COLLEGE OF
ENGINEERING, ARCHITECTURE AND TECHNOLOGY

SENIOR DESIGN EXPO

Spring 2022 Team & Projects Guide

Tulsa Senior Design Expo
Thursday, April 21
1:00pm-8:00pm
Helmerich Research Center

Stillwater Senior Design Expo
Friday, April 22
8:00am-5:00pm
ENDEAVOR Lab

Speedfest
Saturday, April 23
9:00am
OSU Unmanned Aircraft Flight Station

Presentation Schedule

OSU-STILLWATER PROJECTS

Friday, April 22 from 8:00am - 5:00pm in the ENDEAVOR Lab (Stillwater, OK)
ECE and **MAE** Senior Design Awards Ceremony will be at 5:00pm in Room 160

BAE 8:00am - 5:00pm (room 105)
(BAE)-Engineering Wetlands Restoration Fall River Lake, KS
(BAE)-Environmental Rehabilitation
(BAE)-Hops Harvesting Machine
(BAE)-John Redmond Lake Hydrosuction
(BAE)-Shoreline Erosion Control-OSU Research Park
(BAE)-Stormwater Design and Erosion Control

CIVE 8:30am-10:30am (Third Floor)
(CIVE)-Carter G. Woodson School Rehabilitation Design
(CIVE)-City of Perkins Drainage Design
(CIVE)-Guatemala Water Distribution, El Rancho Group
(CIVE)-Mineral Wells Park Pedestrian Bridge Design
(CIVE)-Noble Park Senior Design Team
(CIVE)-Pawnee Hospital Conversion Design
(CIVE)-Pawnee Nation Intersection of Agency and Heritage Circle
(CIVE)-Pawnee Nation Lagoon System
(CIVE)-Ponca City Flood Control
(CIVE)-Samburg, Tennessee Water Tank Design
(CIVE)-Washington and Airport Intersection Redesign

ECE 8:00am-5:00pm (Room 310 and Room 370)
(ECE)-Audio to MIDI Converter (Room 310)
(ECE)-Hardward Based Video Controller and Graphics Processor Unit for a RISC-V Processor (Room 310)
(ECE)-Solar Powered Charging Station for Electric Scooters (Room 310)
(ECE)-Smart Management of Renewable Energy (Room 370)

FPSET 9:30am-Noon (First Floor)
(FPSET)-Dual Stage Dust Explosion Team. Available 10:00am-Noon
(FPSET)-Emergency Action Planning in Houses of Worship Team. Available 9:30am-Noon
(FPSET)-Homecoming Safety Inspection Process Team. Available 10:30am-Noon

IEM 10:00am-Noon Poster at ENDEAVOR for viewing (Second Floor)
Poster and presenters will move to the ATRC Student Excellence Center from 1:00pm-4:00pm
(IEM)-Estimating Lumber Requirements and Minimizing Lumber Wastage in Zeeco Crating Operations
(IEM)-Facility Layout Redesign at Mary Martha Outreach
(IEM)-Improving Reliability of Test Fixture Tracking
(IEM)-In House Part Protection During Assembly
(IEM)-Investigating Cytology Order Processing
(IEM)-Material Dispensing System Design for Webco Industries

Interdisciplinary Projects-Project and presenters will be available between 9:00am-5:00pm at ENDEAVOR for viewing. Some teams will also have an individual team presentation time in certain rooms in ENDEAVOR that are listed below.
(ID)-Autonomous Aircraft Rescue and Firefighting Vehicle (Individual Presentation from 11:00am-Noon in Room 170)
Individual Presentations in Room 102:
(ID)-FoosBots (Room 340) (Individual Presentation from 8:00am-9:10am in Room 102)
(ID)-Flight Data Retrieval and Management (Room 220) (Individual Presentation at 9:20am-10:20am in Room 102)
(ID)-IGVC. Drive-by-Wire System for Polaris Gem e2 (Room 105) (Individual Presentation at 11:30am-1:00pm in Room 102)
(ID)-Spoiler Alert! Active Aero Front Wing for OSU Formula and SAE Team (Room 105)
(Individual Presentation 1:30pm-3:00pm in Room 102)

(ID)-Updraft (Room 220) (Individual Presentation at 3:30pm-5:00pm in Room 102)
Individual Presentations in Room 202:
(ID)-Wind Turbine Test Bed (Room 220) (Individual Presentation from 9:00am-10:00am in Room 202)
(ID)-Advanced Distillation II (Room 220)(Individual Presentation from 11:30am-12:30am)
Individual Presentations in Room 302:
(ID)-The BB-8 Project (Third Floor, Common Area) (Individual Presentation from 9:00am-10:00am in Room 302)
(ID)-Okstate Drilling Team (Room 105) (Individual Presentation from 12:15pm-1:15pm in Room 302)
(ID)-Wair Oxygen Concentrator (Room 340) (Individual Presentation from 3:45pm-4:45pm in Room 302)

MAE-Projects and presenters will be available between 9:00am-5:00pm at ENDEAVOR for viewing. Some teams will also have an individual team presentation time in certain rooms in ENDEAVOR that are listed below.
Individual Presentations in Room 202:
(MAE)-Cough Catchers (Room 220)(Individual Presentation at 8:00am-8:50am in Room 202)
(MAE)-Automating Super Air Meter (Room 220)(Individual Presentation at 12:45pm-1:35pm in Room 202)
(MAE)-KRIMP (Room 105) (Individual Presentation at 1:45pm-2:35pm in Room 202)
(MAE)-Mars Simulator for Elementary Students (1st Floor, Common Area)(Individual Presentation at 2:45pm-3:35pm in Room 202)
(MAE)-Step By Step (Second Floor, Common Area)(Individual Presentation at 3:45pm-4:35pm in Room 202)
Individual Presentations in Room 302:
(MAE)-Multi-Axis 3D Printer (Room 340) (Individual Presentation from 8:00am-8:50am in Room 302)
(MAE)-Autonomous Stage Wagon (Third Floor, Common Area)(Individual Presentation 10:15am-11:05am in Room 302)
(MAE)-Thermal Mechanical Fatigue Test System for High-Temperature Aerospace Samples (Room 220) (Individual Presentation from 11:15am-12:05pm in Room 302)
(MAE)-6-Axis Force Balance (Room 140) (Presentation from 1:30pm-2:30pm in Room 302)
(MAE)-Furnace Tube Evaluation (Furnace Concern Us) (Second Floor, Common Area) (Presentation from 2:45pm-3:35pm in Room 302)

AERO 9:00am-5:00pm in the Classroom Building Northeast Lawn.
(MAE)-Improved Turbojet Thrust-to-Weight: Black Team
(MAE)-Improved Turbojet Thrust-to-Weight: Orange Team
(MAE)-Unmanned Aircraft Rocket-Assisted Take-Off (RATO) System: Black Team
(MAE)-Unmanned Aircraft Rocket-Assisted Take-Off (RATO) System: Orange Team

OSU-TULSA PROJECTS

MAE-Tulsa

This Expo will take place Thursday, April 21 from 1:00pm-8:00pm at the Helmerich Research Center Atrium (Tulsa, OK). Each team will also have an individual team presentation time that is listed below. Individual presentations will be held in room HRC 153.
(MAE)-Moldy PETs Thermoforming Prototyping Tool (Individual Presentation Time 1:30pm-2:20pm)
(MAE)-Sustainable 3D Printing (FutureFilaments) (Individual Presentation Time 2:30pm-3:20pm)
(MAE)-The Fracking Cowboys: Automated Machine or Gauge (Individual Presentation Time 3:30pm-4:20pm)
(MAE)-Under Pressure (Individual Presentation Time 4:30pm-5:20pm)
(ID)-High Speed Assembly Tool-Team Flash (Individual Presentation Time 5:30pm-6:20pm)
(MAE)-The Carpeteers (Individual Presentation Time 6:30pm-7:20pm)

SPEEDFEST 2022

Speedfest will take place at the OSU Unmanned Aircraft Flight Station (Glencoe, OK) on Saturday, April 23 starting at 9am.

Speedfest Black Team Video

Speedfest Orange Team Video

Project Locations

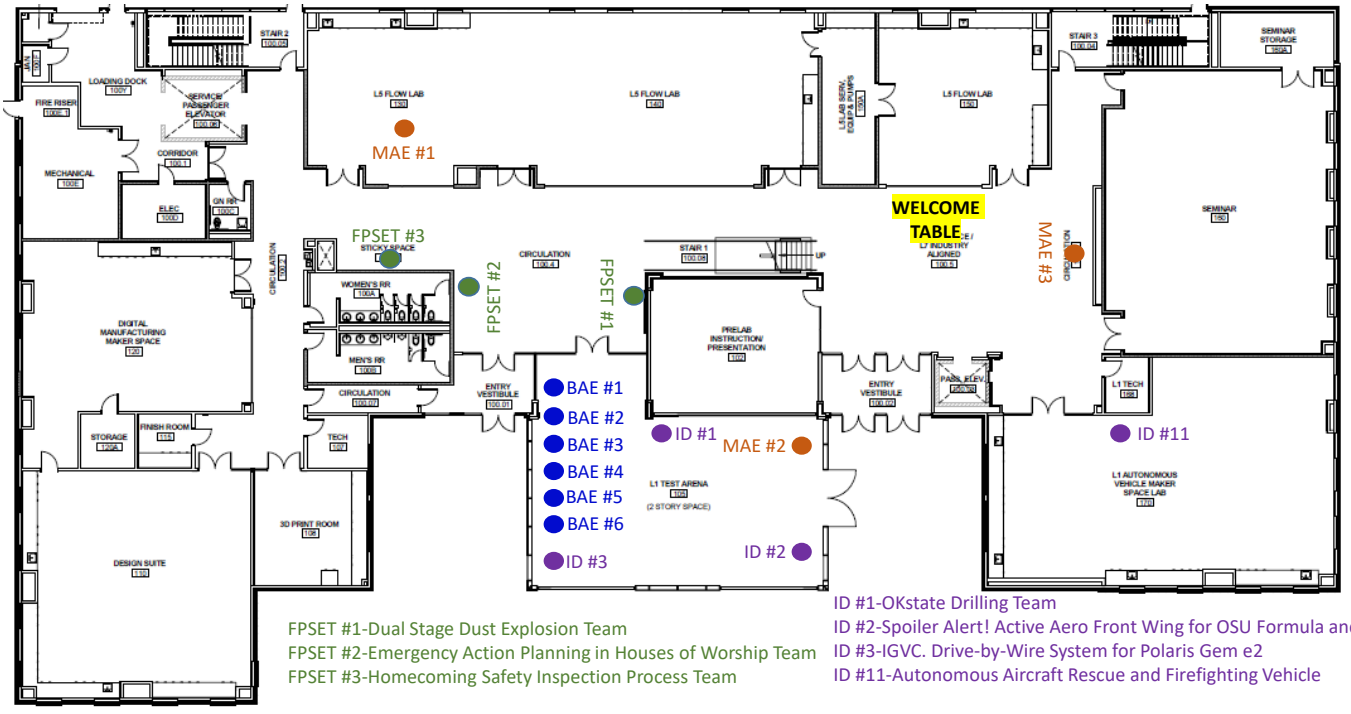
Aerospace Design Team Locations

Map Key:
#26-Engineering North
#28-Advanced Technology Research Center (ATRC)-Student Excellence Center on the first floor.
#38-Engineering South (under construction)
#39-ENDEAVOR Lab

★ -Location of (MAE) Aerospace Senior Design Projects Presenting 9:00 AM-5:00 PM in the Classroom Building Northeast Lawn

MAE #10-Improved Turbojet Thrust-to-Weight: Black Team
MAE #11-Improved Turbojet Thrust-to-Weight: Orange Team
MAE #12-Unmanned Aircraft Rocket Assisted Take-Off (RATO) System: Black Team
MAE #13-Unmanned Aircraft Rocket Assisted Take-Off (RATO) System: Orange Team

1st Floor



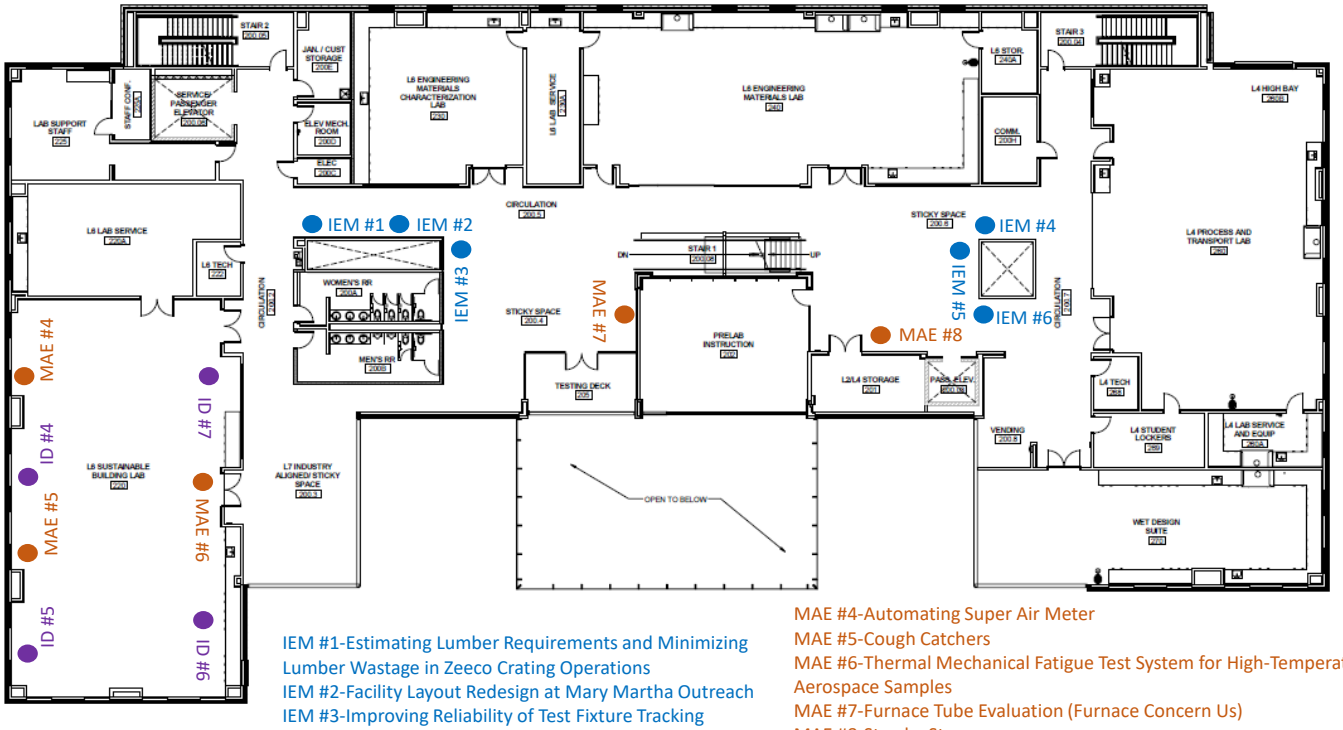
FPSET #1-Dual Stage Dust Explosion Team
FPSET #2-Emergency Action Planning in Houses of Worship Team
FPSET #3-Homecoming Safety Inspection Process Team

MAE #1-6-Axis Force Balance
MAE #2-KRIMP
MAE #3-Mars Simulator for Elementary Students

ID #1-OKstate Drilling Team
ID #2-Spoiler Alert! Active Aero Front Wing for OSU Formula and SA
ID #3-IGVC. Drive-by-Wire System for Polaris Gem e2
ID #11-Autonomous Aircraft Rescue and Firefighting Vehicle

BAE #1-Engineering Wetlands Restoration Fall River Lake, KS
BAE #2-Environmental Rehabilitation
BAE #3-Hops Harvesting Machine
BAE #4-John Redmond Lake Hydrosuction
BAE #5-Shoreline Erosion Control-OSU Research Park
BAE #6-Stormwater Design and Erosion Control

2nd Floor

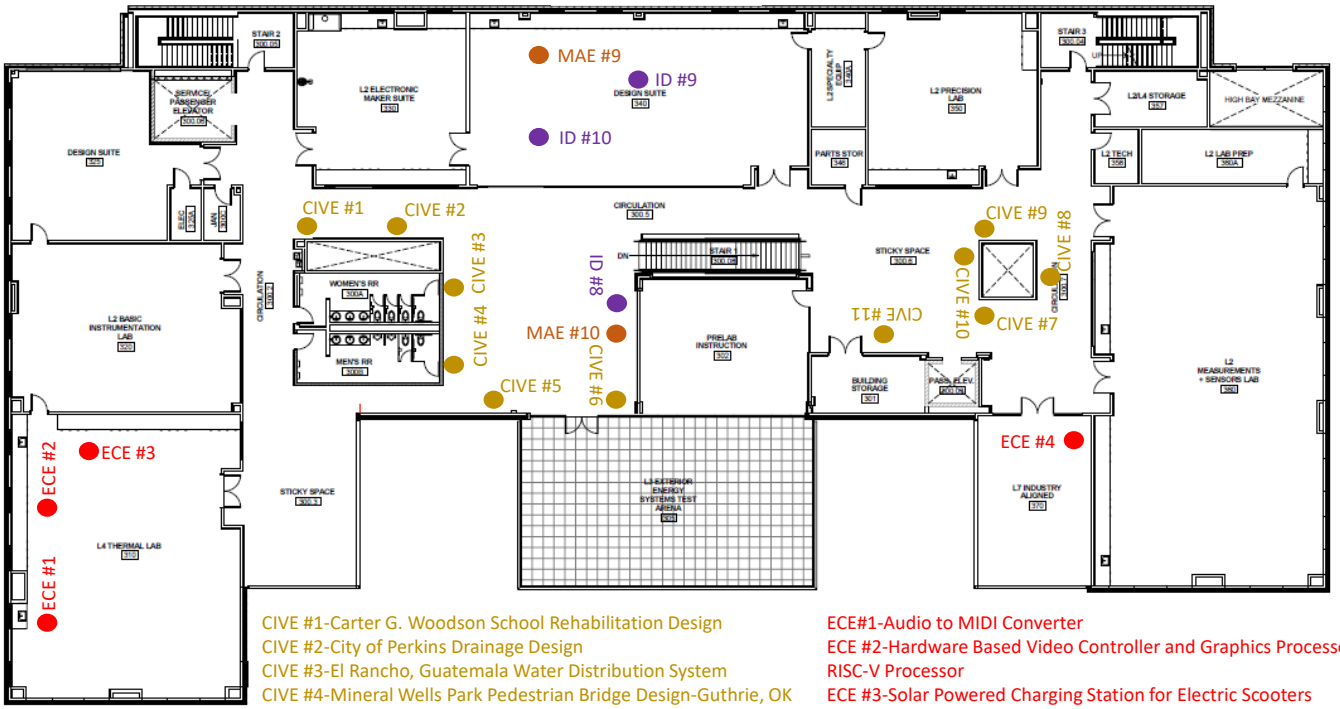


IEM #1-Estimating Lumber Requirements and Minimizing Lumber Wastage in Zeeco Crating Operations
IEM #2-Facility Layout Redesign at Mary Martha Outreach
IEM #3-Improving Reliability of Test Fixture Tracking
IEM #4-In House Part Protection During Assembly
IEM #5-Investigating Cytology Order Processing for Cancer Patients at INTEGRIS Health: Cancer Institute
IEM #6-Material Dispensing System Design for Webco Industries

MAE #4-Automating Super Air Meter
MAE #5-Cough Catchers
MAE #6-Thermal Mechanical Fatigue Test System for High-Temperatur
Aerospace Samples
MAE #7-Furnace Tube Evaluation (Furnace Concern Us)
MAE #8-Step by Step

ID #4-Flight Data Retrieval and Management
ID #5-Wind Turbine Test Bed
ID #6-Advanced Distillation II
ID #7-Updraft

3rd Floor



E #9-Multi-Axis 3D Printer
E #10-Autonomous Stage
gon

CIVE #1-Carter G. Woodson School Rehabilitation Design
CIVE #2-City of Perkins Drainage Design
CIVE #3-El Rancho, Guatemala Water Distribution System
CIVE #4-Mineral Wells Park Pedestrian Bridge Design-Guthrie, OK
CIVE #5-Noble Park Senior Design Team
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CIVE #7-Pawnee Nation Intersection of Agency and Heritage Circle
CIVE #8-Pawnee Nation Lagoon System
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ECE#1-Audio to MIDI Converter
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RISC-V Processor
ECE #3-Solar Powered Charging Station for Electric Scooters
ECE #4-Smart Management of Renewable Energy

ID #8-BB-8
ID#9-FoosBots
ID #10-Wair Oxygen Concentrator

A Word from the Dean

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

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

We have awarded more than 650 degrees this semester and have worked with students, administration and alumni to continue delivering world-class engineers and design professionals. By expanding our facilities and our undergraduate research opportunities, we are pushing forward in creating leaders for the next generation of industry.

The college could not be at the forefront of innovation without the accomplishments and investments of alumni, friends and industry partners in scholarships, internships, equipment and faculty support. In the coming year we will be adding the Zink Center for Competitive Leadership that will push our students even further into innovation with partner companies.

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

Go Pokes!

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

Table of Contents

PROJECT: Engineered Wetlands Restoration Fall River Lake, KS (BAE)
ADVISOR: Dr. Paul Weckler


(Left to Right) Audrey Stephens, Evan Freitas

The U.S. Army Corps of Engineers and the Kansas Water Office came to the Renew team, consisting of Evan Frietas and Audrey Stephens, with a dilapidated wetland in need of rehabilitation. This wetland is connected to Fall River Lake in Kansas and has been deteriorating for the past 10-15 years. Renew is tasked with creating an installment plan and management plan to first, immediately fix the blockage of the control structure and to design a new control structure, and then to help manage the wetland so that there is erosion control, wildlife habitats and proper vegetation. The environment directly benefits from this project. By designing a new control structure to help with the flow of water, the wetland can begin operating as it was intended.

Sponsored by:

PROJECT: Environmental Rehabililtation (BAE)
ADVISOR: Dr. Paul Weckler


(Left to Right) Colton Horn, Kaitlin Blankenship, Jinghang Zhuo

The property of a private landowner in the Edmond area is experiencing the negative impacts of surrounding urbanization. Runoff water has carved an aesthetically unappealing gulley into their land that causes major flooding events on the property due to the increased volume of water it carries. Soil erosion and flood control measures must be taken to preserve the integrity of the land and water table, while maintaining the aesthetics of the natural landscape. The solution must be environmentally friendly, and long term to handle the increasing urbanization of the Edmond area.

Sponsored by:

PROJECT: Hops Harvesting Machine (BAE)
ADVISOR: Dr. Paul Weckler

(Left to Right) Ashton Rapp, Nadia Wright-Morrison, Alex Gardner

Our team's project is to design and fabricate a functional hop harvesting machine that can be operated by a team of at least one person, process 60-90 hops vines per hour, and be able to clear 1 acre of hops within 2-3 days. The benefit of this project is to help farmers/breweries in Oklahoma interested in growing hops without buying a machine that's more than what they need for startup. An additional benefit is the possibility of hops being a new specialty crop for Oklahoma.

Sponsored by:

PROJECT: Shoreline Erosion Control-OSU Research Park (BAE)
ADVISOR: Dr. Paul Weckler

(Left to Right) Daniel Anthamattan, Lilly Schneberger, Kait Lane, Collin Bellmer

In the past, remediation of shorelines across the state has consisted of using riprap and other costly methods to stop shoreline erosion. A floating wetland with the ability to mitigate wave action at the shore would have the ability to treat stormwater runoff, while being more aesthetically pleasing and cost-effective than using riprap or other erosion control methods. Past and current floating wetlands have proven to work, but have not been durable enough to withstand the intense wave action in larger water bodies over long periods. The traditional plastic/PVC structure degraded too easily in the intense Oklahoma sun, causing structural failure and water quality issues from microplastics. This project must have a new, durable design that will have the ability to last for years through constant wave action conditions. The design must also have a dependable anchoring system to ensure the large wetlands cannot float away. Prior designs had issues with wildlife, such as geese, tampering with the wetlands and floating structure. Methods to deter geese and other nuisances would be very desirable. The senior design team presented multiple models to the Natural Resource Conservation Service (NRCS) in the fall and is constructing a final product to implement at the Oklahoma State Technology Research Park in Stillwater, OK.

Sponsored by:

PROJECT: John Redmond Lake Hydrosuction (BAE)
ADVISOR: Dr. Paul Weckler


(Left to Right) Garrett Aranda, Jacob Kettner

The Hydroclear team will be working with the Army Corp of Engineers and the Kansas Water Office to design a hydrosuction system that will be implemented in the John Redmond Lake Reservoir. John Redmond Lake is utilized for ecological, economic, and infrastructural functions and it is not able to utilize these functions to their greatest potentials because of the continuous buildup of sediment deposits. Sediment build up in John Redmond has been fixed in the past by dredging; however, dredging is not economically feasible to continue in the years to come. Hydrosuction is a good solution and will be looked at in further detail and a system will be designed specifically for John Redmond Lake. The system must be economically feasible and must consider the environmental affects to the Neosho River.

Sponsored by:

PROJECT: Stormwater Design and Erosion Control (BAE)
ADVISOR: Dr. Paul Weckler


(Left to Right) Kyle Humphrey, Mattie Wood, McKenna Lovejoy, Sawyer Searcy

Restore Farms OKC is a 5-acre urban farm with an objective to build relationships with the community, while supplying fresh products and farm education. Restore Farms OKC is experiencing flooding due to the increased development of their site. Our team is working on modeling and designing solutions that would help with their runoff issues. The solutions will help our client reach out to more community members and students, along with helping with runoff in their neighborhood.

Sponsored by:

PROJECT: 2 Chems and a Mech (Chem-E-Car) (CHE)
ADVISORS: Dr. Brad Rowland, Dr. Sundar Madihally, Riley Dunham

(Left to Right) Dr. Brad Rowland, Dr. Sundar Madihally, Riley Dunham, Jorge Tapia, Brett Winter, Carson Ball

2 Chems and a Mech is a competitive team that is part of the Interdisciplinary Design of Chemical Systems course. The car is powered by a reaction between acetic acid and Sodium bicarbonate which produces carbon dioxide gas which pushes the piston. The byproducts of the reaction are sodium acetate and water.

Sponsored by:

Chevron Phillips Chemical Company LP

PROJECT: Carter G. Woodson School Rehabilitation Design (CIVE)
ADVISORS: Dr. Laura Arata, Dr. Norb Delatte, Dr. Gregory WIlber

(Left to Right) Ali Almutairi, Mary Grace Fink, Frances Olivia Boyd, Justin Hoppe

The Carter G. Woodson School located in Tullahassee, Oklahoma was destroyed by a fire in 2012. The community of Tullahassee has asked us to rehabilitate the remaining structure to provide a community building for their events and gatherings. The goal of the project is to design an inclusive and welcoming community building that meets the needs and wants of the community, while simultaneously retaining the historical significance of the remaining structure.

Sponsored by:

OSU

HISTORY

PROJECT: City of Perkins Drainage Design (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Conner Fialkowski, Kera Willhoite, Jack Lenart, Stephen Fox

The City of Perkins, Oklahoma has had issues with flooding and erosion control. The intersections of Kenworthy and 7th Street, and Thomas and 7th Street, have been identified as key areas of these flooding issues. The current drainage system is failing and not properly keeping up with current rainfall levels. This project focuses on providing a solution to these drainage issues as well as addressing erosion risk in the surrounding areas.

Sponsored by:

CITY OF Perkins OKLAHOMA

PROJECT: Guatemala Water Distribution El Rancho Group (CIVE)
ADVISOR: Dr. Gregory Wilber

(Left to Right) Shahad Alsejari, Jedidiah Coltrane, Zane Masri, Matthew Young

El Rancho is a small community in the central region of Guatemala in Centralamerica. This region does not have ready access to clean drinking water within their homes. A new ground water well has been drilled and fitted with a water collecting tank at the top of a close ridge. The proposed project is the design of a potable water distribution system of the well water to the local community located lower down the ridge.

Sponsored by:

ENGINEERS WITHOUT BORDERS USA

PROJECT: Mineral Wells Park Pedestrian Bridge Design (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Andrew Abernathie, Alyssa Hostetler, Logan Anderson, Jace Edwards, Leroy Alsup, Tenny Maker

Mineral Wells Park is a historic park located in Guthrie, Oklahoma. The City of Guthrie has asked us to design a pedestrian bridge to cross over a pond within the park. This would provide safer access to the west side of the park, which currently is only accessible by road with no sidewalk for pedestrians. The east side of the park is the main area, while the west side has a few gazebos and is still in a developing stage. The bridge would also feature a fishing dock for visitors to fish in a central point in the pond rather than from the side. Designing the bridge will also include some erosion control plans to fix an existing issue on the northwest section of the pond. A pedestrian bridge in Mineral Wells Park will provide an aesthetic that matches the park's historic look, as well as enhancing the community aspect of the park while implementing a sustainable and functional design.

Sponsored by:

Leroy Alsup, City of Guthrie City Manager
Tenny Maker, City of Guthrie Public Works Director

PROJECT: Noble Park Senior Design Team (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Khamees Alkhashti, Hayden Burt, Regan Lester, Gage Blake

The Noble Park area is an abandoned portion of public property, located in Guthrie, Oklahoma. This area was formerly a thriving Africanamerican settlement, which was established during the time of the Oklahoma Land Run. Residents of the area were eventually bought out of their property by the government, due to frequent flooding. Surrounded by Cottonwood Creek, Noble Park currently has no public access points and is located within a floodplain. With these geological factors in mind, the Noble Park Senior Design Team was tasked with designing a bridge to facilitate pedestrian and bicycle travel across the creek. While this bridge is intended primarily for pedestrian travel, it must support a load of 50,000 lb to accommodate for emergency vehicles that may need to occasionally use the bridge. Additionally, the design team was required to design a parking area near the entrance of the bridge. A small pathway connecting the parking lot to the bridge will also connect to a trail system proposed by the City of Guthrie. The completion of these designs will help reconnect Noble Park to the surrounding community and allow for the City of Guthrie to pursue development of the area into a public park.

Sponsored by:

HISTORY

PROJECT: Pawnee Hospital Conversion Design (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Alice Cottle, Ally Kummell, Ryan Hollenbeck, Josh Wood, Sidney Shellhammer, Will West

Our team intends to convert the Pawnee Municipal Hospital into a community center, with a design that keeps in mind community historical preservation. The center's main purpose will be to act as a combination youth and assisted living center, as the town does not have a large enough population of either demographic for the entire structure to be converted into a youth or assisted living center. The site surrounding the hospital will be converted into a walking track, park, and splash pad, as the city needs more parks and places for the elderly to walk safely. The community center will be paid for by grants that the City of Pawnee is already preparing to apply for. A portion of the hospital will be converted into a local memorial, and much of the original railings, signage, and other elements of the old hospital will be preserved, per community request.

Sponsored by:

PROJECT: Pawnee Nation Intersection of Agency and Heritage Circle (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Nathan Brooks, Dalton Wiseman, Chenwei Huang, Hussain Al Lashit

The intersection of Agency and Heritage Circle in Pawnee Nation has caused problems for vehicle movements. Specifically, since both roads meet each other in a curve, vehicles must make a sharp 90 degree turn onto Agency Road. Moreover, Heritage Circle is an entrance to Pawnee Nation. Thus, many drivers use the road to enter the tribe. The Pawnee Indian Health center is also located on Heritage Circle, so many elderly drivers also use the road to get to the clinic. Therefore, both elderly drivers and larger trucks have high difficulties in making the turn at the intersection. To alleviate the problem the intersection must be redesigned and realigned. Ultimately, the goal is to design an intersection that provides safety and efficiency for drivers traveling through the area.

Sponsored by:

PROJECT: Pawnee Nation Lagoon System (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Mohammad Alkandari, Zach Whittiker, Jehan Shwiyyat, Cheyenne Mata

The Pawnee Nation is running out of lagoon/waste water treatment capacity. The Pawnee Nation is looking to build a new mental health facility, which will increase flow. A new lagoon/wastewater system will be needed to not only hold the increase in water but to also allow for growth in the community.

Sponsored by:

PROJECT: Ponca City Flood Control (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Grant Dickson, Rose Brandy, Kasee Hayes, Mary Ziegler

The City of Ponca City is located alongside the Arkansas River in Kay County, Oklahoma. The city is home to many tributaries of the river and is heavily developed. There are certain areas within the city that are at risk of flooding by these tributaries. The existing infrastructure does not have sufficient capacities for these risks. This group's focus is the upstream end of a tributary running through a residential area. In this area, 81 properties were affected by the 100 year flood and multiple streets are overtopped. There are also multiple culverts in this area that are inadequate.

Sponsored by:

Jim Fairbanks-
City Engineer for the
City of Ponca City

PROJECT: Samburg, Tennessee Water Tank Design (CIVE)
ADVISORS: Dr. Norb Delatte, Dr. Gregory Wilber

(Left to Right) Aedan Cottle, Adam Monaghan, Emmy Ooten, Cale Sawatzky

AACE Solutions is providing an alternative water tank design for the town of Samburg, Tennessee. The current water tank is on the verge of failure. This tank is in need of repair but replacement would be ideal.

Sponsored by:

Community Engineering Corps

Engineers Without Borders USA

GARVER

BECHTEL

PROJECT: Washington and Airport Intersection Redesign (CIVE)
ADVISORS: Dr. Norb Delatte, Bill Millis, Dr. Gregory Wilber

(Left to Right) Carson Roy, Luke Major, Spencer Krawczyk

The city of Stillwater has come to the conclusion that the intersection at Washington St. and Airport Rd. is unable to safely and effectively handle the required volume of traffic flow. There are several issues with the current design that cause a high volume of accidents and traffic back-ups leading up to this intersection. These are especially evident in the northbound and southbound directions. The main struggle is traffic buildup trying to turn into the airport in the northbound left lane of Washington St. The current traffic light system does not have a left turn arrow, therefore there is currently no left turn phase for north and south bound Washington St. traffic. On top of this, Washington St. does not currently have any kind of protected left turn lane. In order to improve the intersection there must be some form of redesign of the left turn system. The overall goal of this project is to improve both safety and traffic flow in this intersection during rush hour and game day traffic.

Sponsored by:

The City of Stillwater OKLAHOMA

PROJECT: Audio to MIDI Converter (ECE)
ADVISOR: Prof. Nate Lannan

(Left to Right) Kellen Whittington, Haidar Musaqlab, Jarrett Mitchener, Jackson Wildman

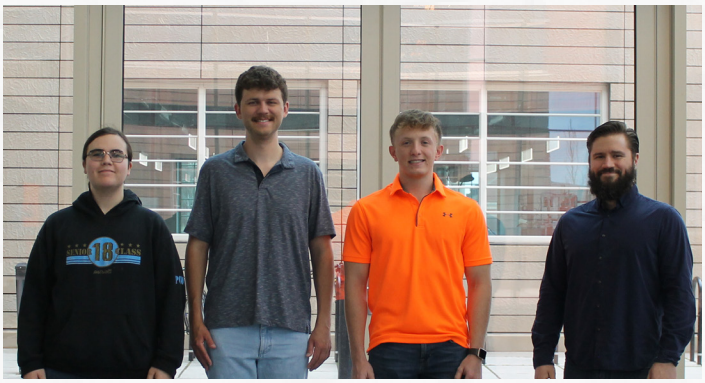
The goal of this project is the development of a system that can convert audio signal from a microphone into basic MIDI note information. The goal is to have a device that can convert the signal in real-time so that a person playing an instrument or singing into the microphone could trigger a sound module or plug-in without latency, thereby allowing for someone to play an organ sound from their acoustic guitar. The goal for the device for this semester would be to operate in “single note” fashion, and not be expected to operate correctly for chords.

PROJECT: Beam-Steering RF Wireless Power Transmitter (ECE)
ADVISORS: Dr. Wooyeol Choi, Haniye Mehraban

Chris Bird, Josh Kusbel, Nick Loeffelholz, Ryan Lucas

This project will demonstrate directed higher-power RF energy transfer over a greater distance than current near-field power transfer devices can facilitate. The transmitter side will implement a four-element array with a beam steering function, each element including an antenna, a power amplifier and a phase shifter. Each receiver element has an antenna, a rectifier and some LEDs to demonstrate the wireless power transfer. This will result in the ability to provide highly-directional power transfer between two devices.

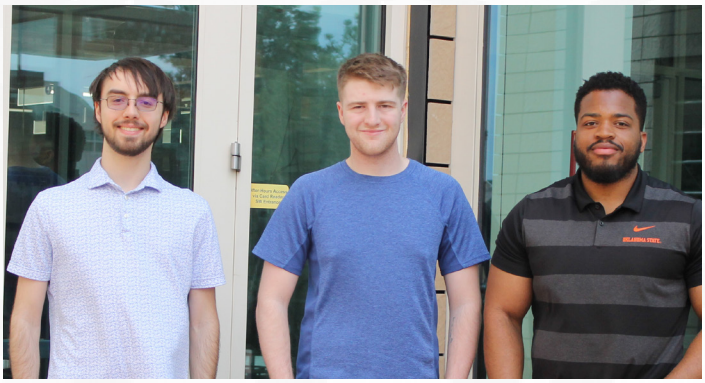
PROJECT: Hardware-based Video Controller and Graphics Processor Unit for a RISC-V processor (ECE)
ADVISORS: Dr. James Stine, Ross Thompson



(Left to Right) Josh Minton, Adam Loeckle, McKain Box, Jacob Pease

In this project, we are trying to implement a video controller using an HDMI connection for use with a RISC-V processor that is being developed by Dr. James Stine and other Wally team members. Our design will be implemented using a field-programmable gate and have the RISC-V processor running at the same time as the graphic processing unit on the board. Our design will require hardware and software interfacing to allow the model to operate correctly.

PROJECT: Smart Management of Renewable Energy (ECE)
ADVISOR: Dr. Hantao Cui

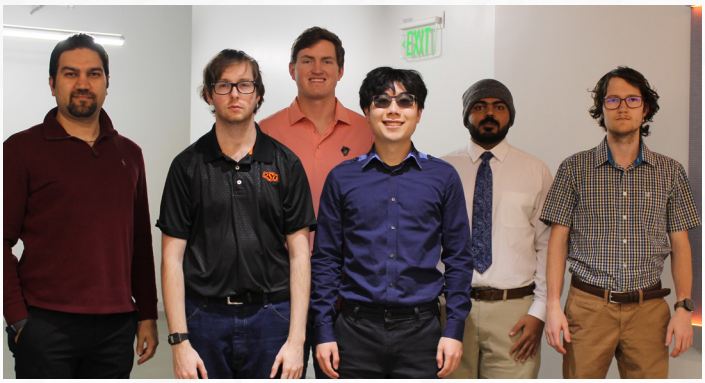


(Left to Right) Alexander Rose, Wyatt Woodson, Selton Thomas

As the world transitions to renewable energy from traditional power sources such as coal, oil and natural gas, the power grid becomes increasingly important to manage. The term most often used for power grids that integrate digital monitoring/management technology into the grid itself is 'Smart Grid'.

The renewable energy lab in ENDEAVOR 350 has two solar panels and two wind turbines which store energy in an on-site battery. This project is a demonstration on how renewable energy can be effectively used in a small-scale environment, such as a home or community, by collecting and displaying energy usage data from the lab equipment. Using this data, the management system must determine what to do with the energy under the current environmental factors, including current power generation, time of day and battery status.

PROJECT: Solar powered charging station for electric scooters (ECE)
ADVISORS: Prof. Nate Lannan, Dr. Hamidreza Nazaripouya



(Left to Right) Dr. Hamidreza Nazaripouya, Ryan Fortson, Matthew Anderson, Jeff Ran, Abdulrahman Alsaeed, Thomas Kidd

This project's goal is to develop a charging station for scooters that utilizes 100% renewable energy. The project involves designing and building the system, which will be performed in the ENDEAVOR labs. The charging station will be a standalone system and is not connected to the grid. It will be composed of a solar panel, a power electronic converter, a monitoring and measurement unit, a control unit, a protection unit and, potentially, a battery storage system. This project will offer a nice demo over an actual solar-based system.

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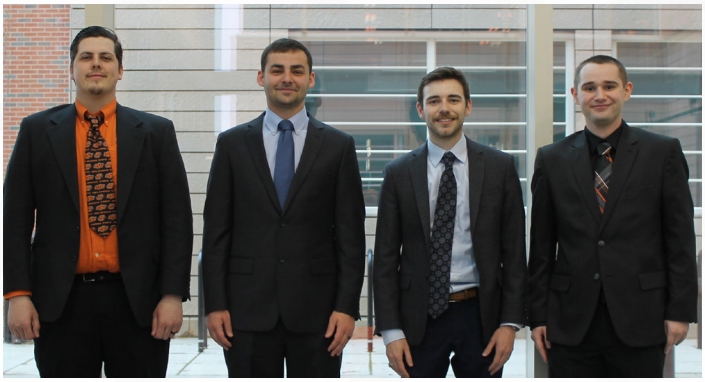
PROJECT: Dual Stage Dust Explosion (FPSET)
ADVISORS: Dr. Haejun Park, Prof. Leslie Stockel



(Left to Right) Gavin Schrader, Robert Anderson, Zac Casteel, Zachary Edwards

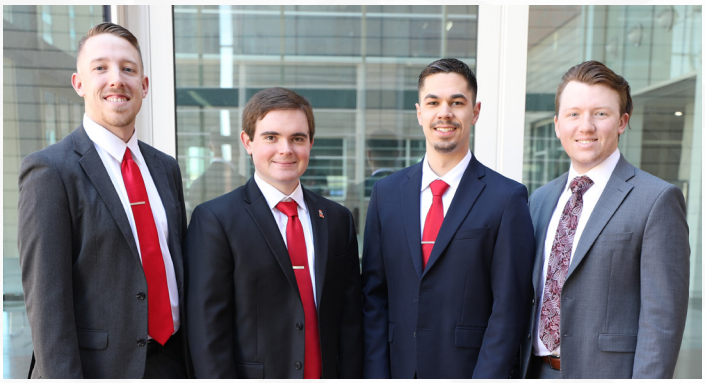
A visual demonstration of a dual-stage dust explosion is essential in assisting viewer comprehension of the danger that such a hazard presents. Through analysis of past events and combustion models, it is known that the destruction created during a secondary dust explosion is greater than a single-stage dust explosion. Unfortunately, existing dual-staged dust explosion apparatuses do not reliably demonstrate the increased hazards of secondary explosions. Using a high-speed camera, we show the pressure wave created by the first explosion and the flame head pushing into a secondary compartment, igniting the fuel suspended in the air by the pressure wave and turbulence, which creates the more powerful secondary explosion. The flame head igniting the suspended fuel is distinguishable with the high-speed camera. With the creation of this apparatus, we can demonstrate the process of how primary and secondary dust explosions occur. The high-speed camera allows us to capture the explosions within our 8",12", 16", and 24" tubes. The question was posed, does the length of the tube effect the flame speed. Through our studies with cornstarch and powdered sugar we were able to determine that the longer the tube the faster the flame speed was. The longer tube allows for more turbulence to be created which directly effects the speed of the flame front.

PROJECT: Emergency Action Planning in Houses of Worship (FPSET)
ADVISORS: Dr. Virginia Charter, Prof. Tim Wilson

(Left to Right) Matthew King, Brady Nelson, Patrick Hall IV

This project is about identifying gaps within emergency response procedures within a house of worship. Through gap analysis and systematic checks, emergency procedures are created along with the current procedures in place to formulate a comprehensive emergency response plan.

PROJECT: Homecoming Safety Inspection Process (FPSET)
ADVISOR: Prof. Tim Wilson



(Left to Right) Ryan Laronde, Zachary Hall, Nathan Swisher, Greg Van Pelt

The Oklahoma State University (OSU) Homecoming Safety Inspection Process was implemented to identify hazards and implement corrective action in response to the electrocution of three students in 1977. Over the years, there continues to be a concern about individuals being exposed to safety hazards and the potential for injuries in the house decoration construction process. An in-depth review of the existing safety inspection process was conducted to identify opportunities for improvement and to reduce the trend of continued exposure to safety hazards. The researchers led a gap analysis and revised the safety inspection process. The researchers interviewed key stakeholders and industry experts, observed the existing inspection process and collected data through stakeholders' surveys to understand the current safety inspection process. The result was a new safety inspection process that uses industry best practices and reviews by industry experts such as ADD. All of the OSU Homecoming stakeholders agreed to begin the implementation of the new safety inspection process. A new hazard tracking system was also built to communicate identified hazards to key stakeholders in an efficient and effective manner. The new safety inspection process was also extended to cover the entire construction and entire deconstruction phases of the OSU Homecoming house decorations. The improved safety inspection process improves identification of workplace hazards, reduction of hazard occurrences and enhances communication between process stakeholders.

PROJECT: Estimating Lumber Requirements and Minimizing Lumber Wastage in Zeeco Crating Operations (IEM)
ADVISORS: Dr. Baski Balasundaram, Michael Foss

(Left to Right) Jason Abernathy, Mason Feddersen, Kendel Hart, Sam Koscelny

The senior design team's project is with Zeeco Inc.'s manufacturing facility in Tulsa, Oklahoma. Zeeco is a manufacturer of many large-scale combustion products and is a global leader in combustion systems. Our project is working with their crating and shipping department for designing shipping crates for industrial burners. Currently, all aspects of the crate build process are left to the builder's discretion and there is no established process for building shipping crates. Due to the reliance on individual expertise for the construction of the shipping crates containing industrial burners, there is variance in the design of crates and potential material wastage. Thus, the company is seeking an application the crating and shipping department can use to standardize the build process and reduce lumber usage. This application will be split into two tools, the first being a cut sheet tool to help the builders identify the required lengths and quantity of lumber, and the second being a mathematical optimization tool to minimize lumber wastage when cutting required lengths/quantity of lumber.

Sponsored by:

Adrian Smith
Scott Dobyns

PROJECT: Facility Layout Redesign at Mary Martha Outreach (IEM)
ADVISORS: Dr. Bing Yao, Tom Saunders

(Left to Right) Megan Mann, Kim Garcia, William Harrison

Mary Martha Outreach (MMO) is a non-profit charity based out of Bartlesville, Oklahoma that focuses on serving families in need. Currently, they are undergoing changes due to new leadership under Misty Wishall and becoming a part of Eastern Oklahoma Catholic Charities. Soon, this Bartlesville location will operate as a central hub for other non-profit food banks in the Northeastern Oklahoma and Southeastern Kansas regions and will be where a largeamount of the inventory is held. Due to this, MMO is having to clean up their warehouse to make space for future increases in inventory by narrowing down what they store to mainly food, clothing and other small necessities. Along with this growth, a new 2,500 square foot cooler and many steel racks will be coming into the facility. There is a need to reconsider the warehouse layout to effectively incorporate the new equipment and satisfy the requirement for the potential inventory increase.

Additionally, due to the pandemic, they are currently having their customers drive through the building when picking up their groceries to limit direct contact for the safety of both customers and volunteers. However, they found the drive-through to be a more efficient way to serve their customers and want to continue this process for the foreseeable future. This can lead to congestion around the pickup area, especially when a delivery truck arrives, as the current entrance of their drive-through is located next to their loading dock. We will be considering alternate routes for the drive-through and paths for the workers to help cut down this issue. The drive-through also poses safety concerns which will need to be evaluated.

For the project, we will first develop two layouts based on: client approval, space utilization, cost, safety and efficiency. Second, we will design alternative routing options for the drive-through to not only possibly solve the congestion issue, but also satisfy the safety requirements in Oklahoma. The new warehouse layouts and drive-through alternatives will be presented to MMO, and they will choose which option they would like to proceed with based on their knowledge of the facility and its operations.

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PROJECT: Improving Reliability of Test Fixture Tracking (IEM)
ADVISORS: Dr. Tieming Liu, Zach Roberts

(Left to Right) Ryne Garrison, Payton Hill, Luke Loughren, Kramer Pascal

Baker Hughes' Broken Arrow location builds safety valves for the oil industry. Each valve must undergo high pressure testing as part of the final inspection. In order to perform the pressure test, a combination of test fixtures must be affixed to the ends of the safety valve. There are hundreds of these test fixtures in the warehouse so keeping track of them is challenging. This is where our project begins.

According to theamerican Petroleum Institute, all test fixtures need to be inspected after a certain number of uses because they have to withstand up to 30,000 psi on a regular basis. Our client is unable to reliably track usage which poses a safety risk. The contributing factors we identified include a lack of test fixture serialization and fixtures not being returned to the assigned storage after each use. As a result, fixtures may be used repeatedly with no indication of their repeated use in the system.

After meeting with all departments who interact with the test fixtures, we have provided our recommendations on serialization of test fixtures and a strategy to track usage reliably. We have also analyzed a bill of materials from the past year to provide an ABC analysis for warehouse storage so that frequently used fixtures are located in prime locations. In addition to these recommendations, we have created an implementation plan for each department so that each key player is well informed as to the next steps and how to maintain reliable tracking.

Sponsored by:

Baker Hughes

PROJECT: In House Part Protection During Assembly (IEM)
ADVISORS: Dr. Joseph Nuamah ,Steve Keister

(Left to Right) Pete Billerbeck, Khanh Do, Emma Ray

Baker Hughes is an international energy company. Their mission is to, "take energy forward- making it safer, cleaner, and more efficient for people and the planet." Baker Hughes in Broken Arrow produces safety valves for oil rigs. The parts are machined and assembled in house and must be protected while they wait to move to their next phase.

Currently, Baker Hughes uses plastic mesh, rubber wrap, and hard caps as protection for their parts. While the rubber wrap and hard caps are reused, the plastic mesh is discarded when the valve is fully assembled. This leaves a large environmental footprint at the end of assembly.

We have created solutions for the mesh protection that is ergonomic and environmentally friendly. This solution was developed by interviewing material science experts and mechanics who use the protection. We also performed data collection of industry standards for part protection and a cost and time analysis to find the most attractive solution.

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Baker Hughes

PROJECT: Investigating Cytology Order Processing for Cancer Patients at INTEGRIS Health: Cancer Institute (IEM)
ADVISORS: Dr. Katie Jurewicz, Jack Watts

(Left to Right) Kylie Dowers, Louisa Ivey, Tyler Wedel

The objective of this project is to study cytology order processing at INTEGRIS Health's Cancer Institute and to improve the cytology order process to reduce the loss of test results and improve the overall patient care process. INTEGRIS Health was created in 1995 after the Oklahoma Health System and Southwest Medical Center in Oklahoma City merged. The INTEGRIS Southwest Medical Center, including their Cancer Institute, has been serving the community since 1965. The INTEGRIS Cancer Institute conducts a multitude of services including imaging and radiology, radiation oncology, cancer rehabilitation, integrative medicine and much more. Currently, the Cancer Institute is experiencing errors in their order processing system which is leading to samples and results not being processed. When this happens, patient diagnosis and treatment can be delayed by more than two weeks. The patient then may need to undergo a second procedure to acquire another sample. This project is aimed to identify the point of error in the sample ordering and testing process, provide potential solution ideas to minimize the loss of test results and improve overall patient care. To achieve the objective, the team will be using the Systems Engineering Initiative for Patient Safety as the main theoretical framework, process analysis, and data collection through interviews and observations. The potential benefits will be to reduce patient retesting occurrences, reduce wait time for diagnosis and treatment and reduce the instances of no test results. This will lead to improved patient experience, higher patient satisfaction and a decrease in patient harm.

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INTEGRIS Southwest MEDICAL CENTER

PROJECT: Material Dispensing System Design for Webco Industries (IEM)
ADVISORS: Dr. Austin Buchanan, Mark Lewis

(Left to Right) Ben Burchard, Chris Chesnut, Jay Eischen

Webco is one of Northamerica's leading manufacturers of precision welded tubing, producing carbon, stainless and specialty steel, nickel, titanium and other alloy tube products for a variety of applications. Webco's Star Center Tube facility was opened in Sand Springs, Oklahoma in May 2012. Built specially to accommodate Webco's machinery and tube manufacturing process, this facility has a unique, spread-out footprint. As such, travel times for employees traversing the facility are significant. Each position in the assembly line requires a specific set of exhaustible materials required for the manufacturing process. When employees leave their posts to retrieve those standard, everyday materials and equipment, production is hampered. By exploring a custom vending machine system to dispense this equipment, we hope to eliminate much of the lost productivity that this facility is currently experiencing. Within Webco, the Mechanical, Repair, and Operations (MRO) unit is working towards an automated storeroom system. Manual cycle counts and 24/7 staffing requirements mean the current system is costly in terms of labor. Part of this Webco automation initiative involves vending machine kiosks being placed throughout the plant floor to distribute inventory items as needed for production. The team has prepared an optimization model, pareto analysis, and some heuristics to generate several alternatives. They will vary in location,amount of machines, type of security, and the stock of each machine. The team will be completing cost benefit analysis on these alternatives to make a final recommendation for the optimal storage solution.

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Project Video

PROJECT: 6-Axis Force Balance (MAE)
ADVISOR: Dr. Joe Conner

(Left to Right) Thomas White, Austin Robertson, Brock King, Ashley Evans, Rylee Mosley

The purpose of this project is to create a 6-axis force balance for use in undergraduate laboratories in the ENDEAVOR wind tunnel. The force balance should be capable of measuring the forces and movements about the three body axis in both the positive and negative direction. Within this project, there are two separate designs, one of which is a hybrid force balance and the other being an internal horizontal sting force balance. Both designs are to share a calibration rig. Strain gauges will be used to measure the experienced loads felt by the test sections. The force balances will be designed to integrate with LabVIEW based on the data reported by the strain gauges. LabVIEW will be coded to perform the decoupling matrices necessary to return accurate readings of the aerodynamic loadings experienced by the test sections.

Project Video | Poster Presentation

PROJECT: Automating Super Air Meter (MAE)
ADVISORS: Dr. Dan Fisher, Dr. Tyler Ley, Prof. Laura Southard, Jake LeFlore

(Left to Right) Mansour Alshehry, Albaraa Nawaz

Concrete is not immune to environmental factors such as temperature variation. Freeze-thaw is the process where the difference in temperature makes voids in concrete which causes stress to accrue inside the concrete. This freeze-thaw is an issue that affects the concrete and decreases its life span.

One element that determines the quality and lifespan of fresh concrete is the distribution and size of air inside the fresh concrete mixture before it dries. Previously, fresh concrete experts relied solely on air volume only to determine the quality of the concrete, but research and experiments reveal that there are other factors. The volume, spacing and bubble sizes of the air define the actual quality of fresh concrete. The modified Oklahoma State University Super Air Meter test helps to analyze and determine the volume, spacing and bubble sizes of the air inside a fresh concrete mixture. The SAM test distinguishes it from the rest of the other tests that depend on the air volume inside the fresh concrete mixture.

Since the super air meter is manually operated, it requires a long time to perform and it increases human errors. The main goal of automating the super air meter is to accelerate all of the processes and make them accurate. Thus, the automated system will not require a well-trained person.

PROJECT: Autonomous Stage Wagon (MAE)
ADVISOR: Dr. Joe Connor

Project Video

(Left to Right) Qasem Alnuwaysir, Caroline Dumbauld

A stage wagon is a vehicle used during theatrical productions to move scenery and other objects. The goal of the autonomous stage wagon is to eliminate the distraction of manual movement on stage and, in turn, allow the production to be more dynamic and engaging to the audience. The user interface that we have developed is simple to navigate while providing complex movements that the stage wagon can perform. The autonomous coding that we have developed can be used as a baseline for several different concepts. The use of the autonomous stage wagon can be extrapolated into industrial applications.

PROJECT: Cough Catchers (MAE)
ADVISORS: Dr. Arvind Santhanakrishnan, Jacqueline Esimike, Mitch Ford

Project Video

(Left to Right) Parker Conway, Alison Trull, Adam Cerow, Ryan Sullivan, Braden Crawford

The coronavirus pandemic has shined a bright light on the spread of bacteria and viruses from person to person. Within this light is a focus on airborne infectious particles and their spread. The focus of this project is to study how infectious particles spread and find a way to reduce and/or remove them to create a "safe space" in one's environment, under the supervision of Dr. Santhanakrishnan. This project is taking a focus on creating a safe space aboard an aircraft in economy class to show safe spaces can be created in compact environments. The goal of this safe space is to limit the spread of airborne bacteria and viruses. To accomplish this goal, we will attempt to direct potentially harmful aerosols into a suction device using airflow techniques. The device will then push the aerosols toward the aircraft's HEPA filters to safely recirculate air back into the aircraft cabin.

Project Video

PROJECT: Furnace Tube Evaluation (MAE)
ADVISORS: Dr. Aaron Alexander, Dr. Christian Bach, Dr. Tao Geng, Dr. Hyujin Park, Chris Seaton

(Left to Right) Tien Ngyuen, Aaron Board, James Cook

High efficiency residential heating furnaces use a secondary heat exchanger to cool the combustion gases below their dew point to around 90˚F. This provides an efficiency boost over non-condensing furnaces, reducing utility expenses for homeowners. The tubes within the secondary heat exchanger use internal turbulators further enhancing heat transfer and reducing overall equipment cost. Currently, no correlations for the complex condensing heat transfer within the secondary heat exchanger tubes are available. This project track will provide high quality experimental data over a range of tube sizes, turbulators and inclination angles. Our goal for the project was to conduct a heat transfer analysis on the physical system in order to verify the computation fluid dynamics model. Then we needed to update the test section by attaching thermal couples to the inner tube in order to acquire test data to verify the heat transfer correlation.

Project Video

PROJECT: Improved Turboject Thrust-to-Weight, Black Team (MAE)
ADVISORS: Dr. Kurt Rouser, Haden Glasgow, Tanner Price, Daniel Velasco

(Left to Right) Noah Brock, Jay Welke, Chandler Smith, Jack Jarboe, Chase Holland, Cade Christison

This design project is intended to increase the thrust-to-weight ratio of a JetCat P100 turbojet that has a stock 22-pound thrust. The project is part of a multi-university competition sponsored by the U.S. Air Force with two teams competing from Oklahoma State University. The APOP Black team took a more conservative approach, taking design inspiration not only from completely new ideas but also from design modifications found to be successful in past years. Our approach includes four key design changes: improved inlet, improved nozzle, improved starter motor and the addition of removable fuel heating coils. Modifications in these areas were deemed the most advantageous for thrust-to-weight improvement without being overly risky or detrimental to fuel consumption or engine lifespan. This was determined through an iterative research and testing process.

The improved inlet is lighter than the original and is manufactured from a high-density polyurethane foam, decreasing weight by approximately 30 grams. The improved nozzle is made from a titanium alloy and has been geometrically modified to produce maximum thrust. The nozzle is approximately 35 grams lighter and is expected to produce about 20% or more additional thrust. The improved starter motor is much lighter than the original, decreasing weight by approximately 25 grams. The addition of fuel heating coils is expected to improve the engine's poor fuel efficiency. The coils are heated using waste heat from the nozzle. These coils are designed to be removable for max thrust-to-weight ratio in the case that their increase in TSFC doesn't outweigh their small detriment to weight.

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Project Video

PROJECT: Improved Turbojet Thrust-to-Weight, Orange Team (MAE)
ADVISORS: Haden Glasgow, Tanner Price, Dr. Kurt Rouser, Daniel Velasco

(Left to Right) Jeremy Barton, Carson Campbell, Tevin James, Steven Moran, Ben Sanford, Jerry Wall

This design project is intended to increase the thrust-to-weight ratio of a JetCat P-100RX turbojet that has a stock 22-pound. thrust. The project is part of a multi-university competition sponsored by the U.S. Air Force, with two teams competing from Oklahoma State University. The approach that was taken was to increase the thrust of the engine by adding an aft-mounted turbofan nozzle in place of the current stock nozzle. This feature operates by extracting energy from the core flow and imparting work to theambient air in order to maximize the possible thrust. This design came through the use of two key tools: our custom-built parametric cycle analysis, which was used to model and predict engine performance; and the aircraft engine design application AEDsys, used to design turbine and fan blade geometry. Next, added weight was decreased by choosing the lightest materials possible that would still operate at the temperatures and stresses required. A secondary scoring criterion was to minimize the specific fuel consumption (SFC) of the turbojet. This aft-mounted turbofan nozzle design will decrease the SFC, because it will produce more thrust than the stock engine with the same fuel flow rate. The thrust-to-weight and SFC scoring criteria will be met with this single design. However, we have also decided to replace the inlet cowling with a custom 3D printed design. This design will decrease the overall weight of the engine, with no effect on its thrust, thus providing a thrust-to-weight increase.

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Project Video

PROJECT: KRIMP (MAE)
ADVISORS: Dr. He Bai, Dr. Arvind Santhanakrishnan, Mitch Ford, Diego Colón Serrano

(Left to Right) Anna Baird, Grant Buchman, Gabriel Webb, Robert Knight, Michael Diaz

Our project goal is to design and construct an underwater vehicle to test the use of metachronal paddling in underwater electric vehicle research. Metachronal paddling is a type of propulsion based on paddles under the vehicles body moving in an asynchronous back-and-forth motion. This paddling type, based off the movement of shrimp, could be instrumental in furthering underwater exploration and underwater propulsion.

Project Presentation

PROJECT: Mars Simulator for Elementary Students (MAE)
ADVISORS: Dr. Jerome Hausselle, Nissrime Aziz

(Left to Right) Lily Jason, Chad Giovanni, Taylor Stoll, Mohammed Abo Qreen

This project aims at designing and fabricating a portable, gravity-offloading device that is intended for kids to experience walking under Mars' reduced gravity.

This Mars simulator is designed for elementary students aged 6 to 10 years old to introduce them to space biomechanics through an engaging experience. The device will be toured around elementary schools in the state of Oklahoma to get younger students interested in science, technology, engineering and mathematics. The design includes an inclined passive treadmill, along with an upper body support that ismounted to a linear carriage to allow for different heights and for accommodating the natural vertical motion of the body while walking.

Sponsored by:

BAMM
Biomechanical Analysis & Musculoskeletal Modeling

Project Video

PROJECT: Multi-Axis 3D Printer (MAE)
ADVISORS: Dr. He Bai, Dr. Hadi Noori, Prof. Laura Southard

(Left to Right) Ben Warner, Gavin Shepherd, Duron Scruggs, Joshua Short

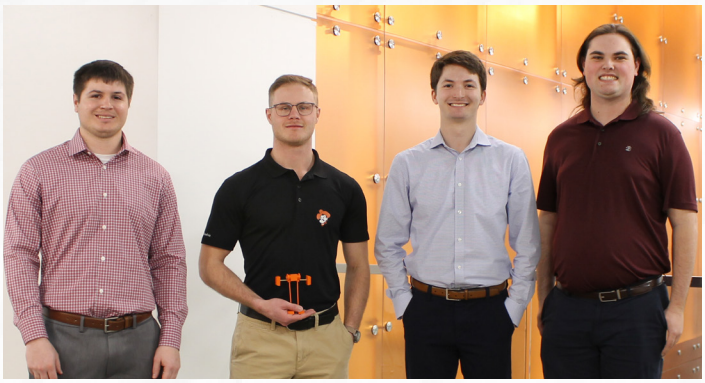
Multi-Axis 3D printing potentially allows for manufacturing of new designs or designs featuring novel spatial properties. A secondary extruding head, placed orthogonally along the frame of the printing body, allows for filament extrusion while possessing 3 degrees of freedom when mounted on an extending arm. The primary arm and print bed retains the 3 degrees of freedom required for the primary print assembly to function. Currently, the print software does not interface between both printer heads simultaneously, so the design is manually sliced before being sent and processed by each printer head individually. Coordination between printer heads is paramount, as collisions between heads will result in loss of print quality and potential equipment damage and failure.

The primary print head first operates until sufficient clearance between the secondary nozzle head and print bed is established. The extended nozzle on the second print head is beneficial for control and maneuverability of the secondary print head while fabricating components with complex shapes.

Early results show potential for multi-axis 3D printing to fabricate complex designs with advanced geometric, spatial and mechanical properties while retaining accuracy during operation of each printer head.

PROJECT: Step by Step (MAE)
ADVISOR: Dr. Jerome Hausselle

Project Video



(Left to Right) Wesley Countz, Joshua Countz, Weston Taylor, Erik Worthen

This project is for a STEAM (Science, Technology, Engineering, Art and Mathematics) camp designed to teach 6-8th grade campers about biomechanics through the construction and racing of passive walkers. We will design passive walkers and a racing ramp to test them, and develop the guidelines to run this activity.

We will design and manufacture 10 sets of modular walkers and then test them using the racing ramp. Kids will be able to chooseamongst various parts to determine the basic properties of their walker (leg length, foot shape, and body mass). The goal is then to race against other walkers to better understand the role of each property on the overall performance of the walkers. The racing ramp will have an adjustable slope and will be sturdy, safe, and intuitive to use. Finally, we will develop the instructions on how to construct walkers and how to use the ramp.

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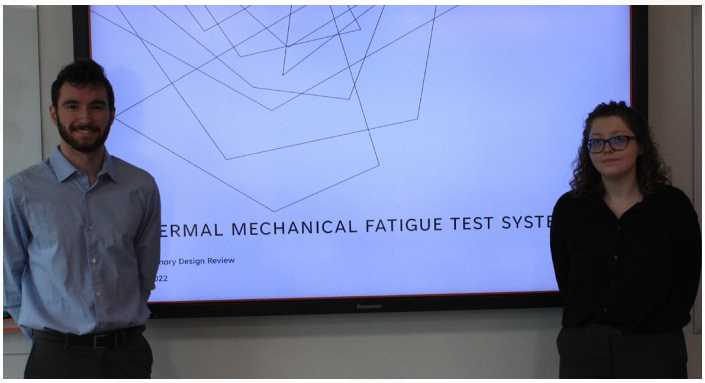
STEAM adventure

BAMM
Biomechanical Analysis & Musculoskeletal Modeling

PROJECT: Thermal Mechanical Fatigue (TMF) Test System for High-Temperature Aerospace Samples (MAE)
ADVISORS: Dr. Dan Fisher, Dr. Hadi Noori

Project Video



(Left to Right) Brandon Bosecker, Lyndsey Murray

The OSU MAE department needs an experimental apparatus to validate Thermal Mechanical Fatigue (TMF) modeling to estimate the lifetimes of aerospace parts and repairs that experience extremely high temperatures. The requirements for this semester's solution are to retrofit an existing tensile test machine with an induction coil heating system, as well as to create a ceramic furnace chamber to encase a metal sample and the induction coil. Inconel 718 sample rods, 85 millimeters in length and 5 millimeters in diameter for the gage section, will be placed in the tensile test machine with the induction coil around the sample and cycled through temperatures of 650°F to 1600°F. This project aims to give OSU unique capabilities in TMF testing, as well as support aircraft gas turbine engine repair development research aligned with workloads at Tinker Air Force Base.

Project Video

PROJECT: Unmanned Aircraft Rocket Assisted Take-Off (RATO), Black Team (MAE)
ADVISORS: Dr. Kurt Rouser, Hayden Glasgow, Tanner Price, Daniel Valesco

Caleb Besmer, Nolan Blueback, Ryan Breish, Tyler Landua, Nethanial Lankford, Javier Lira, Seth Ranta, Reid Rector, Noah Taylor, Brandon York

This design project is intended to retrofit a rocket-assisted take-off (RATO) system to an existing high-speed, turbojet powered unmanned aircraft. The project is a local competition with two teams competing from Oklahoma State University, with students mixing and casting their own solid rocket propellant. The RATO Black Team has gone with a design rationale of one 38 millimeter rocket motor mounted on both the port and starboard side of the fuselage with thrust directly in line with the center of gravity to minimize pitching moment. The aircraft will take off from an angled rail system and reach 150 miles per hour at burnout before the rockets detach from the aircraft. After the rockets detach, the aircraft will be powered by a Kingtech KT30G4+ turbojet engine to cruise at 120 miles per hour. A small engine with a redesigned nozzle was selected to increase fuel efficiency. This design should result in a successful RATO system capable of achieving all of the design requirements while staying within rules and regulations of the competition.

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BERRY AVIATION, INC
AN ACORN GROWTH COMPANY

Project Video

PROJECT: Unmanned Aircraft Rocket-Assisted Take-Off (RATO) System, Orange Team (MAE)
ADVISORS: Dr. Kurt Rouser, Hayden Glasgow, Tanner Price, Daniel Valesco

(Left to Right) Taylor Dobbs,amir Khouri, Brayden Cherrington, Taylor Kramer, Romain Bailey, Ben Kinkaid, Jeremiah Turner, Juardon Neal, Kason Clark, Abby Lestina

This design project is intended to retrofit a rocket-assisted take-off (RATO) system to an existing high-speed, turbojet powered unmanned aircraft. The project is a local competition with two teams competing from Oklahoma State University, with students mixing and casting their own solid rocket propellant. For the RATO Orange Team, a KingTech K-55 was selected as the best engine choice to accommodate the RATO system and best meet the needs of the mission profile. This engine is complimented by a single tri-modal 54 millimeter rocket motor, with the propellant for this rocket motor being a Bate's geometry 3-grain motor using ACPC (Ammonium Perchlorate Composite Propellant). By using a single rocket, the design is kept simple and prevents issues with inconsistencies that could occur in a multi-rocket configuration. Furthermore, tri-modal motors are much safer than traditional mono-modal propellants due to the drastic decrease in chamber pressure. In addition to the engine and rocket, the RATO system includes a permanently attached airfoil spacer, which was designed to be minimally intrusive and that would have as little effect on the aircraft as possible while being strong enough to withstand the load of the 54 millimeter rocket. The system also possesses a detachable bracket which slides into hooks on the airfoil spacer and was designed in such a way to position the rocket thrust through the center of gravity of the aircraft.

Sponsored by:

BERRY AVIATION, INC
AN ACORN GROWTH COMPANY

PROJECT: Moldy PETs Thermoforming Prototyping Tool (MAE OSU-Tulsa)
ADVISORS: Dr. Masoud Allahkarami, Dr. Jay Hanan

(Left to Right) Nathan Dobie, Steven Barber, Kris Cathcart, Rebecca Sommers, George Mantooth

In support of our client, Origin Materials', mission to enable the world's transition to sustainable materials, our team is providing the design, production and testing of a mold to thermoform a PCO 1881 bottle cap from Origin Materials Plant-Based PET Material. The cap will be designed with the carbonated beverage industry as a potential target consumer.among the challenges are to develop a mold and process that will prove viability of utilizing thermoformed PET sheet materials to create a plug seal, thread torque, and tamper evident (TE) feature that meets or exceeds industry standards.

The NaturALL Bottle Alliance, with key members Origin Materials, Danone, Nestle, and PepsiCo., could benefit from a thermoformed PET cap for the bottling industry to supplant a portion of the traditional injection-molded HDPE/PP caps. Quality of material, and a difference in melting point of different materials, causes challenges for recycling traditional injection molded bottle caps along with the PET bottle. Providing a plant-based PET closure that could be recycled along with the container provides a direct contribution to Origin Materials' sustainability goal of reducing the global carbon footprint. By some estimations, the global market for bottle caps is nearly 583.3 billion bottles annually.(PET global bottle production 2021 | Statista)

ORIGIN

PROJECT: Sustainable 3D Printing (FutureFilaments) (MAE OSU-Tulsa)
ADVISORS: Dr. Masoud Allahkarami, Dr. Jay Hanan, Chris Scott

(Left to Right) Miranda Zajic, Matthew Hofstetter, Zachary Cain, Eric Jones, Tyler Stopp, Erick Pepek

Our project tests the viability of using a sustainable 3D printer filament material being developed by Origin Materials, versus a material currently on the market. This includes filament creation through the extruding process from the pellets, with the goal of 3D printing with our made material.

Project Video

PROJECT: The Carpeteers (MAE OSU-Tulsa)
ADVISOR: Dr. Jay Hanen

(Left to Right) Spencer Myers, Trent Springs, Jarrett Denton, Heath Simmons, Alex Dry

The Team Carpeteers project is focused on combining renewable plastic and carpet to produce a desirable composite material, having significantly greater quality than current market product (an example is replacing wooden pallets). The teams goal is also to design a product that has the aim of eliminating plastic and carpet waste in landfills.

Sponsored by:

niagara EST.1963 BOTTLING, LLC

PROJECT: The Fracking Cowboys: Automated Machine or Gauge (MAE OSU-Tulsa)
ADVISORS: Dr. Masoud Allahkarami, Dr. Jay Hanan

(Left to Right) Nikhil Verma, Diontre Morris, Braden Watkins, Catelyn Costner, Chris English

The Fracking Cowboy project is a continuous project that will carry on for a couple of semesters until the project has achieved its full scope. This entails an automated machine that can produce 18,000 pucks a day with high quality and great precision. This semester, our group will be focusing on designing and producing an efficient way to dispense ceramic pills and transport them to the puck. Such a machine already exists in the market; however, it is very costly for our $2,000 budget. Hence this semester, our team will demonstrate the principle of this $7,000 machine that can dispense and transport each pill to the puck at tremendous speed and accuracy. Due to the lack of time (machine is from China) and funding, our objective is to convince Oil States to consider purchasing this $7,000 machine to reduce human errors and labor cost.

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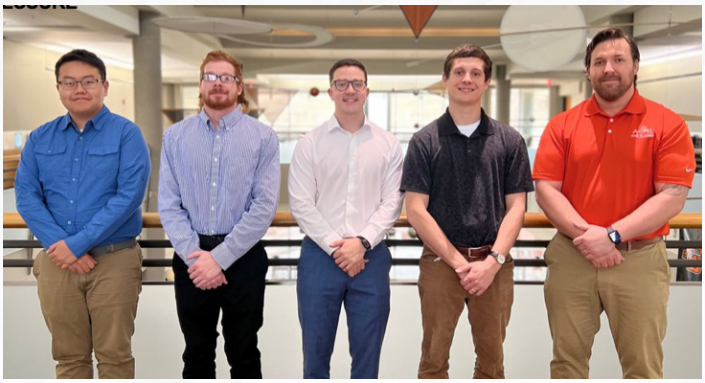
Oil States OIL STATES INDUSTRIES, INC.

Project Video

PROJECT: Under Pressure (MAE OSU-Tulsa)
ADVISORS: Dr. Khaled Sallam, Mr. Chris Scott



(Left to Right) Keezeng Vang, Garrett Olson, Hunter Burchett, Ben Roper, Nicholas Banks

Gasoline, diesel and gas turbine engines all have great qualities. By researching these different engine types we hope to create a more efficient engine, a cleaner environment and longer engine life. Pressure chambers are a valuable tool to research and better understand fuel injection within internal combustion engines. Research to improve the atomization process at different pressures can help discover new possibilities. The purpose of the pressure chamber is to emulate elevated pressure and temperature to test and research fuel injectors. The test chamber design offers extended optical access, longer testing time and easy maintenance.

Sponsored by:

OSU TULSA

Project Video

PROJECT: Advanced Distillation II (CHE, MAE)
ADVISOR: Dr. Brad Rowland

(Left to Right) Jonathan Moran, Ethan Myers, Chloe Schadler

The second iteration of the advanced distillation fixture is a very small lab scale modular distillation column, operating in near total reflux. The column stands on top of a reboiler and can contain a boa art mixture of ethanol and water, or a tertiary mixture of ethanol, methanol and water. The entire column is designed to be easily assembled by students and has multiple operating variables that can be freely changed. The trays will have the ability to take samples of the liquid at each stage, sample the vapor on each stage, record the temperature using RTDs, run a feed or reflux stream into any stage, pull a small vacuum and view the distillation process within each stage.

Sponsored by:

OSU ENDEAVOR
College of Engineering, Architecture and Technology

Project Video

PROJECT: Autonomous Aircraft Rescue and Firefighting Vehicle (EET, MET)
ADVISORS: Dr. Joe Conner, Dr. Avimanyu Sahoo

(Left to Right) Levi Deal, Brian Blackwood, Thomas Zacher, Mitchell Wilson, William Abel, Jacob Jester, Skyler Williams, Cole Horton

Our project is to design an Autonomous Aircraft Rescue and Firefighting (AARFF) Vehicle, which can navigate through a prescribed ground course autonomously, extinguish a pot fire and return to the "fire station" while avoiding obstacles. The AARFF teams will participate in the CEAT Senior Design Expo and Speedfest 2022.

Sponsored by:

HENSON RACING ENGINES

Project Video | Poster Presentation

PROJECT: Flight Data Retrieval and Management (IEM, MAE)
ADVISOR: Dr. Nicholetta Fala

(Left to Right) Jacob Meysing, Ryan Hiatt, Katrina Sabatelli

The OSU Flight Center has been recently searching for a solution for storing and sorting their aircraft's flight data. These aircraft log flight data through onboard computers and store the data on SD cards. The data collected includes information about flight altitudes, navigation and the engine. Airport personnel can use the data to facilitate training of student pilots and maintain the aircraft. Previously, the method of copying and managing the data was tedious, resulting in the data being unused. The objective of this project is to design and build a fully-enclosed and user-friendly device that facilitates the uploading, storage and downloading of flight data. The Flight Data Apparatus is a device designed and fabricated by our group to meet this objective. The device consists of two configurations, a desk mount and kiosk, that create an ergonomically modular design. The interface of the device is intuitive and easy to use. A touch screen will show two options to upload or download the flight data. When the user taps on the upload button the data is copied to a hard drive within the device. If the user wishes to download, a USB flash drive must be inserted into the USB port and then the download button will be tapped. The Flight Data Apparatus significantly simplifies the process of copying and managing the data retrieved from the aircrafts while including the option of expandability in the near future.

Project Video

PROJECT: FoosBots (ECE, MAE, MET)
ADVISORS: Dr. Joe Conner, Dr. Gary Yen

(Left to Right) Cole Mitchell, Garrison Locke, Alex Rivera, Jackson Law, Slayter Teal, Hunter Collins, Johnny Enriquez, Michael Thompson, Jonathan Harris, (not pictured: Kenny Gipson)

The primary objective of this project is to turn foosball into an arcade game that can be played by one or two players. Our goal for this project is for the table to be used as a teaching tool for future OSU students at a variety of different collegiate levels. The central focus of our design is modularity so that future OSU students can quickly and easily get up to speed on the work we have done and make modifications of their own. We will achieve this by designing the table in such a way that components and software packages are easily interchangeable. This will allow future teams to create more advanced AI software, use a different camera or even replace the actuators with another configuration.

Project Presentation | Project Video

PROJECT: High Speed Assembly Tool-Team Flash (IEM, MAE)
ADVISORS: Dr. Masoud Allahkarami, Dr. Yao Bing, Dr. Jay Hanan, Prof. Laura Southard

(Left to Right) Mohumad Sibanti, Erin Lewis, Dakota Burris, Gage Lehmann, Laura Singletary

The objective of this project is to design a heating system for a high-speed capping device that will heat high density polyethylene caps to 55 degrees Celsius at a rate of 500 caps per minute. The system we have designed will apply direct radiant heat to the sides of each bottle cap. Our system will allow the assembly line to be more efficient and produce fewer defects.

FLASH

Worldwide Contractor's Management

Project Video

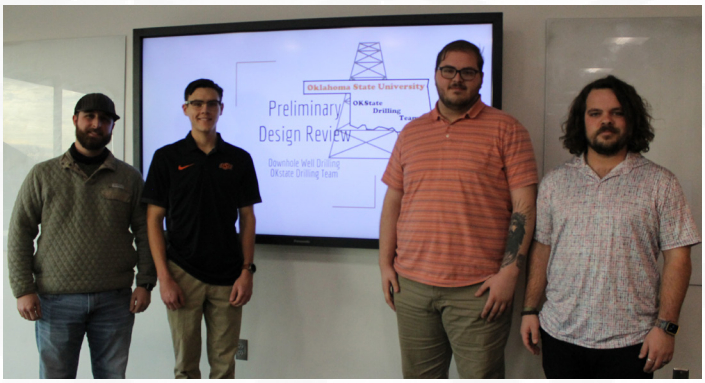
PROJECT: IGVC Drive-by-Wire System for Polaris Gem e2 (ECE, EET, MAE, MET)
ADVISORS: Dr. He Bai, Dr. Rushikesh Kamalapurkar, Dr. Weihua Sheng, Dr. Robert Taylor

(Left to Right) Kenya Williams, Brandon Dang, Collin Thornton, Luke Johnson, Max Minnick, Jacob Schoeling, Samuel Fipps, Derby Whitefield, Tyler Tucker, Levi Weaver

The aim of this project was to create a drive-by-wire system for a Polaris Gem e2 in order to prepare for the Intelligent Ground Vehicle Competition. The goals for this project include controlling the throttle, gear changing, adding a computerized brake system and computerizing the parking brake.

Project Video

PROJECT: Okstate Drilling Team (MAE, MET)
ADVISORS: Dr. Robert Taylor, Dr. Robert Weckler, Prof. Laura Southard, Richard Greenly



(Left to Right) Taylor Groom, Marshall McClain, Harley Kelton, Aaron Houtchens, (not pictured: Gabriel Guerra)

Water4 is a locally-owned business in Oklahoma City, Oklahoma whose mission is to equip people to eradicate their water crisis through faith, empowerment, entrepreneurship and technology. The company is focusing on ending the global water crisis by drilling water wells across Africa. This opportunity will allow individuals a chance of owning a business, and a clean source of water. Not only does the company drill the wells, Water4 is responsible for finding cost effective solutions to water access, sharing hand pumps and designing water systems built from cutting edge technology.

Our team will be communicating with Richard C. Greenly, who is the owner of Pumps of Oklahoma, and founder of Water4. Mr. Greenly has set the goals for our semester's final design project team to optimize drilling rates, specifically 10 feet per hour.

Sponsored by:

OKLAHOMA STATE UNIVERSITY

Water4

PUMPSOK
Real. Friendly. Experts.

Project Video

PROJECT: Spoiler Alert (ECE, MAE, MET)
ADVISORS: Dr. Ryan Paul, Dr. Robert Taylor, Dr. Gary Yen, Prof. Laura Southard

(Left to Right) Erin Matthews, Brian Guthery, Weston Gorham, Carson Elmore, Anthony Corpuz, Cameron Mendoza, Hunter Lowell, C. Tanner Price, Michael Schlotthauer, Levi Penwell, Ian Babb, Kyler Martinez, Gwangmin Kim, Austin Wilkins, Luke Smith (not pictured: Jacob Robbins)

The objective for this project is to develop a dynamic front wing for a Formula SAE car using independently actuated left- and right-wing elements. Making the project active will increase the handling of the car, however, it must be quantitatively proven through a decrease in lap time and/or qualitatively measured by an experienced driver's feedback. The front wing will have both static and dynamic control modes that will be able to be selected while the vehicle is stationary. The package also must be easily removable for testing purposes and for easy integration into future Bullet Racing, Oklahoma State Formula SAE cars.

An aerodynamic package increases downforce, which increases normal force on the tires, increasing grip with the ground. The higher grip increases stability and maximum cornering speeds. FSAE tracks are short and tight, which means that cars typically do not go very fast, so maximizing cornering speed by increasing grip is of the utmost importance. Of interest in these tracks are the slaloms and tight radius turns. In these corners, a vehicle's linear speed is not high, but it pulls substantial lateral g-forces which allows for higher cornering speeds, decreasing lap time.

A natural progression from the above discussion is why it is advantageous to implement an active aerodynamic package as opposed to a static one. Simply put, FSAE cars compete against each other, and any small design advantages can have large impacts on performance. The largest disadvantage of a static aerodynamic package is that it increases drag, which reduces the vehicle's top speed. By utilizing an active aerodynamic package with adjustable-pitch flaps, downforce and drag can be actuated and modulated, optimizing the aerodynamics for any part of the track. High downforce is advantageous for cornering as discussed above, low drag is advantageous for straightaways where maximum grip is not important but linear speed is, and high drag is advantageous for late braking.

An estimated performance gain is expected to be 3.5 miles per hour quicker in a constant radius 30-foot corner. This is calculated by using data from Oklahoma State's FSAE team and comparing that to leaders of recent years FSAE competitions. The best FSAE cars have great suspension and well-developed aero packages; while the objective is not to compete and measure against other teams' suspension set-ups, an increase of about 3.5mph is the objective and expected performance gain.

Project Video

PROJECT: The BB-8 Project (ECE, MAE)
ADVISORS: Dr. Joe Conner, Dr. Weihua Sheng, Zhidong Su

(Left to Right) Joseph Lee, Zi Albert, Daniel Albrecht, Jaci Reichenberger, Youssef Dallaly

The BB-8 Project is a continuation of an independent research project that was undertaken in the summer of 2019. The basis of this project is to create a functional BB-8 robot that mimics the motion of the BB-8 in the Star Wars franchise. This project will continue in future senior design semesters to update the functionality of the system and continue to incorporate more advanced algorithms and mechanisms to create a life-like droid. The end goal of this project is for the BB-8 to be used as a marketing tool for the perspective student office to display the achievements of students in their undergraduate program. This semester, our focus is to use body-hardening techniques to create a more impact and wear-resistant mechanism, but also to create control algorithms to enable a smooth user experience when controlling the BB-8 manually.

PROJECT: Updraft (Comp Sci, ECE, MAE)
ADVISORS: Dr. He Bai, Dr. Christopher Crick, Dr. Jamey Jacob, Dr. Rushi Kamalapurkar, Dr. Blayne Mayfield, Dr. Jim West, Prof. Laura Southard

Project Video

(Left to Right) John Miller, Kyle Shepard, Caleb Goodart, Logan Dounn, Nicholas Goertemiller, Nathan Bates, Andrew Schnell, Chase Wilson, Trevor Morrison, Ryan Vidal, Calleen Zimmer, Sergio Sanchez

The National Science Foundation urges the need for testing drone stability controls under variable wind conditions. These variable wind conditions originate often from large buildings redirecting and disturbing wind, causing abnormally strong gusts in urban regions. For drones and airborne vehicles, this provides a hazard for stability. In a testing environment, this project would provide a tool to test stability, controls and other responses of a drone under gust wind conditions. Such a device would be able to characterize a gust wind at varying angles. Engineers would be able to use this to improve their designs and ensure that such drones won't fail under similar outdoor conditions, especially in urban environments.

The Quadcopter Navigational Testbed is essentially a modular and controllable bed of fans that provide a gust of wind as set to user preferences at varying angles. With this device, one could characterize the gust load desired by velocity profile and angle and fly drones over the gust to test stability responses.

PROJECT: Wair Oxygen Concentrator (ECE, MAE)
ADVISORS: Dr. Masoud Allahkarami, Dr. Jay Hanan, Dr. Weili Zhang, Bamidele Ali

Project Video

(Left to Right) T. Everett Goebel, Stephanie Wallace, Jacob Wallace, Connor O'Donnell

Oxygen concentrators are used as alternatives to oxygen tanks for those with Chronic Obstructive Pulmonary Disease (COPD) who need supplemental oxygen. Our team's goal is to develop a system that is able to provide a steady flow of 80% pure concentrated oxygen at a rate of 4 liters per minute to accommodate those with severe COPD. To be wearable, the device should weigh less than 5 pounds, and be able to fit to a form that is comfortable for the end user. This semester, the project has taken to focusing on developing the system for concentrating oxygen and leaving the project optimization development to future students.

Sponsored by:

Innovative Safety and Performance Solutions, Inc.

PROJECT: Wind Turbine Test Bed (ECE, MAE)
ADVISORS: Dr. Dan Fisher, Prof. Nate Lannan

Project Video

(Left to Right) Marc Noto, Ali Alnuwaysir, Nathan Johnson, Preston Johnson

Our project is designing a vertical axis wind turbine and corresponding energy storage that will be housed on a cart. Attached to the cart will be a learning module that can be used to demonstrate and simulate different load situations. The cart will include a wind source and an enclosure to showcase all of the components. The end goal being an ECEN and MAE teaching tool for CEAT students and patrons.

2022

Saturday, April 23

Gates open at 7:00 AM

Heats begin at 9:00 AM

Awards Presentation at 7:00 PM or earlier if heats are completed.

OSU Unmanned Aircraft Flight Station

(12 Miles East of Stillwater) 4015 N Clay Rd, Glencoe, OK 74032

*NOTE: The best route to the UAFS from any direction, is to take highway 51. Turn North on Clay Rd., and proceed 3.2 miles. The field is on the right.

speedfest.okstate.edu