



COLLEGE OF  
ENGINEERING, ARCHITECTURE  
AND TECHNOLOGY

# SENIOR DESIGN EXPO

Spring 2021 Team & Projects Guide



Friday, April 23  
VIRTUAL

# 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 services. This year has been a trying time for our nation and OSU. However, our college has remained committed to our core land-grant mission.

Our faculty have learned how to deliver content and engage students in the new paradigm. Our students have been resilient and have continued to learn, lead and achieve. They have innovated ways to complete working on complex industry-inspired capstone projects while also following all COVID-19 policy and procedures to keep themselves safe.

We have awarded 1,009 degrees this year 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.

This is an unprecedented time for OSU, the state and the nation, and I am proud to say that CEAT faculty and students rose to the challenge. 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.

I hope that, while we are not able to conduct an in-person expo, you enjoy getting a virtual 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!**

A handwritten signature in black ink that reads "Paul J. Tikalsky". The signature is fluid and cursive, with a long, sweeping underline.

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

# Presentation Schedule

Click project to view presentation

## OSU-STILLWATER PROJECTS

**Wind Turbine Blade Tear Drop Camper (MAE, MET) 9:15 AM-10:15 AM**

**Autonomous Golf Cart (MAE) 11:30 AM-12:20 PM**

**Swerve Drive (MAE) 12:30 PM-1:20 PM**

**Wind Turbine Blade Manipulator/Slicer Tool (MAE) 1:30 PM-2:20 PM**

**Wearable Air Purifier STW (MAE) 11:30 AM-12:20 PM**

**Phased-Array-Based RF Wireless Power Transfer System (ECE) 2:00 PM-3:00 PM**

**High-Tech Sustainable Electric UTV (MAE, ECE, EET) 2:30 PM-4:30 PM**

**Hypogravity Simulator Redesign (MAE) 11:30 AM-12:20 PM**

**Wearable Air Purifier STW (MAE) 11:30 PM-12:20 PM**

**Flexible Heat Exchanger Test Setup (MAE) 1:30 PM-2:40 PM**

**OSU High Efficiency Furnace Heat Exchanger (MAE) 2:40 PM-4:00 PM**

**Stillwater Decompression Chamber (MAE) 2:30 PM-3:20 PM**

**Autonomous Stage Wagon (ECE, ME) 3:30 PM-4:30 PM**

**Fuel: Autonomous Aircraft Rescue and Firefighting Vehicle 4:30 PM- 5:00 PM April 27**

**Asfixyators: Autonomous Aircraft Rescue and Firefighting Vehicle 5:00 PM-5:30 PM April 27**

## OSU-TULSA PROJECTS

**Wearable Air Purifier TUL (ME) 12:30 PM-1:20 PM**

**Wind Turbine Blade Repurposing-Bus Stop Shelter (ME) 1:30 PM-2:20 PM**

**Composite Overmold (ME) 5:00 PM-5:50 PM**

**High Speed Assembly (ME) 6:00 PM-6:50 PM**

**Fish Decompression Chamber TUL1 (ME) 3:30 PM-4:20 PM**

**Fish Decompression Chamber TUL2 (ME) 4:30 PM-5:20 PM**

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**[www.facebook.com/SpeedfestUSA](http://www.facebook.com/SpeedfestUSA)**

**Speedfest Black Team Video**

**Speedfest Orange Team Video**

# Table of Contents

BAE .....	5
CHE .....	7
CIVE .....	8
DET .....	11
ECE .....	13
IEM.....	13
MAE .....	17
OSU-Tulsa ME.....	21
Interdisciplinary.....	24

**PROJECT:** HydroLogical Solutions (BAE)

**TEAM:** Hydrological Solutions

**ADVISORS:** Dr. Michael Buser, Dr. Sherry Hunt, Josh Phillips, Chris Stoner, Dr. Paul Weckler



Courtney Andrews



Seth Durham



Roy Haden



Preston Lee



Rosie Rosales



Josh Taber



Cameryn Taylor



Jordan Williamson

The United States contains numerous bodies of water that have been created or altered by the use of man-made dams. Throughout these reservoirs, there are various dams that are classified as “high-risk”. In the event that one of these dams were to fail, significant loss of life and property could take place. These “high-risk” dams would benefit from closer observation and monitoring to mitigate, or entirely prevent, such a devastating event.

In response to recent flooding that has occurred in Stillwater, Oklahoma and the surrounding area, HydroLogical Solutions has developed a prototype of a water level monitoring system that collects data from a local dam site and transmits the data

to an online information platform. The information platform has a user-accessible dashboard and provides real-time data from the monitoring site.

**Sponsored by:**



United States Department of Agriculture

**Agricultural Research Service**



United States Department of Agriculture

**Natural Resources Conservation Service**

**Poster Presentation**

**PROJECT:** Reach Water (BAE)

**TEAM:** Reach Water

**ADVISOR:** Dr. Paul Weckler



Jacob Auer



Will Ellison



Matt Studyvin



Our team, Reach Water, has been tasked with improving a currently-existing water well drilling unit to ensure it is able to drill through multiple types of soils and rock at a consistent rate of ten feet per hour. To accomplish this, we have made several minor adjustments to the instruments and components of the machine and undergone many hours of testing to better understand how to optimize the drilling process. Specifically, we have analyzed things such as power requirements,

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**Poster Presentation**

**PROJECT:** Guadalupe-Blanco River Stream Trailer (BAE)

**TEAM:** Guadalupe-Blanco River Stream Trailer

**ADVISOR:** Dr. Paul Weckler



Sage Counts



Natalie Hodde

Due to financial constraints, primary and secondary schools do not always have the capability to take students to on-site field trips. Our design is intended to provide students with the same educational experience without requiring schools to travel. Our team has partnered with the Guadalupe-Blanco River Authority to design an educational unit that highlights the Guadalupe Bay area, including its ecosystem, geography, and relationship with people. This unit will be a mobile exhibit that can be easily transported and operate independently. It is an enhanced stream trailer that will feature infographics as well as interactive and sensory elements, to provide students with the opportunity to learn the information and then apply it. Some of the interactive features include a 3-D model of the bay, touchscreen displays and electronic games.

**Poster Presentation**

**Sponsored by:**



**PROJECT:** Tatonka Innovations (BAE)

**TEAM:** Tatonka Innovations

**ADVISOR:** Dr. Paul Weckler



Sydney Cannon



Min Yeop Kim



Trinity Smith



The senior design team, Tatonka Innovations, has been tasked to design a livestock chute for Tonkawa Processing Corp. Tonkawa Processing Corp is a small meat processing facility located in Tonkawa, Oklahoma. As a recipient of a COVID relief grant designed to provide supply chain improvements during the pandemic, they have decided to construct all new facilities and have enlisted help from Oklahoma State University faculty and

students. The designed chute will be able to accommodate almost all sizes of goats, sheep, swine, cattle, and bison. Implementation of the design will allow for small processors to use innovative technologies to be conduct safe and efficient animal handling to occur during the stunning process in harvest.

**Poster Presentation**

**Sponsored by:**



**PROJECT:** Watercraft Radar Tower (BAE)

**TEAM:** Watercraft Radar Tower

**ADVISORS:** Ben Alexander, Dr. Paul Weckler



In the last several years the price of radar technology has declined, making it more affordable to consumers on the market. One of the most popular uses for these radar systems is for boat navigation. Modern GPS systems along with the far-reaching scan of a radar has given leisure boaters the ability to cruise at night or in rough conditions with safety. PLC Marine, LLC has partnered with Oklahoma State University and the senior design team Extended Marine Solutions to provide an aesthetically pleasing multi-functional mounting solution for radar navigation and guidance systems on pleasure craft.

In this project, the team is attempting to design and build a prototype for an extendable and retractable telescoping radar tower which supports a marine radar and GPS system as well as recreational accessories. The tower is to be designed to fit into the base plate already present on most watercrafts and attach to the ski pylon on the back of smaller marine craft such as pontoons. It is essential that the tower extends beyond 9 feet. Additionally, it should have enough strength to lift the upper section with the radar system along with these attachments. If within reason, the tower design should have space available for future attachments such as lights, speakers, and cameras.

**Sponsored by:**

PLC Marine, LLC | Mr. James Moore | Mr. Pat Carrell

**PROJECT:** Chem-E-Car Competition (CHE)

**TEAM:** Hydro-Bond

**ADVISORS:** Gary Allen, Dr. Brad Rowland



Our vehicle (Hydro-Bond) will compete in AIChE's annual Chem-E-Car competition. Hydro-Bond uses the power generated from the hydrogen reaction to propel itself. The reaction is a mixture of sulfuric acid ( $H_2SO_4$ ) and ( $NaBH_4$ ). Molecules of hydrogen ( $H_2$ ) then flow up from the 250ml glass reactor through a silicon tube into Hydro-Bond's 5-cell TDM Flex Stack fuel cell. Oxygen ( $O_2$ ) is feed into the fuel cell through a fan located underneath the fuel cell. Hydrogen molecules enter at the Proton Exchange Membrane's (PEM) and are stripped of their electrons. Oxygen molecules pass the PEM and to the cathode which force electrons through a circuit generating electricity. The fuel cell can consume up to 3,300 cc per minute of hydrogen which can produce 5 to 7.5 watts. This power is then used

to power the 9V DC motor on the vehicle. This electricity is then converted into torque which in turn rotates the wheels of Hydro-Bond.

**Sponsored by:**



**PROJECT:** Chem-E-Car (CHE)

**TEAM:** We Hope It Works

**ADVISORS:** Gary Allen, Dr. Sundar Madihally, Dr. Brad Rowland



Becky Chvatal



Riley Dunham



Devin Hirner



Jarel Miller

We designed, built, and calibrated a shoe boxed sized car that is propelled and stopped by chemical reactions only. Our car employs an electro-chemical battery pack of manganese-zinc reactions for propulsion, and comes to a halt with an iodine clock that cuts the power after a given time, depending on concentration. With these two reactions we are able to launch our car and have it come to a halt at a requested distance. Utilizing the ENDEAVOR facility, we 3D printed, laser cut, and machined all of the parts for our car such as the chassis, battery containment, gears, and wheels. This project exercised skills such as time management, patience, persistence, and teamwork.

battery containment, gears, and wheels. This project exercised skills such as time management, patience, persistence, and teamwork.

## Project Video

Sponsored by:



**PROJECT:** OSU Water Treatment Plant Drinking Water (CIVE)

**TEAM:** Clearest Consultants

**ADVISORS:** Dr. Norb Delatte, Dr. Jorge Gonzalez Estrella, Dr. Greg Wilber



Jumanah Alsaleh



Dominique Barnes



Olivia Bunch



Dawniece Ford



Kendra Hess

The Oklahoma State University Water Treatment Plant experiences taste and odor complaints insummer months. The taste and odor issues have been reported to last from 7-10 days up to 3 months, with the issue increasing in duration in recent years. The

quality problem is believed to be a result of increased Geosmin and Methyl-Isoborneol (MIB) concentrations in Lake Carl Blackwell, the source water, during the increased temperatures of summer months. These compounds are terpenes associated with algae- while not harmful to human health once treated, the organics are highly aromatic and volatile even after treatment.

The team focused on removal of geosmin and MIB instead of source-water mitigation. Although removal of algae and cyanobacteria at Lake Carl Blackwell would decrease the geosmin and MIB, reducing the taste and odor issues, that is environmental remediation which is outside of the client's interests. Treatment will only take place at the OSU Water Treatment Plant (WTP). Current water treatment processes that are successful at geosmin and MIB removal were compared. Three possible treatment processes are presented to the client for review:

1. Granular activated carbon (GAC) addition to rapid sand filter beds
2. Powdered activated carbon (PAC) added as slurry directly to water
3. Oxidation with or without UV

**Sponsored by:**

OSU Water Treatment Plant | OSU Energy Services | Dr. Cristian Contreras Nieto

**PROJECT:** OSU Steam Tunnel Assessment and Repair Design (CIVE)

**TEAM:** Steamy Inc.

**ADVISORS:** Dr. Norb Delatte, Dr. Greg Wilber



Elizabeth Klumpp



Shannon Landreville



Kyler Wattenbanger



Wanying Zheng

The purpose of the project is to assess the structural integrity of the steam tunnels under Oklahoma State University (OSU). The steam tunnels are constructed of concrete, lined with pipes, and provide utilities to the campus. Because they were built in segments, the ages of tunnels are different, and they do not always connect. The main problem with the tunnels is due to the structural deterioration that comes with age such as corrosion and general deterioration of the concrete as well as utility leaks. The members of the team will

enter various tunnels and provide a structural assessment report to OSU Energy Services that will include recommended rehabilitation methods with applicable costs.

**Sponsored by:**

OSU Utilities Distribution | OSU Energy Services

**PROJECT:** OSU Stormwater System Upgrade Design (CIVE)

**TEAM:** Smarbertson Solutions

**ADVISORS:** Dr. Norb Delatte, Dr. Mark Krzmarzick, Dr. Greg Wilber



Jose Garcia



Alexis Jergenson



Cole Roberts



Caleb Smith

Our team's project is located in Stillwater, Oklahoma. The cross streets are Western road where it turns into Hall of Fame Ave and Farm road. Specifically along Farm road, we need to analyze the storm sewer hydrology and pipe network around the area. The reason we need to analyze this area is because this street experiences extreme flooding when a heavy rainstorm enters Stillwater. This leads to problems for the nearby infrastructure and the roads safety for the public. Smarbertson Solutions

needs to identify the best solution to prevent flooding in the area in the most economical way.

We will also look at the areas surrounding infrastructure to develop solutions that are realistic and constructable to fix the issue. To ensure that our solution will work, we will check how our solutions impact the area by utilizing the software known as the Stormwater Management Model by EPA.

**Sponsored by:**

OSU Utilities | Dr. Cristian Nieto

**PROJECT:** Booker T. Washington School Flood Team (CIVE)

**TEAM:** Booker T. Washington School Flood Team

**ADVISORS:** Dr. Laura Arata, Dr. Norb Delatte, Emily Duncan, Jorge Chavez Enriquez, Dr. Greg Wilber



Jackie Fuller



Stephanie Nwakoby



Garrett Willis



Loyd Spaugy

Segregation occurred in Stillwater, Oklahoma from the late 1800s until 1956. There were no high schools for African American students to attend in Payne county until Booker T. Washington built a high school around 1936. The original gymnasium is still standing in Stillwater on 12th street. Booker T. Washington School had high school students attend until 1956, two years after the Brown vs. Board of Education supreme court decision. B.T.W. students were then integrated into the

Stillwater Public School System. The school was then used as office spaces and temporary housing until 2007, and now sits vacant.

In order to reach the end goal of restoring this building, honoring the community this building represents, and reconciling this part of Stillwater's history, a large part of this project was researching and describing the current state of the land and flood patterns. The objective for the B.T.W Flood team is to report the current conditions of this land area and propose flood mitigation solutions to make the land area usable to reduce future flooding of the former Booker T. Washington School in Stillwater, Oklahoma.

**PROJECT:** Design for Wind Turbine Blade Re-purposing (CIVE)

**TEAM:** WB Engineering

**ADVISORS:** Jim Beckstrom, Dr. Norb Delatte, Dr. Mohamed Soliman, Dr. Greg Wilber



Conley Adams



Abdullah Husain



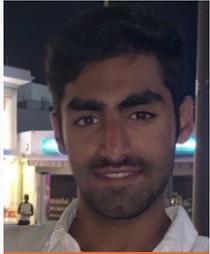
Christian Branch

This is the second phase of a multi-semester series of projects aimed at finding commercial uses of used commercial wind turbine blades. The blades are fiber reinforced plastic (FRP) with structural foam and wood, nominally 100 feet long and weigh approximately six tons. This will require cutting samples from the blades and testing materials for physical, mechanical and chemical properties.

**PROJECT:** Booker T. Washington School Structural Assessment and Repair Design Team (CIVE)

**TEAM:** Extreme Engineering Consultants

**ADVISORS:** Dr. Laura Arata, Dr. Norb Delatte, Emily Duncan, Jorge Chavez Enriquez, Dr. Greg Wilber



Hussain Baqer



Haydn Leatherland



Guillermo Martinez



Jonathan McGill

Segregation occurred in Stillwater, Oklahoma from the late 1800s until 1956. There were no high schools for African American students to attend in Payne county until Booker T. Washington built a high school around 1936. The original gymnasium is still standing in Stillwater on 12th street. Booker T. Washington School had high school students attend until 1956, two years after the Brown vs. Board of Education supreme court decision. B.T.W. students were then integrated into the

Stillwater Public School System. The school was then used as office spaces and temporary housing until 2007, and now sits vacant.

This report is a full analysis of the current state of the Booker T. Washington School located at 619 W 12th Ave, Stillwater, OK. Extreme Engineering Consultants has been tasked with determining the structural integrity of the school. This report will cover the findings, data analysis, alternative analysis and their final recommendation that the team of civil engineering students has gathered from their site visits. It is understood that the client's primary goal is to have the Booker T. Washington School recognized as a historical landmark to some degree. Extreme Engineering Consultants will provide an assessment of the structure and report it to the best of their ability for the client to use it as supplementary material for the client's bid to have the school recognized.

**PROJECT:** Small Capacity Refrigerant Pump (DET, MET)

**TEAM:** Small Capacity Refrigerant Pump

**ADVISOR:** Dr. Ilchung Park



Matt Hartshorne



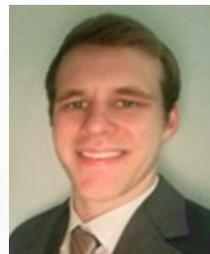
Joe Maehs



Bryant Messerli



Cooper Parsons



Hank Shultz



Ben Worwag

This project will develop refrigerant pumps to be used for various HVAC&R small scale heat transfer experimental setups. For this capstone design project, our team will design, build and test a small capacity pump. These pumps will be used in a follow up senior design project that will develop a small capacity refrigerant calorimeter for testing of heat exchanger samples.

[Project Presentation](#)

[Project Video](#)

Sponsored by:



**PROJECT:** Autonomous Aircraft Rescue and Firefighting (AARFF) Truck (DET, EET, MET)

**TEAM:** Axfixyators

**ADVISORS:** Dr. Jeeyeon Hahn, Dr. Avimanyu Sahoo



Mohammed Alfaihan



Kody Anderson



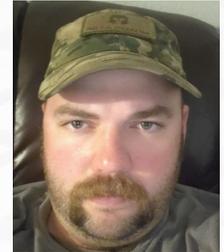
David Chuning



Tim Hardick



Larry Hutcheson



Beau Malloy



Turner McCoy



Anthony Mlca



Joshua Stevens



John Watson

The team will 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 teams will complete building the AARFF truck and participate in Speedfest 2021. The maximum budget limitation for the vehicle is \$3000 excluding the cost of provided parts. The vehicle will be electric powered with two batteries (6000 mAH max capacity). The wheel base can be a maximum of 22 inches. The vehicle will carry a fire extinguishing mechanism capable of extinguishing a Jet A fuel.

**PROJECT:** Autonomous Aircraft Rescue and Firefighting (AARFF) Truck (DET)

**TEAM:** Fuel

**ADVISORS:** Dr. Jeeyeon Hahn, Dr. Avimanyu Sahoo



Mustafa Alfakih



Alejandro Becerra



Coleman Briscoe



Kye Collins



Michael Davidson



Chris Gosie



Kyle Griffith



Blaine Harris



Trevor Janda



Zeke Leyba

The team will 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 teams will complete building the AARFF truck and participate in Speedfest 2021. The maximum budget limitation for the vehicle is \$3000 excluding the cost of provided parts. The vehicle will be electric powered with two batteries (6000 mAH max capacity). The wheel base can be a maximum of 22 inches. The vehicle will carry a fire extinguishing mechanism capable of extinguishing a Jet A fuel.

**Project Video**

**PROJECT:** Phased-Array-Based RF Wireless Power Transfer System (ECE)

**TEAM:** Phased-Array-Based RF Wireless Power Transfer System

**ADVISORS:** Dr. Wooyeol Choi, Dr. Ickhyun Song



Dhyaa Alkhamees



Raed Alnassir



Brock Hogan



Khalid Nadhreen

Near-field power transfer and energy harvesting is used for cell phone apps requiring low-level power transfer over small distances. This project will demonstrate directed higher-power RF energy transfer over greater distances. You can imagine a base station dynamically delivers power to remote drones. Tentatively, the transmitter side will implement a four-element array with a beam steering function, an antenna, a power amplifier, and a phase shifter. The receiver has a rectifier and some LED's to

demonstrate the wireless power transfer. This will result in the ability to provide highly-directional power transfer between two devices.

**PROJECT:** Cost-effective Freight Carrier Selection for ArcBest (IEM)

**TEAM:** Cost-effective Freight Carrier Selection for ArcBest

**ADVISORS:** Dr. Baski Balasundaram, Michael Foss



Cade Phelan



Torie Richardson



Kaustavi Thapa

This project concerns ArcBest's managed transportation service in which they manage the customer's freight as a third-party logistics company. A major component of this service consists of determining which carriers will fulfill the customer's shipments. To do this, ArcBest meets with the carriers to negotiate rates for the customer by using various shipment data. The carriers then bid for the freight at the shipment level, and the bid data is used to determine the most cost-effective contract for the customer that allows for the largest profit margin for ArcBest.

The overall objective of this project is to develop a new methodology for the carrier selection process that incorporates the customer shipment data and the carrier-provided shipment rates to determine a selection of carriers for each of the customer's shipments at minimum cost to the customer. We will use the tools we acquired from Operations Research to formulate an integer program that takes in bid data as input parameters and implement it using Python and Gurobi.

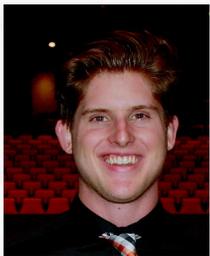
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**ArcBest**  
More Than Logistics™

**PROJECT:** MUSC: Workload Balanced Surgeon Scheduling (IEM)

**TEAM:** MUSC: Workload Balanced Surgeon Scheduling

**ADVISORS:** Ashley Estes, Dr. Farzad Yousefian



Trent Darby



Bailey Hackler



Gloria Flores Morales



Courtney Williams

The Medical University of South Carolina (MUSC) is the state's only comprehensive academic health science center. There are more than 2,000 students studying in six colleges (Dental Medicine, Graduate Studies, Health Professions, Medicine, Nursing, and Pharmacy). MUSC provides residency training for over 750 graduate health professionals and is comprised of approximately 1,425 full-time and 300 part-time faculty.

The focus of this project is on the operating room scheduling of general surgeons within the College of Medicine. There are 16 surgeons in the three divisions within the scope (Colorectal, GI, Oncology), all of which are allocated blocked time during the week. The project will explore the development of systematic scheduling tools that balance surgeon workload and improve overall access.

Sponsored by:



**PROJECT:** OnCue Supply Chain Project (IEM)

**TEAM:** OnCue Supply Chain Project

**ADVISORS:** Bill Duesday, Dr. Tieming Liu



Emmanuel Akinwale



Manas Kakade



Cole Luetkemeyer



Matthew Wilkinson

OnCue is a local chain of gas-station convenience stores. They started operations as a family-owned business in 1966 and have since grown to 75 locations across the state, hiring over a thousand employees. 'Red Rock Bakery' is a Stillwater restaurant that has the same parent company as OnCue. Our senior design team was tasked with the project of finding new products, some possibly made in-house by OnCue subsidiary Red Rock Bakery, that could improve profits over the current alternatives.

We were to also find methods by which their distribution system for these products could be optimized.

OnCue likes to classify its stores mainly into two types, based on the distribution network and the time they were opened. The 'Heritage Stores' were the original 18 stores around Stillwater and the surrounding area, and the 'Metro Stores' around OKC and its suburbs. The company is growing and expanding to areas outside of Oklahoma and this means that they have to be more competitive in their industry in procurement, distribution logistics and their in-house production. The key focus is in-house production because research shows that their major competitors produce 75% of the products they offer in their stores so this project helps OnCue identify and evaluate the products that will further the company's competitive edge in this area.

Sponsored by:



Project Presentation

**PROJECT:** Scheduling Optimization at Ameristar Fencing (IEM)

**TEAM:** Scheduling Optimization at Ameristar Fencing

**ADVISORS:** Dr. Juan Borrero, Tom Saunders



Lily Anthony



Abbey Berrey



Sara Humphrey



Mallory Newell

Ameristar is an industry-leading fence manufacturing company. Ameristar has a highly-functioning plant. They have a vast catalog of fencing options including options for special orders. Having all different types of orders requires intensive scheduling so we will be evaluating the scheduling in the Montage department. The Montage department is the second main step in which the fence pickets are assembled into panels. The Montage department has four machines to fulfill the work. We are looking

to optimize the usage of each machine in order to avoid purchasing new equipment. Since there are so many variations of orders, the machines have to switch out parts to cater to the different orders, adding down time for the switch out. We will be looking at the scheduling of these products and the way to find the scheduling with the smallest down time and optimal number of orders produced daily.

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**AMERISTAR®**

**ASSA ABLOY**

**PROJECT:** Storeroom Layout Improvement for Webco's Southwest Tube Division (IEM)

**TEAM:** Storeroom Layout Improvement for Webco's Southwest Tube Division

**ADVISOR:** Dr. Manjunath Kamath



Matt Burchard



Don Chasteen



Austin Lucas

Webco Industries is a leading tube manufacturer that competes globally by responding quickly to customer needs and prioritizing efficiency. Webco has identified their manufacturing floor storeroom in their Southwest Tube division in Sand Springs, Oklahoma as an opportunity for improvement. With over 5,000 SKUs, the storeroom would benefit from an intentional layout that allows the attendant to quickly locate required items and provide a higher level of customer service to workers. Our team is incorporating facility layout techniques and ergonomic analysis to produce an improved storeroom layout that will identify a new item placement for high usage and high criticality items.

Sponsored by:

**WEBCO**  
INDUSTRIES

**PROJECT:** Federal Aviation Administration Data Analytics (IEM)

**TEAM:** Federal Aviation Administration Data Analytics

**ADVISORS:** Kevin Doeksen, Dr. Bing Yao



Miranda Almen



Amrit Chugani



Aspen Dixon



Erik Andino Mejia

The Federal Aviation Administration's mission is to provide the safest, most efficient aerospace system in the world. The FAA is the agency within the United States Department of Transportation responsible for promoting civil aviation through the regulation and oversight of the National Aerospace System. One primary function within the FAA under the Civil Aviation Registry (Registry) is to develop, maintain, operate, and deliver services related to the registration of U.S. aircraft and the

certification of airmen. The Registry project undertaken by this OSU Industrial Engineering senior design team is to analyze aircraft registration documentation data from 2015 to 2020 and provide feedback on the impact of COVID-19 on aircraft registration. COVID had a significant impact on the aviation industry, and the Registry is interested in information that could better prepare them for similar national crises and to assist the Registry in the design and implementation of their new web-based services set to be released in October 2021. The senior design team will take the 6 years of service documentation data and deliver a descriptive and predictive analysis which will inform the Registry on how improve their services.

**Sponsored by:**



**PROJECT:** J.B. Hunt Driver Fleet Scheduling (IEM)

**TEAM:** J.B. Hunt Driver Fleet Scheduling

**ADVISORS:** Dr. Austin Buchanan, Bill Dueuease



McKenzie Goudy



Chad Henderson



Brandon McKisick



Abby Revoir

J.B. Hunt is one of the largest transportation companies in North America. Our team's project will be with the Dedicated Contract Services (DCS) division. Every week, a list of tours and drivers are provided to a J.B. Hunt planner. Our team is responsible for creating a scheduling tool that matches the tours with drivers based on various constraints. This scheduling tool will be replacing the manual matching process currently used by the planners. The tool will be designed to maximize the tours accepted and will

provide the benefit of drastically decreasing the time spent each week matching tours and drivers. We will be using operations research concepts to build an optimization model that completes the matching process.

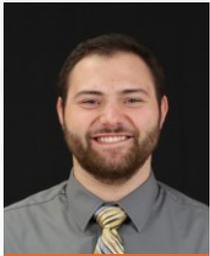
**Sponsored by:**



**PROJECT:** Hypogravity Simulator Redesign (MAE)

**TEAM:** Hypogravity Simulator Redesign

**ADVISOR:** Dr. Jerome Hausselle



Stephen Gibson



Nathan Hodges



Emalee Hough



Aaron Linscott

With increasing space exploration, more research needs to be conducted on how reduced gravity affects the body, long term. The hypothesis behind the simulator is that reducing the amount of loading on the body, due to hypogravity, will cause loss in bone mass. This, in turn, would increase the risk of fracture when back on Earth. This simulator will be used to find the difference in muscle and joint forces to be put into a model that can predict long term effects which will be used to develop better training plans

for astronauts before and after they journey into space. The Hypogravity Simulator project for this semester involves weight reduction and stability enhancements on the previous design as well as a new exoskeleton.

[Project Video](#)

[Learn More](#)

**PROJECT:** OSU High Efficiency Furnace Heat Exchanger (MAE)

**TEAM:** OSU High Efficiency Furnace Heat Exchanger

**ADVISORS:** Dr. Aaron Alexander, Dr. Christian Bach



Hassan Alhassan



Mohammed Bin Amer



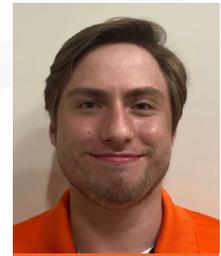
Hayden Bullinger



Mitchell Krause



Denver Long



Thomas Martinson



Zach Pfeifer



Kaden Rackley



Jacob Schimmels



Trysen Willits

Johnson Controls Inc has approached OSU for a study on a 30,000 Btu/Hr in-home furnace unit. This study will monitor the changes in dew point temperature between the inlet and outlets of the high efficiency section of the heat exchanger to be modeled and improved. Condensate flow will be monitored to back up the engineering energy balance equations to ensure the calculations are correct. To accomplish this study, extensive research has been done to develop a system that will create a "flue gas" similar to what will be measured in the industry application. This system entails inline air heaters, a custom-made air humidifier, and then a small-scale test section including fins in a custom made cooling duct to give us our desired conditions.

Sponsored by:

[Project Presentation](#)

[Project Video](#)



**PROJECT:** Stillwater Decompression Chamber (MAE)

**TEAM:** Stillwater Decompression Chamber

**ADVISOR:** Tyler Worden



Aaron Corona



Abby Haddox



Zane Peckenpaugh



Matt Russell

Deep water fish can experience adverse health effects where their swim bladder expands, causing their stomach to protrude out of their mouth and eyes. Typical treatments for this illness can be invasive and harmful to the fish. An alternate solution would be to depressurize the fish with a hyperbaric chamber. Hyperbaric chambers are enclosed areas where the air/water pressure increases to two or three times higher than normal atmospheric pressure, allowing the lungs of the participant to

gather more oxygen than usual. They can also rid the bloodstream of nitrogen gas bubbles.

Our project objective is to build a mobile hyperbaric chamber for the Oklahoma Aquarium that can generate two to three atmospheres of pressure.

[Project Video](#)

Sponsored by:



**PROJECT:** Swerve Drive (MAE)

**TEAM:** Swerve Drive

**ADVISORS:** Dr. Joe Conner, Jonathan Powers, Laura Southard



Trevor Clark



Jacob Smith

We are creating a swerve unit in order to create fluid omnidirectional movement for a variety of uses. Swerve drive is a drive train that allows for each wheel to orient and drive individually to allow for endless movement options. The initial purpose of our design will be to fulfill the needs of the Autonomous Stage Wagon design team by designing a swerve drive that is contained beneath the loading plane. We also plan to create a design that is flexible and modular so that OSU CEAT can use it for any future projects that require omnidirectional movement.

[Project Video](#)

**PROJECT:** Wearable Air Purifier Stillwater (MAE)

**TEAM:** Wearable Air Purifier Stillwater

**ADVISOR:** Dr. Jay Hanan



Evan Fulghum



Jaden Kasitz



Mason Rinker



Colin Scott



Noah Woods

The uvSABA (Safe Air Breathing Apparatus) is an air purification device born out of innovation needs during the COVID-19 pandemic. This device offers clean air to travelers, families, technicians, or anyone who desires the safety and security

of breathing clean air. The goal of the Wearable Air Purifier -Stillwater (WAPS) Team is to, "improve the interface for (this) wearable air purification project. The team's overall scope of work is to simplify the overall device, reduce noise, reduce cost, and improve ease of use, all while maintaining the functionality of the design. The team's stretch goals that will be met with this final design are incorporating an LED display and safety sensors, making the device usable with a face shield, and implementing USB charging.

**Project Video**

**Sponsored by:**

**Innovative Safety and Performance Solutions**

**PROJECT:** Wind Turbine Manipulator/Slicer Tool (MAE)

**TEAM:** Wind Turbine Manipulator/Slicer Tool

**ADVISORS:** Dr. Joe Conner, Laura Southard



Mohammed Alsomali



Mathew Harmon



Jeremy James



Bosung Kim



Samuel Li



Brady McClendon



Pierce McLaughlin



Evan Wright

The lack of efficient tools to cut wind turbine blades is one of the reasons they end up filling land fields, currently, one common way to repurpose old wind turbine blades is crushing and then shredding them to use in cement production. Our objective is to make a tool specifically designed to cut wind turbine blades in a manner that is cheaper than using common saws, like a chain saw, while also being more time efficient.

**Project Video**

**PROJECT:** Autonomous Golf Cart (MAE)

**TEAM:** Autonomous Golf Cart

**ADVISORS:** Dr. He Bai, Dr. Rushikesh Kamalapurkar



Nick Dool



Joohyeon (jully) Lee



Diego Colón

The autonomous golf cart project has been a multiple-semester project for MAE 4344. The Fall 2020 team implemented two automatic kill switches and developed the steering wheel system. The safety features are implemented, and the Spring 2021 team aims to achieve autonomous driving in a structured environment comparable to SAE level II autonomy, also referred as partial driving automation.

The following are the main goals of our objective:

1. Lane tracking
2. Adaptive cruise control
3. Emergency braking

All team members in the project are highly interested in controls engineering and wanted to be involved in the project to be able to design controllers and implement them.

## Project Video

**PROJECT:** Flexible Heat Exchanger Test Setup (MAE)

**TEAM:** Flexible Heat Exchanger Test Setup

**ADVISORS:** Dr. Christian Bach, Dr. Dan Fisher, Damon McClure, Saad Saleem, Scott Sancers, Dr. Rong Yu



Sami Alabbad



Austin Fulmer



Bipin Kafle



Lauren Moriarty



Tucker Wilson

The Design System will support the Center for Integrated Building Systems project 21-05, led by PI Dr. Bach. The research being done is on environmentally friendly refrigerant, which will be key to reducing our footprint on the environment. This duct work system

will be used to test said refrigerant through coils of different geometries. Our task is to design and build a modular duct system that is capable of testing coils that are +/- 6 inches of the 48"/72" coil that we have been given while still being able to accurately run tests on the air entering and exiting the coil.

## Project Video

Sponsored by:



**PROJECT:** Composite Overmold (OSU Tulsa - ME)

**TEAM:** Composite Overmold

**ADVISORS:** Siddhesh Chaudhari, Dr. Jay Hanan, Clinton Switzer, Dr. Ranji Vaidyanathan



Justin Fisher



Jacob Mills



Jake Rader



Chris Scott



Jessie Wright

Our goal with this project is to make polymeric composites using resins from bottling operations and whole recycled carpet as reinforcement. This will be achieved through the designing and machining of a new mold from aluminum to meet the size requested

by our customers for their test requirements. We intend to further improve the takt time in the current process. After ensuring the test mold preforms as intended and improves the process, we plan to make another mold from steel to improve the cycle life of the mold. The making of this composite will use two of the largest waste products in landfills today. If this process can be improved to be a cost-effective solution, the result will compete in the market as an alternative to wood. This composite has a lot of potential.

[Project Video](#)

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**PROJECT:** Decompression Chamber (OSU Tulsa - ME)

**TEAM:** Tulsa Team 1

**ADVISOR:** Tyler Worden



Rian Fuller



Trevor Phillips



Micah Rogers



Emily Rose



Andrew Westbrook

This project is a decompression chamber for the Oklahoma Aquarium. Currently, the Oklahoma Aquarium does not have a decompression chamber to treat fish with barotrauma. The decompression chamber may also be used to perform

demonstrations of the chamber in action to educate guests from a STEM perspective. The chamber is designed to pressurize up to 3 atmospheres while still circulating water to maintain oxygen and temperature.

[Project Video](#)

Sponsored by:



**PROJECT:** Decompression Chamber (OSU Tulsa - ME)

**TEAM:** Tulsa Team 2

**ADVISORS:** Dilli Dhakal, Pralhad Lamichhane, Tyler Worden



Tyler Cleveland



Matt Glander



Jason Hall



Jordan Smith



RJ Stout

The scope of our project is to produce a fully functional decompression chamber for the Oklahoma aquarium. The Aquarium has been open since 2003, and has been displaying and teaching students and people about the beauty and life of many

of the creatures that live in our oceans today. The aquarium is a locally funded non-profit organization that does not currently have a decompression chamber. Some of the benefits for the chamber would include being able to treat certain fish ailments safely and easily, while also being able to educate or inspire students or bystanders by performing demonstrations about water pressure and its effects.

Sponsored by:



OSU Budget and Fabrication Labs

[Project Video](#)

**PROJECT:** High Speed Assembly (OSU Tulsa - ME)

**TEAM:** High Speed Assembly

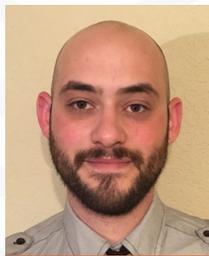
**ADVISORS:** Dr. Jay Hanan, Tyler Worden



Patrick Damkoehler



Ly Huynh



Chris Moore



Joseph Nguyen



Connor Williams

Design a generic unit to improve the efficiency of part assembly on a filling and capping line.

Our system of heating and lubrication will be used in a high-speed assembly line and therefore needs to run efficiently.

The system will do this in two ways: first ambient heat will be applied to the caps during the prepping phase, and second heated water is applied to the caps before the capping process begins.

This system must be food safe to meet FDA standards.

[Project Video](#)

Sponsored by:



**PROJECT:** Wearable Air Purifier Tulsa (OSU Tulsa - ME)

**TEAM:** Wearable Air Purifier Tulsa

**ADVISORS:** Dr. Jay Hanan, Tyler Worden



Nissrine Aziz



Ryan Burkholder



Samantha Carpenter



Nathan Dick



Remington Moseman



Moises Romo

This project, provided by the Oklahoma State University senior interdisciplinary capstone course, involves the improvement or redesign of a current wearable air purifier device from the company MetCel LLC. Our main objective in this project is to improve the human body interface.

The current product requires the user to either hold the purifier device or purchase a satchel type case, both of which present an issue. Company liaisons want a product can be used easily while doing daily tasks important to a person's lifestyle. To improve the device and accomplish a better human body interface, we decided to either modify the air delivery system at the face or replace the device in its entirety opting for a smaller and more functional setup. With both avenues of design in mind, and through communication with our stakeholders and faculty champion, our solution will resemble the latter. Our final design selection improves the overall device and promotes more user freedom allowing the user to wear the product with a face shield, eat while remaining protected, and opt for a hands-free interaction.

[Project Video](#)

Sponsored by:  
MetCel LLC

**PROJECT:** Wind Turbine Blade Repurpose - Bus Stop Shelter (OSU Tulsa - ME)

**TEAM:** Wind Turbine Blade Repurpose - Bus Stop Shelter

**ADVISORS:** Dr. Jay Hanan, Tyler Worden



Michael Costa



Edgar Estrada



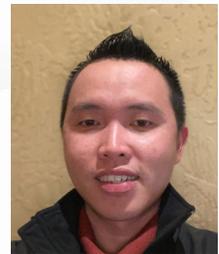
Paul Kroutter



Seth Kuhn



Richard Lawrence



Joseph Nguyen

Our project is to take retired wind turbine blades from wind farms and find ways to recycle them, because currently the blades are simply dumped in landfills where they just take up space because they do not decompose. Our team decided to make bus stop shelters from segments of the blade. This is an effective and "green" way to reuse the blades and is readily visible to the public eye. Our hopes are that this will promote a more environmentally-friendly mindset in the users of our shelter.

[Project Video](#)

[Project Presentation](#)

**PROJECT:** Autonomous Stage Wagon (ECE, ME)

**TEAM:** Autonomous Stage Wagon

**ADVISORS:** Dr. Joe Conner, Dr. Michael Gard, Laura Southard



Kenneth Brush



Joe Porter



Hazelynn Shettles



Brett Zacharias

The Autonomous Stage Wagon (ASW) is in its third semester of development. The spring 2020 team drafted the operational architecture, started assembly on the ASW, and worked with autonomous movement via preprogrammed directions. Fall 2020 validated design decisions from spring 2020, continued assembly on the ASW, and designed and implemented a control loop system and collision avoidance. The purpose of the spring 2021 continuation of the project is to improve the omni-directional

movement of the ASW, design and implement gear boxes, upgrading new motors, improve collision avoidance and move towards a final working product.

## Project Video

**PROJECT:** Large Triaxial Testing System Design (CIVE, MAE)

**TEAM:** Big Earth Testing Systems

**ADVISORS:** Dr. Norb Delatte, Dr. Deb Mishra, Laura Southard, Dr. Greg Wilber



Noah Anderson



Joe Fodor



Jeffrey Huizenga



Bryson Ridley



Tyler Root



Dylan Routh

This project involved the development of a large tri-axial testing system for coarse-grained geo-material characterization. This project developed a large-scale triaxial testing system (capable of accommodating samples up to 12-in. diameter and 24-in. tall) for laboratory characterization of coarse-grained geo-materials, such as railroad ballasts. The work involved designing and constructing a test cell and loading frame, procurement of the instrumentation components, selecting an actuator and connecting to the hydraulic power supply, and designing and developing control and data acquisition software. For the loading mechanism in this project, an MTS Systems Hydraulic Actuator was used. This actuator has a force capacity of 22 kips over an effective area of 7.57 in<sup>2</sup>. This actuator applies normal, compressive stress on the sample while the surrounding sides compress with uniform stress due to either water or air pressure.

A testing cell that can house the samples while they are being stressed was designed and fabricated. Stress tests have been done to choose an appropriate material to construct the test cell. Through National Instruments technology, communication software between a personal computer and the actuator was developed in LabVIEW measuring the displacement of the actuator and pressure applied to sample. Structural designs were done ensuring the steel frame supporting the loading system was adequate. Appropriate enhancements to members were made as necessary. Connections to the members were evaluated and designed ensuring adequate strength and safety.

**PROJECT:** Electric Guitar Pedal (ECE, MAE)

**TEAM:** Electric Guitar Pedal

**ADVISORS:** Jim Beckstrom, Dr. Chuck Bunting, Dr. Mark Perry



Diego Carreno



Jason Conway



Roy Dayan



Dillon Giles

\*IR is a room-mimicking convolution reverb pedal, designed to simulate the acoustic signature of a room while wearing headphones. Using an array of sensors and highly optimized DSP routines, \*IR calculates the impulse response of a room and applies it in real-time using a uniformly-partitioned overlap-and-save algorithm, giving any audio passed through it the same acoustic characteristics as if it'd been played out-loud.

The White Rabbit Power Supply is a low-noise selectable-voltage power supply. It features five isolated outputs, two of which can provide up to 450 mA of current. Each output is individually configurable for voltages of 9, 12, 15, and 18 volts. The Silverback Volume Pedal is a buffered guitar volume pedal, designed to be robust in both its electrical and mechanical design. Its design minimizes frictional surfaces and utilizes reliable components in order to be a no-frills, high-fidelity tool for every guitarist.

## Project Video

**PROJECT:** 3D Concrete Printer (ECE, MAE)

**TEAM:** 3D Concrete Printer

**ADVISORS:** Jim Beckstrom, Dr. Daniel Cook, Dr. Nishantha C Ekneligoda, Dr. Qinang Hu, Dr. Tyler Ley, Dr. Sonia Li



Cole Christy



Eric Galliton



Max Gordon



Nguyen Le



Jayce Massengale

Print three adjoining free standing walls, with the 3D Concrete Printer, that are eight feet tall. Include one functioning window and a functioning door.

Printing goals:

- + One nine feet long wall with a three feet wide door, eight feet tall
- + One seven feet long wall with a one foot wide window, eight feet tall
- + One six feet long wall, six feet tall produced with autonomous control
- + The walls will be structurally connected and support each other
- + Walls are moveable

## Project Video 1

## Project Video 2

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STRATEGIES  
*MORE TO THE POUR*

**PROJECT:** 3D Concrete Printer (MAE)

**TEAM:** 3D Concrete Printer Concrete Delivery

**ADVISORS:** Jim Beckstrom, Dr. Tyler Ley, Bryce Randall



Braughn Bigham



Casey Smith



Dade Eddy

Previous senior design students have built a functioning 3-D concrete printer capable of printing walls 3-4 feet high using a specially made hopper and auger system. This system used smoothing plates to form the wall, eliminating the need for wooden forms. The main goal of our project is to improve upon their design to allow continuous printing of walls up to 8 feet tall. These walls include rebar for structural support, a framed window wall, and a wall printed using an autonomous printer.

One problem the previous team faced was that concrete had to be manually shoveled into the hopper, interrupting printing. Our subteam's specific goal was to design a concrete delivery system

that can constantly load the hopper with concrete while allowing printing up to these new heights. We accomplished this through the design of a skid steer attachment that supports a concrete pouring bucket with hydraulics allowing the bucket to be tilted forward to dump the concrete into the hopper when needed. This lets the printer continue printing without the need to stop for concrete refilling. This system will allow universal attachment to many brands of skid steer and quicker printing of 3-D concrete walls without the need for extensive, manual labor in the process. The results of our design may influence the way concrete walls are made commercially and reduce the environmental footprint of concrete wall construction. Through our work, we are getting hands-on experience designing hydraulic and structural systems, technical experience on the use of heavy machinery in construction, and knowledge about working on an interdisciplinary team to complete a shared goal.

**Project Video**

**PROJECT:** 3D Concrete Printer (MAE)

**TEAM:** 3D Concrete Printer Printed Structures Production Team

**ADVISORS:** Jim Beckstrom, Dr. Tyler Ley, Laura Southard



Chase Albert



Owen Gibson



Ryan Sampson



Taylor Swaim

The 3D Concrete Printer Printed Structures Production team is working in tandem with three other sub-teams to fully implement the 3D Concrete Printer project started by previous semesters students. The goal of the project is to create a concrete pouring system that can be attached to a piece of lifting equipment like a bobcat or a skidsteer and then have that piece of equipment able to be remotely given instructions on how to pour with the Concrete Printer. The printer can then lay the concrete and essentially

print a wall from the ground up. The automation of the system will allow fewer workers to be involved with the concrete construction process, as well as eliminate the need for the 'tilt-up' construction method that is currently used to raise concrete walls.

**Project Video**

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Battery Module

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Connor McAlister



Jackson Moore

Our team designed and built a battery swapping mechanism. This includes the battery selection, battery case, and guide rail system design. To accomplish this, we first selected the battery type and power capacity needed to reach our goal. Next, we designed a case and guide rail system that will allow a quick removal and replacement of the battery while interfacing with the cart. We worked with the Controls Team to select a compatible charger; Secondary Energy Systems Team and Solar Team to determine the energy balance; Frame Team for our installation of the guide rail system; DAQ Team for measuring key performance indicators and experimental testing; and Management Team throughout the semester.

[Project Video](#)

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John Zink Foundation

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Solar Structure

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Brenden Dominick



Mung Khual



Ricardo Roopnarinesingh

Our team has been tasked with adding solar energy as a secondary energy source to the electric UTV. By adding 600 watts of solar panels to the vehicle, we are able to extend the vehicle's range throughout the day and harness renewable energy at the same time. With the pull-out solar panel, not only is it safe to use, but provides the user with additional shade for those hot days on the ranch!

[Project Video](#)

Sponsored by:



John Zink Foundation

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Frame/Suspension/Brakes

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Tyler Baskind



Derrick Bryan



Michael Meador



Rancetan Schneeberger

The Frame/Suspension/Drivetrain/Brake Sub Team will be designing and building a new utility bed for the UTV to fulfill mission requirements. In this new bed we will mount a propane tank for the generator located under the seats as well as provide additional storage to enable the UTV to meet the required payload capacity.

Project Video

Sponsored by:



John Zink Foundation

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Project Management

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Landon Anderson



Tyler Groh



Ethan Springer



Jared Town

The Project Management Team is tasked with directing and assisting the other teams with planning, budgeting, safety and goal completion. The management team works daily with the other sub teams to keep them on task and communicating efficiently and effectively to ensure a completed project.

Project Video

Sponsored by:



John Zink Foundation

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Secondary Energy Control System

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Kara Marchetta



Anthony Sorrentino



Heba Alamri



Vignesh Venkatesh

The Secondary Controls Team has created a system of logic in Python that regulates the use of each power supply, being the solar panels, generator, and wall outlet. This logic is implemented on a Raspberry Pi, which sends its decision based off the power output of the solar panels to an Arduino via serial communication. The Arduino is coded to control multiple relays which is how the power sources will be streamlined together. In addition to deciding which power source is to be used, Controls is also responsible

for the overall safe regulation of power flowing to the batteries. Therefore, Controls has purchased and mounted charge controllers for each power source.

[Project Video](#)

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John Zink Foundation

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Secondary Energy

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Ethan Miles



Zach Plemons



Sammy Willhoite

Our solution to create a secondary energy system was to use electric generation fueled by propane to extend the distance of the vehicle. The generator is fully automated and integrated with the vehicle. The generator is mounted under the seat and the propane tank securely mounted to the bed. Our generator provides enough power to allow the vehicle to go that extra distance when it is needed most. Most importantly, it provides clean emissions and is a sustainable system that protects our environment.

[Project Video](#)

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John Zink Foundation

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Battery Cart

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Caleb Bryan



Ryan Cameron



Robbie Colburn



Jake Cox



Bryan Landen

The battery cart subteam was tasked with designing and fabricating a way to quickly and easily remove batteries from the UTV and charge them for later use. Our solution was to modify a scissor lift cart and build a charge station from scratch.

Project Video

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John Zink Foundation

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** DAQ

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Valentin Brito



Juan Luevano



Daniel Salinas

The Vehicle Power and Performance instrumentation and DAQ concept development team has been tasked to research instrumentation and develop methods of relaying crucial information to the Secondary Controls Team and Secondary User Interface's Team. Five key problems and solutions, specific to the DAQ team, have been identified. These include:

- How to accurately measure voltage and current in the system to ensure proper and safe performance of the vehicle's battery module.
- Using a voltage divider circuit and an Arduino Mega 2560 to measure voltage. Current sensors will be in series with battery module and other subsystems to acquire needed data.

- How to send crucial information to Controls logic to initiate secondary sub-systems' charging responses.
- Current sensor, voltage sensor, and tilt sensor codes will be written in the Arduino interface and integrated with Control Team logic.
- How to communicate effectively with UI system to display appropriate data for user.
- Raspberry Pi User Interface will communicate with DAQ and Controls via serial communications .
- How to create a safe wiring harness involving all sub-systems.
- SAE standards and codes for wiring and safely handling Electric Vehicles will be followed.
- How to ensure electrical systems are accessible but also protected from environmental factors.
- Locate area within current frame least exposed to the outside (Under hood) and place circuitry within a weatherproof electrical enclosure.

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Project Video

**PROJECT:** High-Tech Sustainable Electric UTV (ECE, EET, MAE)

**TEAM:** Secondary Energy User Interface

**ADVISORS:** Jim Beckstrom, Dr. Dan Fisher, Dr. Brian Norton, Laura Southard, Dr. Robert Taylor, Tyler Worden



Elisabeth Floyd



Tim Parsons

The User Interface team's project goal for the Senior Design Expo is to present a functional user interface that will be mounted to the dashboard and will request and display data from the controls and DAQ system about the UTV and its power sources (i.e. battery percentage, UTV speed, tilt, etc.). The UI will also provide the UTV operator with the ability to turn the generator and solar panels on/off.

Project Video

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John Zink Foundation

**PROJECT:** Wind Turbine Blade Tear Drop Camper (MAE, MET)

**TEAM:** Wind Turbine Blade Tear Drop Camper

**ADVISORS:** Jim Beckstrom, Bryce Randall, Laura Southard



Hope Castleberry



Matthew Cunningham



Ky Davis



Derek Hooker



Justin Kendall



Colton Lindsey



Ian Pickens

The purpose of our project was to take a cut out section of a used wind turbine blade and transform it into a tow-able teardrop camper. This re-purposing shows that we do not need to waste so much material by simply throwing it in the Earth and creating pollution. We chose this project because we care about the environment and how much waste that is put there. We want to create a product that is affordable, safe and appealing to allow everyone to have the opportunity to get out and see what this world has to offer.

Project Video

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