UNT COLLEGE OF ENGINEERING
EST. 1890

Department of

MECHANICAL AND ENERGY ENGINEERING

Senior Design Day 2020

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ASHRAE

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Department of Mechanical & Energy Engineering

Team Members:

- Daffron,Turner James
- Branscum,Jacob
- Mal,Abdul
- Bernier-Grubisa,Jacob T
- Samuel,Kennan Justyce
- Al Mukhaini,Ahmed Mohammed Khamis Rashid

External Sponsors/Mentors:

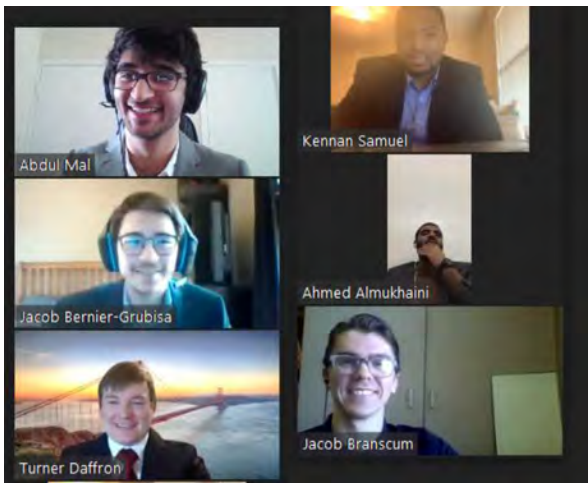
- ASHRAE

Internal Sponsors/Mentors:

- Weihuan Zhao

Abstract:

Team ASHRAE's project is to implement Phase Change Material (PCM) inside a Heating, Ventilation, and Air Conditioning System. The energy recovery ventilator's main goal is to preheat incoming outside air from 15 degrees to a minimum of 20 degrees or a maximum of 25 degrees Celsius using latent heat from the phase change material. The PCM will be placed within spokes of a wheel. The wheel will rotate from a vent with cold-outside air flow to a vent of warm-inside air flow. When the wheel passes through the cold air flow the PCM will solidify, releasing energy into the air and preheating it before the air passes into the HVAC system. This will relieve load on the HVAC system, requiring it to the heat the outside air less before it reaches room temperature. The wheel will then pass into the flow of inside temperature air. This will liquify the PCM again, charging it with energy before it passes back.



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L.E.V. Tech

Team Members:

- Abulaila,Noran Ghassan
- Oxford,Drisana
- Jackson De Avila,Stephanie Alexandria
- Adenuga,Oluwasubomi
- Gunn,Michael
- Campbell,TJ

External Sponsors/Mentors:

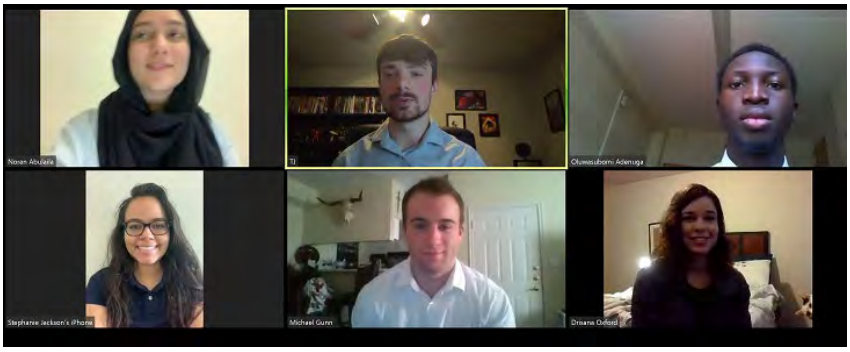
- AT Systems

Internal Sponsors/Mentors:

- Mark Wasikowski

Abstract:

On January 26th, 2020, news was released that a helicopter containing Kobe Bryant, his daughter Gianna, and 7 other individuals crashed midflight. During the flight, there was a dense fog and the pilot was instructed to not fly out that day, however, he still went out. During the flight, the pilot was under the influence of visual distortion and crashed into the ground, killing all passengers in the process. A 2018 study saw that 33% of all helicopter crashes occur to these types of occurrences. When a pilot runs into a visual distortion scenario, they feel a spatial distortion and think that they are flying straight and level, when in actuality, they are flying straight toward the ground. As of writing this abstract, there is still no training for these situations. AT Systems goal for us, was to develop a headset that could hold their specially developed film. Our project is the design and manufacturing of a training headset for helicopter pilots in a visual distortion scenario. Every piece is created using injection molding, mainly for the purpose of keeping the headset as light as possible. The material chosen for every piece is polypropylene homopolymer for the purpose that it is lightweight, strong, and doesn't absorb moisture, which is important because this will be worn by pilots and we don't want sweat to effect the object. Because we are injection molding, we need molds. Rather than outsource this, which could cost up to $28,000, we will be manufacturing our own molds, using SLA 3D printing. The resin we will be using in the printer is a High temperature resin from formlabs. In total, we have 7 pieces of the headset. Suby Adenuga oversees the creation the crown (Item No. 1), Stephanie Jackson is in charge of creating the arms (Item No. 2), Drisana Oxford will make the bottom cover and the servo holder (Items No. 3 & 5), Noran Abulaila will create the visor (Item No. 4), TJ Campbell oversees the creation of the universal attachment (Items No. 6 and 7), and Michael Gunn creates the servo latch (Item No. 8).



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Super Seniors

Team Members:

- Poling,Angela
- Salam,Ahmed
- Riera,Luis Andres
- El Masri,SAMMY
- Mallett,Travis Scout
- Alfadhle,Ahmed Abbas A

External Sponsors/Mentors:

- Dualams

Internal Sponsors/Mentors:

- Nandika D'Souza

Abstract:

Sponsors Jeff Abbott and John Houston are entrepreneurs who look for solutions to problems that they encounter in their own lives. Jeff owns an auto body shop where he repairs and restores cars. One thing that Jeff is known for is rewiring cars. Over the years, Jeff has noticed that the standard methods for bundling wires, manually applying electrical tape or zip ties, is not very efficient. This prompted Jeff's idea to create a handheld tool that applies some type of adhesive to the bundle of wires, removing the need for significant human interaction, making the process more efficient. The task given to our team was to choose an appropriate adhesive to bundle the wires and to create the hand tool to apply the adhesive. We wanted to find an adhesive that was strong, easy to clean or remove, and safe for humans and the environment. We researched tapes, pastes, liquids, hot melts adhesives, natural adhesives, UV adhesives, and more. Ultimately, we decided to use a UV adhesive because they are easy to apply, easy to clean, strong, and abundant in the marketplace. We also spent a lot of time developing the design of our tool. Our tool had to be ergonomic, lightweight, relatively portable, and compatible with our adhesive. The biggest challenge we faced in designing the tool was the issue of the UV light and glue head placement; we did not want the residue on the tool or the adhesive in the tubes of the tool to be exposed to the UV light, causing it to cure. Ultimately, we decided to make our tool into an attachment for a caulking gun, where our UV adhesive would be packaged inside the same 11 oz. tubes that a caulking gun uses.

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FSAE Powertrain

Team Members:

- Babinec,Brice Charles
- Bartkowiak,Bryce Nathan
- Cramer,Ethan
- Sanders,Thomas Mitchell
- Jaresh,Rane
- Hinkle,Kenneth Allen

External Sponsors/Mentors:

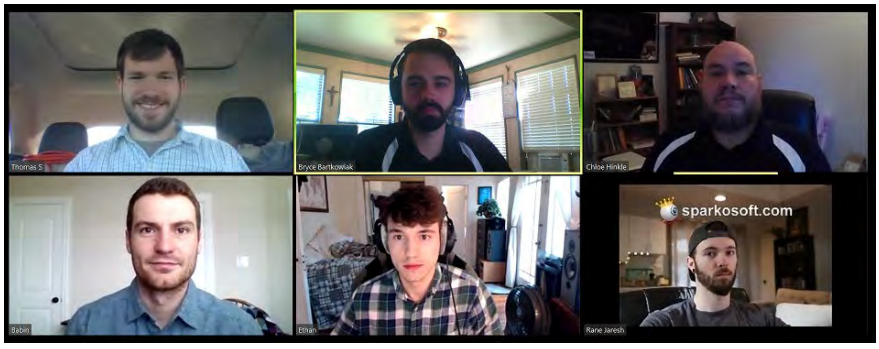
- SAE

Internal Sponsors/Mentors:

- Xiaohua Li

Abstract:

The purpose of the SAE Powertrain Senior Design Project is to design, manufacture, and validate a reliable powertrain system for a Formula SAE Racecar. Because of this goal, we were able to get very specific goals from our customer, Mean Green Racing. We focused on solving timing issues with the engine, optimizing the power output and efficiency, and improving the oiling and cooling systems. To solve the timing issues, we decided to improve the mounts for each timing sensor. This meant designing a completely new Camshaft Cover and Crank Position Sensor Mount. Both of these solutions needed to hold the sensors in very precise locations even during engine operation, but still allow for easy adjustment if necessary. In order to optimize the power output and engine efficiency, we redesigned the entire intake and exhaust systems. The intake was routed vertically instead of horizontally and fitted with a different style throttle body for improved airflow. For the exhaust, we introduced resonance chambers and a venturi style collector to increase the exhaust gas velocities and improve our scavenging effects. The oiling system was a point of failure for the team in the past, so we fabricated a baffling system to keep oil from sloshing during quick maneuvers and designed a new oil pickup that reduces the chance of oil starvation if sloshing does occur. The radiator underwent a full thermal simulation and size was chosen based on worst case scenario environmental conditions.



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Agricultural Research

UNT COLLEGE OF ENGINEERING
Department of Mechanical & Energy Engineering

Team Members:

- Woodhead,Peyton
- Phillips,Jacob A
- Haittan,Ali Abdullah S
- Tipa,Anthony Michael
- Harthi,Al Makhtar
- Aoufi,Reyan

External Sponsors/Mentors:

- UNT

Internal Sponsors/Mentors:

- Tae-Youl Choi

Abstract:

Our project is a sustainable renewable energy greenhouse for use by the general population. This greenhouse has its own water supply and is powered by renewable energy in the form of wind and solar power. The solar panels are designed to track the sun to increase efficiency, feeding power to the greenhouse. Systems inside the greenhouse include a drip irrigation system powered by a pump, an Arduino that controls all temperature and moisture sensors, and a ventilation system that utilizes the fans used in personal computers. The greenhouse consists of a wooden box structure that houses the irrigation system and soil-bed. The wind-turbine is attached to the side of the base, and a square pyramid made of clear acrylic acts as a cover for the soil bed to protect it from the elements without obstructing light to the plants. The purpose of this design is to allow people to grow plants without having to worry about having the right type of soil, the threat of pests, or keeping up with them daily.

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VIBE

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Department of Mechanical & Energy Engineering

Team Members:

- Culberson,Gavin Parker
- Sutherland,Christopher Cameron
- McGehee,Brandon Robert
- Osueke,Adimchinobi Ezemdi
- Pankotai,Robert Ryan
- Al Ismaeel,Mortaja Ahmed J

External Sponsors/Mentors:

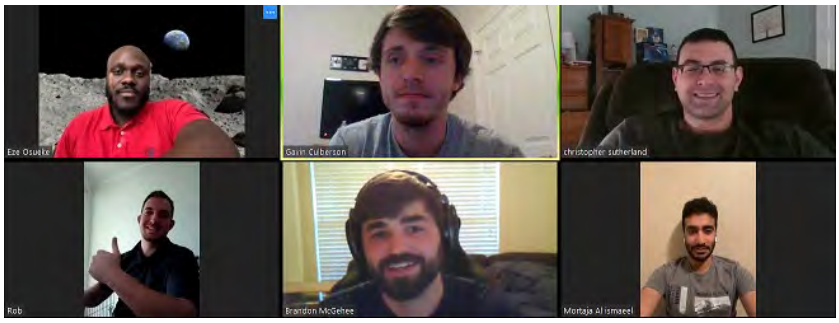
- UNT

Internal Sponsors/Mentors:

- Haifeng Zhang

Abstract:

The purpose of the mechanism is to convert rotational energy provided by wind intake/speed to linear reciprocation/motion. This linear motion will act as an agitator for a piezoelectric bimorph and a reciprocating piston motion for the magnet in our electromagnet system. Both methods will produce a current in Alternating Current (AC) that can be harvested, amplified, and converted into Direct Current (DC) that will be used to power other electronic devices with a minimum power requirement of 0.2 mW. The mechanism will not exceed the boundary dimensions of 5”x5”x5” and will fall into the weight range of 2-10 lb. An efficiency of 50-80% with a lifespan of 168 hours will fulfill the optimal goal of this device. Lightweight materials were chosen for the parts primarily Aluminum 6061 T6, Piezo Ceramic, Copper, PVC, and Brass. Piezoelectrical devices are an ever-changing field of study and there are very limited resources in this field. Large scale applications are not being used due to the lack of technology, output, and cost. Piezoelectric energy harvesting devices are used in microsystems to generate power via vibration or agitation. The mechanical motions that are harvested generate small amounts of voltage that can be used to power wireless devices or other small system machines. Electromagnet induction is also another source of energy being harvested by much larger systems using vibrating magnets inside or around a copper coil. Electromagnets are a common alternative energy source that produces a large amount of today’s power. Most values produced are measured in micro volts and thus most piezoelectric devices tend to stay in the micro-system field. The exceptions to this can be found in structures such as windmills and damns, but then size becomes a factor. In theory, the premise of this device is to produce a form of energy harvester that can be used as an attachment to cars, boats, and other vehicles that have limited space but can benefit from having the alternative energy source to power small electronic sensors that are used to indicate/warn the user of potential problems. Some factors to take into consideration when analyzing any part of this mechanism is not only the weight acting on system but the vibration as well. If the resonance frequencies match, then the mechanism will start to vibrate more violently and could cause the structure to fail prematurely.



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FSAE Electric

Team Members:

- Castaneda Jr.,Francisco Rafael
- Contreras,Ana C
- Bailey,Brendon Collin
- McDaniel,Dustin Keith
- West,Kenneth
- Marcus Voltaire (ETECH)

External Sponsors/Mentors:

- SAE

Internal Sponsors/Mentors:

- Xiaohua Li

Abstract:

It takes 6 months to build a Rolls-Royce, but only 13 hours to build a Toyota.... As Rome wasn't built in a day, things that take time, we ought to value. Industrialized in 1765, the plow and heavy artillery were motorized for locomotion. Then modernized in 1901 and jump started the inspirational era of General Motors, the purpose of the automobile is to shorten the time it takes to travel from one distance to the other, making it more convenient and efficient for humanity to fulfill tasks and complete work. Convenient because in a world that's evolving faster and more often, we need speed to just stay relevant. Gasoline and diesel vehicles achieve speed, transportation, and work (even efficiently according to some) but only at the cost of spent fossil fuels. Electric powered vehicles have tackled 2 birds with one stone. With great creations comes great preparation. Our SAE Formula Electric project highlights the history of the electric car era, the preparation that goes into building an electric vehicle, and the teams engineering design, manufacturing, and leadership skills by applying engineering theories learned in the classroom.

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Fin-o-vators

UNT COLLEGE OF ENGINEERING
Department of Mechanical & Energy Engineering

Team Members:

- Dunn,Evan
- Jourdan,Adrian
- Zapata,Carlos
- Tchatchoua,Jordan Roussel
- Davenport,Jared

External Sponsors/Mentors:

- UNT

Internal Sponsors/Mentors:

- Tae-Youl Choi

Abstract:

The overall assembly consists of a frame, fish tank, grow bed, mechanical filter, and biological filter sub-assemblies. The design is manufacturable and stays within UNT's budget of $1500. By meeting these requirements, the project should be very successful in operation. The metal frame provides a secure and stable structure to hold the rest of the parts and subassemblies. The fish tank will contain the fish necessary to provide the essential nutrients for plant growth, while also efficiently collecting the solid waste that the fish produce, thus creating a selfcleaning fish tank. The mechanical filter will collect the solid waste material over time and will need to be changed out every so often, its' design is made such that the removal and cleaning of the filter is easy and safe. The nutrient rich water is then pumped upwards to the grow beds, that will effectively and evenly distribute that water throughout the grow bed design, feeding the plants and helping them grow. The biological filter will then clean the water after it has passed through the grow beds before it gets back to the fish tank where the cycle will begin again. The overall assembly will be delivered in parts and have instructions so as to easily be constructed inside the consumer's home. After germinating their own seeds, the consumer can place them in the grow bed's plant holders without the need of dirt, as the plants will be subject to the aquaponics growing method, the nutrient film technique (NFT) which uses less water and provides more plant growth per square foot, than traditional farming methods. The consumer will also be able to choose their own fish, as long as the fish and plants are compatible. There will be an included pamphlet showing which plant and fish combinations are possible in the design.

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Pioneering Precision Technology

Team Members:

- Surujpaul,Arun Y
- Wages,Dylan
- Hidalgo Rotunno,Alejandro
- Santiago Ramos,Harold

External Sponsors/Mentors:

- ARL

Internal Sponsors/Mentors:

- Hamid Sadat

Abstract:

The Army Research Lab, ARL for short, came to UNT with a problem involving the acquisition of data for a new drone they have been developing for some time now called CRC10, CRC20 with the number indicating the weight of the drone in pounds. These types of drones don't have any data associated with their flight when it's between hover modes to fly mode or from 90 degrees to 0 degrees where the main body of the drone is parallel to the ground like an airplane. The task was split between 3 departments making MEEN and ETEC build the frame that will hold the drone while the EENG oversaw the gathering/interpreting the data from the tests flights we were going to be conducting. Our main priority was to make the structure strong but lightweight for both the vehicle it was going to be placed on and for the load cell that ARL had provided for us at the beginning of the project. The device would need to rotate both in the pitch of the drone and the yaw of the drone. The pitch mechanism was made from a hinge and a makeshift rotary table was made with ball bearings. A slotted plate with the use of a bolt and nut is used to lock the yaw movement from 0 degrees to 180 degrees with 90 degrees having the drone pointed to the front. With the help of SOLIDWORKS, the best solution material wise that could grant both criteria needed was a combination of polyester ratchet straps, suction cups, aluminum plates, and carbon fiber tubing. The test would then consist of the vehicle test and the acoustic chamber test. The vehicle test was to acquire the data between the two degrees previously mentioned at a speed of 40 mph. While the acoustic chamber test is done to verify where the system might reach resonance frequencies. All the mechanisms used in the device are manually changed and easy to reach making it easy for the customer to change the angles of the drone.

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Not Vision Goggles

Team Members:

- Dugan,Garrett N
- Wootton,Cody Len
- Kouba,Jeffrey Allen
- McMenamin Jr.,Sean Patrick
- Jelic,Adam Louis
- Gonzales,George

External Sponsors/Mentors:

- AT Systems

Internal Sponsors/Mentors:

- Mark Wasikowski

Abstract:

The University of North Texas, College of Engineering team Not Vision Goggles has partnered with AT Systems to design a helicopter training device that mounts on the top of a helicopter pilot radio head set to simulate spatial disorientation. Spatial disorientation is caused by a mixture of obscured vision, linear acceleration, and rotation; this leads to a perceptual misjudgment of the vertical direction. Statistics show that between 5 to 10% of all general aviation accidents can be attributed to spatial disorientation, 90% of which are fatal (FAA 2019). In order to properly train a pilot to ignore their senses, they must train in a real scenario of spatial disorientation. The concept of this design is to allow pilots to safely train in spatial disorientation in clear, safe conditions using a variable opacity visor that is controlled by a tablet. Emergency redundancies were implemented in the design to provide a safe training simulation while in flight.

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FeARLess UAV Research

Team Members:

- Esquivel,Francesca
- Czajkowski,Justin P
- Chavez,Sofia
- Amaral,Pietra
- Tobin,David Devere
- Salazar,Elizabeth Marie

External Sponsors/Mentors:

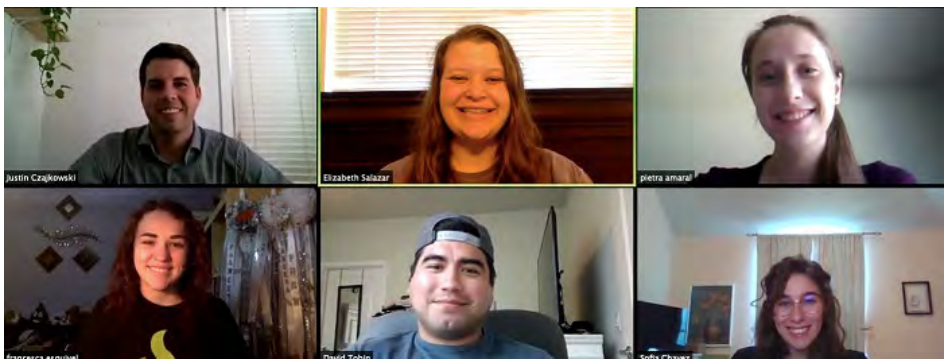
- ARL

Internal Sponsors/Mentors:

- Hamid Sadat

Abstract:

As a team we were asked by The Army Research Lab (ARL) to develop and design a rotor blade and variable pitch mechanism that increases the VTOL UAV's (Vertical Take-Off and Landing Unmanned Aerial Vehicle) forward flight efficiency by 15 %, increases the hover efficiency by 5%, and decreases the acoustic noise by 5 dB. To accomplish our customer given requirements, we came up with 3 different designs, a variable pitch mechanism actuated by an SMA (Shape Memory Alloy) rod, a variable pitch mechanism actuated by a servomotor, and a variable camber blade actuated by an SMA flap. Each of these mechanisms allow the blade to be in an optimal position for hover and forward flight. We also designed, manufactured, and tested different rotor blade models for each design. These rotor blades were carefully designed based on multiple simulation iterations as well as on the torque and thrust test stand. Both variable pitch mechanisms use a similar blade that is designed with a twist throughout the entire blade, a tapered tip, variable chord, and a larger thickness at the tips. The variable camber blade has a swept tip and a slot in the trailing edge to insert the SMA flap. Our goal for this project is to innovate how drones, both army and civilian, operate. Implementing SMA actuators on small scale aircrafts is not often done, and we want to prove that it can be accomplished. SMA actuators could replace larger actuators, like servomotors, and be more efficient because they require less energy, less programming, and less space and weight on the UAV. We also want to prove that small scale drones could have variable pitch and camber mechanisms that increase range, efficiency, and payload capacity. Lastly, we want to demonstrate that these parts can be manufactured remotely, and efficiently in case of a need for emergency repairs. As we worked through this project, we were forced to change our ideas and designs based on problems we encountered. When designing the blade, our most optimal blade on the software was not able to manufacture correctly. It was designed too thin and it was impossible to manufacture adequately. We also noticed the number we were getting from our test stand were not matching the simulation number, so we were forced to change our design many times. For the mechanical system actuated by the servomotor an issue we encountered was difficulty of manufacturing. The assembly is complex with many moving parts and the original size of the design was exceedingly small. We were forced to make the parts larger to help with manufacturing and assembly. Lastly, for the variable camber design, it was difficult to get an SMA plate small enough for the original design. Also, camber change is complicated and it added difficulty during simulation. We decided to treat the rotor as a flap rotor and this helped with research and the design process. This project has proven to be extraordinarily complex and intricate, but as a team we have been able to cross every obstacle to create an outcome that best meets the requirements.



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Gone with the Wind

PLEXON

Team Members:

- Esquivel,Francesca
- Czajkowski,Justin P
- Chavez,Sofia
- Amaral,Pietra
- Tobin,David Devere
- Salazar,Elizabeth Marie

External Sponsors/Mentors:

- Plexon, Inc.

Internal Sponsors/Mentors:

- Yunwei Xu

Abstract:

The wind tunnel is an important piece of machinery that has many uses. The main purposes for a wind tunnel are to be able to test the amount of lift and drag of objects and to be able to easily visualize how air flows around an object. However, most wind tunnels for basic fluid studies are fairly small in size. If the testing chamber of the wind tunnel is not large enough, the results within may not give accurate readings of the Reynolds Number and other similar necessary fluids relations. To help increase the accuracy of this, the size of the testing chamber can be increased. For the purpose of the wind tunnel designed by Gone With the Wind, the internal cross-sectional area within the testing chamber has been increased to 16 square feet. A larger testing chamber will help improve the accuracy of the lift and drag coefficients and the Reynolds Number. Increasing the size of the testing chamber will also increase the size of the rest of the components of the wind tunnel. The initial goal of the wind tunnel was to have a ratio of about 3:1 for the cross-sectional sizes of the nozzle and test section. This ratio would allow for more compression and have higher wind speed values within the testing chamber; the higher wind speeds will also produce more accurate data. However due to money and time constraints, a strong enough fan could not be purchased to allow for more air flow, thus resulting in a lowspeed wind tunnel with the capability of having an interchangeable drive system to allow for stronger fans to be used. This wind tunnel also has the capability to be connected with additional connecting parts to be converted into a closed-circuit wind tunnel.

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CNC Rebuild Team

MULTICAM
Complete CNC Solutions

Team Members:

- Ohemeng-Dapaah,Emmanuel
- Kissaru,Ebenezer
- Wallace,Colin Mackenzie
- Nguyen,Matt
- Ranjbar,Nabil Moayedi

External Sponsors/Mentors:

- Multicam Inc.

Internal Sponsors/Mentors:

- Mark Wasikowski

Abstract:

The aim of this project was to address two of the most important factors that every customer and manufacturer hopes to improve; safety and productivity. In doing so, we developed a water pumping system to facilitate the working water in the waterbed, to and from the work surface to reduce the time taken to complete each experiment. We also designed a conveyor belt system to facilitate the entry and exit passages and to also reduce human contact with the high temperature plasma as much as possible. The Water pump system incorporates a 0.1 hp centrifugal two-way pump which transports water through an ergonomic piping system and flows out of a suction cup into the waterbed. During emptying, the presence of a screen mesh prevents metal oxides from entering the piping systems and reduces contamination. Secondly, the conveyor belt comprises of a three-part collaboration; the Entry and Exit system, a redesigned waterbed with incorporated slits and an elevation system. The Entry and Exit system feed in the work material unto the work surface and after serves as an accumulator which receives the completed material. These additions were designed to support 50 lb. sheet metal with a stress factor of safety of at least 1.5. Therefore, reducing the loading time from minutes to seconds and to also reduce the amount of physical exertion on the user. The redesigned waterbed assembly was designed to accommodate the elevation system while maintaining the structural integrity of the current Wright table, the inclusion of machined slits set an exact position to allow no interference with the rest of the cutting operation. Lastly, the elevation system lifts up the sheet metal which is held in place by the rollers and based on calculated angling and gravity will cause the finished work material to slide into the exit system. This is also made possible by the use of a step motor; the factor of safety was simulated to be over 1 and the mechanics were constructed based on substantial CAE analysis.

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Dude Where's My Car

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Department of Mechanical & Energy Engineering

Team Members:

- Felio,Maximilian David
- Dudek,Nicholas
- Fruth,William Mitchell
- Guevara,Alexander James
- Montgomery,Benjamin Alvin
- So,Surgi

External Sponsors/Mentors:

- UNT

Internal Sponsors/Mentors:

- Yijie Jiang

Abstract:

Our project goal was to design and assemble a turbocharger testbench. The purpose of the test bench is to simulate conditions for turbocharger operation; variable airflow, and proper oil temperature flow, while keeping whoever is operating the testbench safe from any possible mechanical failures. The list of engineering parts included were the cart, the frame, the support arm, turbocharger air inlet adapter, tachometer positioning rail, and the frame box housing. Our theoretical customer, Dr. Jiang, insisted that for this project we keep the operating limit of the product to 50,00 RPM for a given turbocharger, and to keep the design within the given budget of $1500. Beyond this, our requirements and restrictions were set in place at our discretion. Things like frame and cart dimensions, and other attachments were first designed with standard static loading in mind; the weight of the turbocharger being the most important. Given these restrictions, and our simulated designs, we believe that the Turbocharger Testbench would have been a success in design, although we would have gone over budget due to the material costs and other accessory devices needed for successful operation.

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Shenron

UNT COLLEGE OF ENGINEERING
Department of Mechanical & Energy Engineering

Team Members:

- Beltran Jr.,Ricardo E
- Wherry,Justin
- Reed,Landon
- Ramirez,Luis Gerardo
- Albrahim,Hussam Riyadh A
- Tomonaga,Satoshi

External Sponsors/Mentors:

- UNT

Internal Sponsors/Mentors:

- Parham

Abstract:

Our fellow Senior Design Group, Team Shenron initially had chosen to compete in the NASA Student Launch (SL), where the project involves groups from different colleges and universities across the nation competing with each other by designing, building and flying payload or vehicle components. The components would fly on high power rockets (HPR) determined by the range safety officer and the team. The team was officially formed and assigned to the project the day before the competition proposal deadline. However we still attempted to create a proposal according to the previous “Team Rocket” senior design group. Due to our circumstances and time, the team was unable to participate in the competition. We as a team decided to ultimately focus on continuing to design, build and test a High Power Rocket (HPR), in addition work on Thrust Vector Control (TVC) using control systems. Our team’s focus is to have those members interested in retrieving their HPR L1 Certification, to design and build their own rocket. Doing so, we had 3 out of the 6 members interested in earning their certification. That means we needed to design and build a total of 3 high power rockets. One rocket is meant for one person and 1 certification. In order to get better test data and results, we decided to design and build the 3 rockets similarly but with miniscule differences. We want to focus how the shape of the nose cone affects the rocket, in addition straight fins vs circular fins. Thrust vector control, our main focus is to design and build a gimbal mount that will be attached to a couple tubes and installed into the bottom end of the rocket. First stage of TVC is testing the movements of the gimbal, making sure it moves according to the programming. 2nd stage is testing with a small motor. Last stage is installed to the rocket and fully tested by launching.

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Lennox Design Issue

LENNOX INTERNATIONAL

Team Members:

- Santos,David Nicholas
- Schneider,Daniel T
- Jones,Travis Louis
- Valdez,Tomas

External Sponsors/Mentors:

- Lennox Intl.

Internal Sponsors/Mentors:

- Weihuan Zhao

Abstract:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) new regulations for residential HVAC equipment requires switching to a lower GWP (Global Warming Potential) equipment by the year 2025 with current HFC Refrigerants beginning to phase-out in 2022.

Therefore, UL Safety standards have been updated to accommodate the use of 2L class refrigerants in HVAC and other refrigeration applications. One of these new standards requires the field-installed refrigeration pipe connections to be moved to the interior of the system cabinet.

However, due to space constraints and proximity to sensitive electronic components, the costs associated with moving these connection points is challenging, and our team has been tasked to find an innovative connector solution to accommodate the new UL safety regulations related to the upcoming Low-GWP refrigerants.

The final design met the customer requirements to have a per-part cost of less than $3 with an estimated life span equivalent to the air handler's life. The installation was made to be fast and simple, and the part was designed to have an easy molding manufacturing process.

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Integrity

integrity™ Forensics & Engineering

Team Members:

- Davis,Darrin Lee
- Hodges,Jaben W
- Sloan,Luke

External Sponsors/Mentors:

- Integrity Forensics

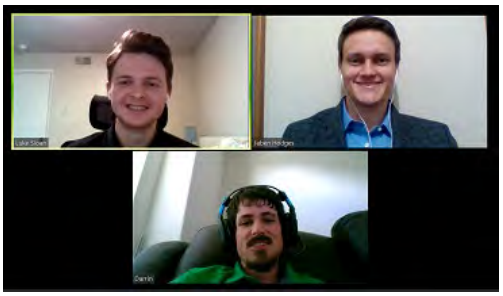
Internal Sponsors/Mentors:

- Parham

Abstract:

The objective and goal of our project was to create a durable and functional computer-controlled x-ray system for use in the forensics engineering field for fire investigation purposes. Our most important scope requirements were that we design and build a table no larger than a size specified by our sponsor that was capable of linear motion at a speed specified by our sponsor under a maximum load specified by our sponsor. Once the mechanical system was complete, our sponsor was going to integrate an electronic system of their design with our machine. Through senior design 1 and 2 (MEEN 4150 and 4250), we designed a machine and sized stepper motors as well as rack and pinion gears that were capable of fulfilling all of our sponsor's requirements. After completing fabrication, all gears meshed properly, and the linear motion of the machine was smooth along its linear bearings. We have since delivered our portion of the project to our sponsor for their electrical engineer to integrate his custom electronic system that he designed based off of our motor specifications. Lastly, our sponsor will eventually be taking the machine we designed and fabricated to be powder-coated in order to protect it from environmental elements.

Our portion of the project is completely done, and despite the COVID-19 pandemic, our project goals and requirements have been 100% fulfilled which resulted in our sponsor being very happy. Overall, our senior design project was a very valuable learning experience for all of our team members and is considered to have been a success in both our's and our sponsor's eyes.



UNT COLLEGE OF ENGINEERING
EST. 1890

MEEN Recycle

UNT COLLEGE OF ENGINEERING
Department of Mechanical & Energy Engineering

Team Members:

- Anyadiegwu,Obinna
- Brown,Israel
- Odumegwu Ojukwu,Afamefuna
- Odeyinka,Abiodun

External Sponsors/Mentors:

- UNT

Internal Sponsors/Mentors:

- Mark Wasikowski

Abstract:

Our project goal was to utilize the Universal Robot 6 axis manipulator robot to help in automating the process of recycling. Originally our group wanted to use the UR10 with several sensors to automatically sort through different kinds of recycled materials but this scope was too large so the group, along with our advisor decided to move the scope down to just creating an economical end effector. With that in mind, we wanted to create an end effector that was both cost effective and could be used in the recycling environment. We researched different materials based on price, strength, corrosion resistance, weight and machinability.

After the initial research we landed on Aluminum 6061 T6, an aluminum alloy due to its high strength to weight ratio, corrosion resistance, ease to be manufactured, and economical price. We ran static load simulations to get to the least material with a low possibility of breaking or fatigue. While the plate sizes could be smaller and meet a 1.05 factor of safety, we had to consider the price so ordering 1 plate of aluminum at $41.06 would keep it as economical as possible. In conclusion with parts and paying a machinist $25 an hour, our overall cost would be around $800 to manufacture. If it was sold for a 25% profit, that would make our price tag $1000 which is ⅛ of the cost of most end effectors listed on the Universal Robot Website.

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Fluids

UNT COLLEGE OF ENGINEERING
Department of Mechanical & Energy Engineering

Team Members:

- Al Barami,Walid Mohamed Said
- Al Rawahi,Yousuf Yaqoob Said
- Epps,John Phillip
- Yancy,Brian L

External Sponsors/Mentors:

- UNT

Internal Sponsors/Mentors:

- Tae-Youl Choi

Abstract:

The objective of this project is to design and construct an Osbourne Reynolds Apparatus. This device provides a visual representation of laminar and turbulent flow characteristics in a pipe. SolidWorks modeling and simulation was used to create fluid flow models, stress analysis, and optimization on structural support components.