantly reduce the risk of worker injuries.

ADVISOR(S)

Dr. Rodriguez Coca, Laura Green, Levi Hazelton, Mike Mitchell

SPONSOR(S)

NS NATIONAL STANDARD



(Left to Right) Top Row: Nathan Her, Jose Bocanegra Yanez, Caleb Fiddler

Bottom row: Xinchi Zhang, Yunhe Chen, Fengyuan Guo, Jiayao Chen, Makayla Reed

MECHANICAL & AEROSPACE ENGINEERING

PROJECT TITLE

BEACON FOR A UNIVERSAL AND DEPLOYABLE INFLATED EXPLORATION SYSTEM

BUDIES is an inflatable tower that will include navigation and communication capabilities. The tower will use an RGB LED system, which will allow lunar instruments, such as rovers, to triangulate their position using a sensor. For astronauts, it gives them a landmark to determine where their location is. This technology is important since navigation and location systems are not currently available on the Moon, and BUDIES offer a cheaper, easier, and quicker alternative to GPS systems on the Moon. The tower will also include an antenna allowing communication to be broadened into the areas where the towers are. The inflatable tower requires little set-up and is low maintenance, therefore making the most efficient use of the user's time to establish a navigation network on the Moon. The tower will be in a collapsed state when first manufactured for easy compact storage during transportation. When inflated, the tower will stand at 14.7ft tall and 4.1ft wide. It has a tri-leg design to be as stable as possible while also minimizing mass.

ADVISOR(S)

Dr. Joseph Conner, Dr. Ben Loh

(Left to Right) Trevor Quinones, Landon Vogts, Paxton Sparks, Emma Gray, Hunter Joy, Hailey Wilkens, Kyle Austin

Project Trailer

MAE

PROJECT TITLE

BOX AUGER DESIGNS: 3D CONCRETE PRINTER

Our job is to help in the process of designing and developing a fully autonomous concrete 3D printer that others can easily replicate to print affordable concrete buildings and structures. More specifically design a cohesive system to address the following objectives: ensure rebar is aligned during printing, Concrete Consolidation in Hopper, Automated Smoothing, 90° Corner Efficiency, Rounded Corner Capability. Basically, if you can rent a skid-steer, you can print a house!

ADVISOR(S)

Dr. Tyler Ley, Jim Beckstorm, Jake LeFlore, David Porter

(Left to Right) Ella Higgins, Callon Fish, Zach Pennington, Elise Ward, Nick English, Ricky Wilson

PROJECT TITLE

CHILLER COMMISSIONING

This project is working to bring a Hot Gas Bypass Chiller System to full operational capacity. The HGBC supports the testing of hydronic heat exchangers in the Psychrometric Coil Testing Facility by providing cooling capacity to the Pumped Water Loop. The HGBC consist of a Hot Gas Bypass Loop that can respond quickly to changes in capacity and a pumped Refrigerant Loop that can allow for the testing of different refrigerants without changing out a compressor.

ADVISOR(S)

Dr. Christian Bach, Rasheed Shittu

(Left to Right) Tucker Tomlinson, Jacob Taylor, and Sreyleak (Alex) Nith

Project Trailer

MAE

PROJECT TITLE

COWBOY RACING: FRONT SUSPENSION DESIGN

Cowboy Racing is Oklahoma State University's Baja SAE team and has been competing since 1995. Since around that time the team has been using various ATV suspension setups. Most of the suspension systems used were stock ATV setups with custom A-Arms, Trailing Arms, or other suspension types. The goal of the team in the last couple of years has been to select our own specific suspension design with custom suspension geometry, knuckles, and rear bearing housings, while still using the same 4130 tubing. The goal of this senior design project is to further this endeavor to stay competitive in the Baja SAE competition. The objective of the 2024 Cowboy Racing Baja Senior Design Project is to design and manufacture a front suspension system for the 2023-2024 Cowboy Racing Mini Baja Car. The objectives of the designed front suspension are to maximize the strength to weight ratio, minimize unsprung weight, and obtain suitable geometry for off road vehicles. Redesigning the front suspension will increase the handling and performance of the Baja Car. To accomplish this, the Senior Design team applied engineering standards and principles relating to material properties, kinematics, and computer aided design. Additional knowledge for the design project was acquired through textbooks, informational videos, and benchmarking of other Baja teams. The increased handling and performance of the Baja Car will be proven quantitatively through an increased lap time on the Baja test track, and/or qualitatively through the feedback of an experienced driver.

ADVISOR(S)

Dr. Dan Fisher, Chip Palmer

SPONSOR(S)

WEBCO FINISHLINE ST

(Left to Right) Mason Hagelberg, Drew Milligan, Craig Mullarkey, Spencer Swanson, Joshua Davies

Project Trailer

Instagram

Email Contact

PROJECT TITLE

CVD ENGINE

Internal combustion engines are ubiquitous in transportation today, with key mechanisms for piston firing generally similar across the spectrum of commercial models. Research aiming to optimize engine performance tends to design using these traditional mechanisms. AmeriBand LLC has developed a proprietary mechanism for translating power to an output shaft through a wobble plate. AmeriBand has outlined key benefits of this engine design when compared to a standard commercial engine, such as greatly reduced friction losses during operation, decreased engine volume and weight, and continuously variable engine displacement. Previous work done with AmeriBand in the development of a prototype focused on a 5-cylinder engine design. The objective outlined for this project was to produce proof of concept for a 7-cylinder prototype. To accomplish this, research was done to better understand the mechanism of the engine. Following initial research, design concepts were generated by team members in SolidWorks. Initial design concepts were refined after a discussion with AmeriBand, and then the final design concept was selected and iterated. To provide proof of concept for the design, two major deliverables were selected through discussion with project mentors and AmeriBand. A material deliverable was desirable to validate the geometry of the new engine mechanism. Analytical deliverables were also desired to determine the engine's projected response to loadings during operation. The material deliverable selected was a 3D-printed mock-up of the engine block to demonstrate its primary mechanism. The analytical deliverable selected was a set of conclusions relating to the engine's performance under the maximum assumed stresses including, if possible, potential points of failure, failure modes, and material recommendations. The current project state includes a ready-to-fabricate model of the engine. Additionally, initial stress calculations have been used to determine necessary geometry and material parameters for the output shaft and the rotating wobble plate.

ADVISOR(S)

Dr. Dan Fisher, Prof. Laura Southard, Chip Palmer

SPONSOR(S)

AmeriBand LLC

(Left to Right) Preston Hill, Carter Koob, Carter Keith, Hunter Moulayianis, Tommy Colston, Russell Mayes, Ben Dobbins

MAE

PROJECT TITLE

DANCING TURTLE ROBOT

The goal is to create a Dancing Turtle Robot for the Dancing Turtle Festival in Stillwater, OK. The team has decided to create a humanoid animatronic that is able to replicate humanlike dance moves, movement, and interactions. The scope of this semesters work is to create the skeleton of the animatronic with at least one functional arm and leg as well as a face with the ability to replicate emotions. The dance moves for this semester will consist of scripted movements to mimic popular dance moves, such as the running man, the disco, the robot, etc. The robot itself will be attached to a mount to allow easy mobility and much cleaner movements. The robot needs to be modular and easily modified by future semesters as this is a 3-4 semester project.

ADVISOR(S)

Dr. Joe Conner, Dr. Brad Rowland

SPONSOR(S)

(Left to Right) Trey Hall, Savanah Amend, Jack Smith, Brady Johnson

Not Pictured: Benjamin Koob

Instagram

Project Trailer

More Information

PROJECT TITLE

DESIGN & FABRICATION OF A TURBOJET THRUST REVERSER MODIFICATION

This project involves the design and analysis of a thrust reverser retro fit kit that bolts on a JetCAT P100-RX in place of the stock nozzle. The motivation for this study is for small to medium sized high-speed unmanned aircraft that would benefit from shorter landings and ground maneuverability. 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 nozzle. From this analysis it was determined that the best design would be for a two-duct door actuated system to alter the flow path and achieve reverse thrust. Finally, detailed drawings of each component were made and analyzed. The final design is a duct system that attaches to the back of the JetCAT and turns a door when actuated, blocking flow in one direction. The engine will produce normal thrust while the door is in the "up" position, but when the door is "down", thrust reversal is achieved. The goal is to generate as much reverse thrust as possible, while allowing for an integrated design applicable to real aircraft. This set up will produce over 40% reverse thrust based on the thrust/weight ratio of normal engine operation. Observation from this study can inform potential aircraft and engine designers for small to medium sized high-speed aircrafts.

ADVISOR(S)

Dr. Kurt Rouser

SPONSOR(S)

AFRL
AIR FORCE RESEARCH LABORATORY

(Left to Right) : Alexandra Boyko, Chaz Daggett, Ryan Evans, Luis Kastner, Kade Faith, Blake Brown

MAE

PROJECT TITLE

FORCE FEEDBACK YOKE PROJECT BY THE YOKE-A-HOLICS

The Force Feedback Yoke (F.F.Y) project, developed by a team of four mechanical engineering students, introduces an innovative flight simulation system designed to enhance the realism of pilot training and simulation experiences. At the heart of this project lies an assembly that uses electromagnetic coils, controlled by a Raspberry Pi through multiple DC motor drivers, to generate variable force feedback on the yoke. This feedback accurately simulates the physical forces a pilot would feel in response to wind speed and flight dynamics, offering a tangible connection to the virtual flight environment. Users can interact with the system via a LabVIEW interface, which provides real-time adjustments of simulated conditions, such as wind speed, to vary the feedback forces accordingly. Designed with the future of flight training in mind, the F.F.Y project aims to set a new standard in simulation technology, offering an immersive, educational tool that bridges the gap between virtual and actual flight experiences. The final product of this project will be incorporated into the MOTUS flight simulator system located at the DML.

ADVISOR(S)

Dr. Joe Connor, Dr. Ryan Paul

(Left to Right) Logan Wrede, Grant Gilbow, Tony Dong, Chris Dyke

Project Trailer

PROJECT TITLE

HYPOGRAVITY TEST BED

This project involves designing and fabricating a machine that will induce hypogravity onto c. Elegan worms as part of a series of experiments carried out by our client at OSU-Tulsa. This machine is called a Random Positioning Machine (RPM) and our project is to design, fabricate, and test this RPM to make sure it meets all requirements set by our client. Once we have completed our part in this project, the RPM will be used to test how lower levels of gravity effects the neuro-muscular system of multiple generations of c. Elegan worms. A c. Elegan worm is 1 mm long and has a lifetime of about 2 to 3 weeks. In order to see the effects of multiple generations, the RPM will be operational for 6-8 weeks at a time to get the desired experimental results.

ADVISOR(S)

Dr. Jerome Hausselle, Dr. James Manjarrez

(Left to Right) Jack Harding, Trey Bennett, Samantha Robinson

Project Trailer

MAE

PROJECT TITLE

SAFETY TOW – TEAM COWBOY HITCH

The “Cowboy Hitch” team has been tasked to design, build, and test an optimized safety tow apparatus designed by Mason Caillet, Colin Myers, and Joe Reed for the Safety Tow Company. Our objective was to develop a solution that affixes to the vehicle side rather than the trailer side for towing purposes, while allowing for flexibility across all trailer coupler sizes. Our design is tailored to accommodate class 4 trailers weighing up to 10,000 lbs. From the very beginning, our team has been committed to delivering a fully completed design ready for mass manufacturing for Safety Tow. We are confident that our design embodies three standards we’ve set: simple, economic, and universal.

ADVISOR(S)

Dr. Dan Fisher, Joel Quarnstrom

SPONSOR(S)

SAFETY TOW

(Left to Right) Colin Myers, Mason Caillet, Joe Reed

Project Trailer

PROJECT TITLE

SPACE COWBOYS ARGONIA CUP

We are the Space Cowboys! A Senior capstone design project team consisting of 12 members. The goal of our project was to create a 2-stage high powered rocket capable of carrying a payload of as many golf balls as possible to the highest achievable attitude. This project is a part of the annual Argonia Cup collegiate rocketry competition that occurs every March in Argonia, Kansas, and each participating team is tasked with the same mission. This year, a record of 19 teams from 16 different universities competed in the competition. For our design, we wanted to break new ground for rocketry at Oklahoma State. We designed and fabricated the first ever 100% scratch-built airframe rocket that has ever flown from this university. Utilizing composite flat plates, mold layups, and the X-Winder, a composite filament winding machine, we manufactured all of the tubes, coupler, fins, bulkheads, and centering rings found our 2-stage rocket. We employed advanced rocket construction techniques, flight simulations, and top of the line flight computers to create a competitive rocket that is 98% carbon fiber by weight and the first custom wound rocket from Oklahoma State. Our rocket, "Rango Mk 1" stands at a staggering 16.5 feet tall and weighs 66 pounds. Rango carried a payload of 210 golf balls, totaling a payload weight of 22 pounds. In competition, we had a successful 2-stage launch that qualified our team for 3rd place in this year's Argonia Cup. Our rocket achieved an altitude of 3,698 feet with a maximum acceleration of 6 G.

ADVISOR(S)

Dr. Jamey Jacob, Andrew Walsh, Ryan Narrell, Zach Wattenbarger

SPONSOR(S)

(Left to Right) Brett Winter, Natalie Thornton, Nick Sweeney, Tommy Hosty, Robert Paddack, Josh Klingman, Ben Klingman, Caden Mincey, Jarrett Schwarz, Jordan Block, Logan Thornton, and Charlie Fett

Vechicle Poster

Rango Poster

MAE

PROJECT TITLE

THE ECLIPSE FROM ABOVE THE CLOUDS – SOLAR BALLOON SCIENCE DURING THE 2024 ECLIPSE

On April 8th, 2024, a total solar eclipse would travel over a large part of the United States. More than 50 research groups, including this team, were a part of the NASA National Eclipse Ballooning Project (NEBP) to help increase the local community's participation in STEM research and collect valuable engineering and atmospheric data. Our team was tasked with developing sensor payloads that attach to high-altitude solar balloons. These balloons, termed heliotropes, float within the lower stratosphere (~ 20 km from Earth's surface) and will float for as long as the Sun is out to heat them. On the balloon, there were two sensor payloads. The upper payload contained sensors that record various atmospheric data, such as temperature, humidity, pressure, and solar radiation. It also utilized three high-quality GoPro cameras to catch the eclipse from above the clouds. The bottom payload recorded infrasound data which are low frequency pressure waves that are below the threshold of human hearing (< 20 Hz). With all this equipment, the goal was to see how the rapid onset of light to dark, and then back to light, affects what goes on in the Earth's atmosphere. It is difficult to get large quantities of data during eclipses because of their low frequency and the location that they occur. Since this past eclipse, the next one to occur in the contiguous U.S. will not be until 2045.

ADVISOR(S)

Dr. Jamey Jacob

SPONSOR(S)

(Left to Right) Kristen Bird, Abe Red, Grayson Hurst, and Kate Spillman

Project Presention

PROJECT TITLE

TURBOJET BLACK

This Project presents experimental results of a thrust reversing mechanism for a stock JetCat P100. The thrust reversing mechanism was modeled using computer aided design software and was created as a replacement for the stock nozzle of the JetCat P100. The thrust reverser was designed to reduce thrust of the P100 jet engine by reversing 40% of the exhaust flow at the maximum throttle position. Furthermore, the design was manufactured to actuate in less than five seconds and be able to reverse the flow for 30-seconds. This was executed by removing the stock nozzle of the P100 and replacing it with a manufactured nozzle containing the thrust reversing mechanism. This was achieved by adding a diverging section to a redesigned nozzle equipped with thrust-reversing ducts and a guillotine valve to redirect the flow upon actuation. To test the effectiveness of the thrust reversal mechanism, systematic intermediate testing and analysis was conducted including computational fluid dynamics, finite element analysis, heat transfer test and analysis, and various other individual component testing. This was conducted to verify the mechanism's ability to generate optimal reverse thrust while maintaining a sufficient margin of safety.

ADVISOR(S)

Dr. Kurt Rouser, Caleb Besmer, James Masoner

AFRL
AIR FORCE RESEARCH LABORATORY

(Left to Right) Dawson Manning, Austin Rouser, Brooks Benson, Logan Rock, Peyton Stice, Sam Hjelm

MAE

PROJECT TITLE

VERTICAL THRUST TESTER MODULE

Our project is to design a module to house hydrodynamic thrust bearings for testing. Our module will replace an existing module designed to test different components on an existing test bench. Our module must be able to withstand test conditions (20,000 lb of axial force, 7200 rpm, and 350 degrees farenheit). This new module will allow our sponsor company to test single bearings without having to run tests on the assemblies that contain thrust bearings.

ADVISOR(S)

Dr. Dan Fisher, Prof. Warren Lewis

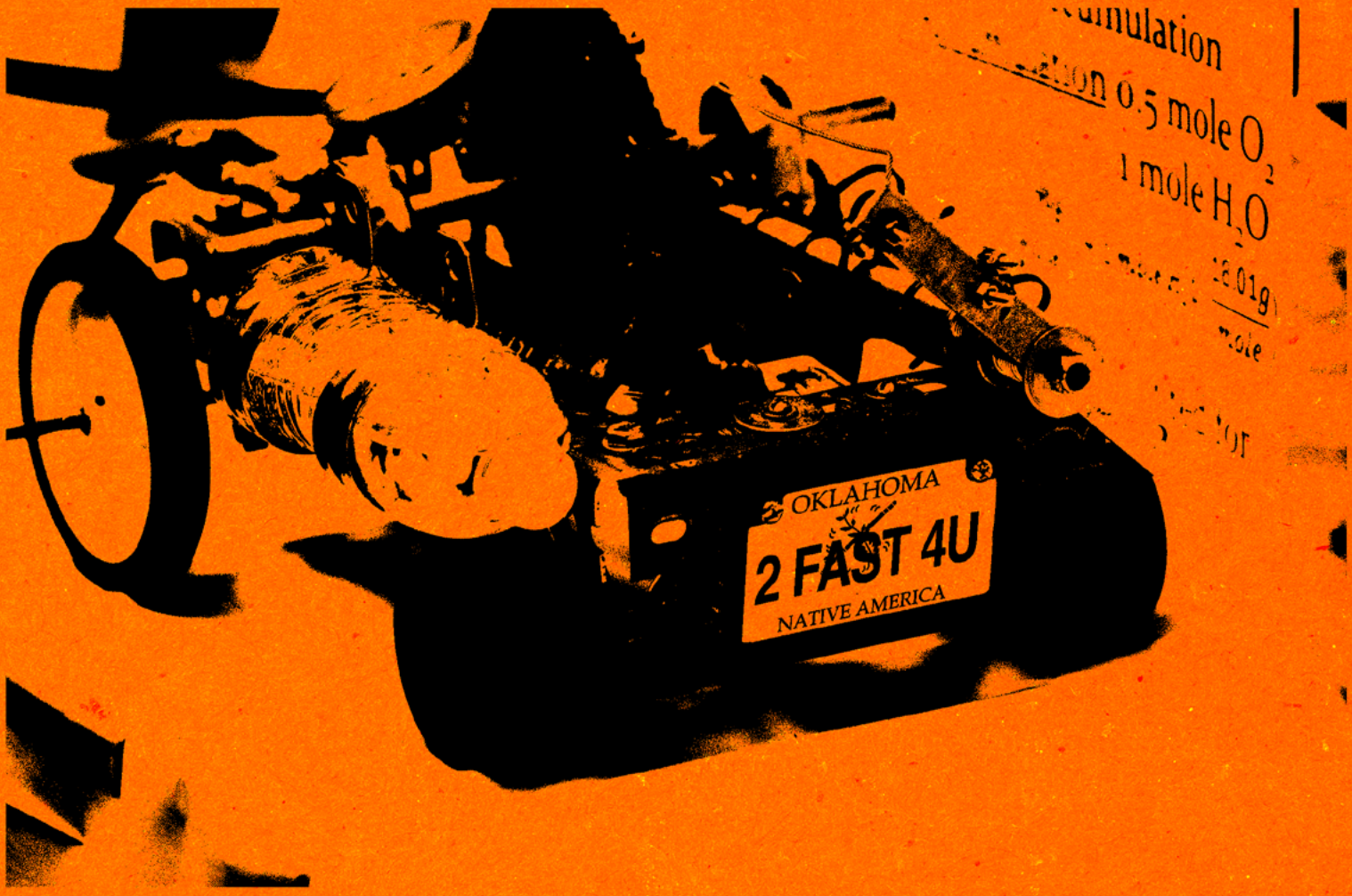
SPONSOR(S)

Ben Wakeling

EXTRACT

(Left to Right) Phillip Chauvin, Weldon Wolf, Sam Lewis

Project Trailer



COMPETITION TEAMS

PROJECT TITLE

CONCRETE CANOE

COMPETITON

Concrete Canoe is an annual civil engineering competition put on by the American Society of Civil Engineers where students design, build, display, present, and race a canoe made out of lightweight concrete. This year, the OSU Concrete Canoe Team's theme is C.O.W.: Concrete on Water. The canoe was designed for durability and constructability, with a uniform center section and foam for floatation hidden in each end. The team competes at the ASCE Region 6 Student Symposium on April 10-13 in San Angelo, TX!

PROJECT TITLE

COWBOY ROCKETWORKS

COMPETITION

Our club has its main focus in competition, personal high-powered rocketry certifications, and research. The two largest competitions we partake in are the Argonia Cup and the Spaceport America Cup. For reference, the Cowboy Rocketworks rocket is 14 feet long, and the Capstone rocket is 16 feet long. Every year, we also offer a Capstone section of the club under our advisor Dr. Jacob. For this past competition, the rocket had to light a sustainer and carry a payload of any amount of golf balls of your choosing. The score for the competition took in account the size of the payload and the altitude of the rocket. Our Capstone team placed third this year.

Discord

Argonia Cup 2024 Video

Argonia Cup Photos

March Fun Fly Photos

Google

Thank you to Google for their partnership in the CEAT Senior Design Expo!