



Department of
ENGINEERING
TECHNOLOGY

Senior Design Day 2020



MECHANICAL ENGINEERING TECHNOLOGY

Laboratory Equipment for Two-Phase Immersion Cooling

Team Members:

- Shelby Maverick
- Simbisai Kaiboni
- Xavier Villalobos
- Travis Copeland
- Jameel Haddad
- Hasan Al Sadiq

External Sponsors/Mentors:

- ASHRAE
- 3M Mentors:
 - Mr. Phil Tuma
 - Dr. Jimil M. Shah

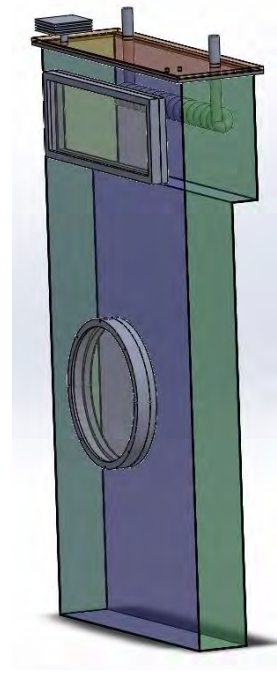
Internal Sponsors/Mentors:

- Dr. Huseyin Bostanci

Abstract:

The objective of this project is to provide a more efficient, energy saving, and environmentally safe cooling method to implement into data centers cooling strategy. Implementing a two-phase immersion cooling method will reduce energy consumption, reduce noise pollution, and be environmentally viable.

In this approach, electronic components are submerged into a pool of dielectric liquid featuring a low boiling point (30-60°C). The liquid boils on the surface of the heat-generating components, and as vapor bubbles rise, they passively and effectively transport the heat away. This method achieves higher heat transfer rates/power densities, and has very compact and flexible packaging options. Compared to conventional air cooling, two-phase immersion cooling provides a much simpler system, reduced capital and operational expenses, reduced environmental impact, and higher efficiency, and energy savings (>90% electricity savings).



Special thanks to Rick Pierson and Bobby Grimes for helping answer all our manufacturing questions!

Laboratory Equipment for Optical Sensing Systems-Based Spectroscopy

Team Members:

- Jonathan Smith
- Jalen Winborn
- Abbas Alqallaf
- Cody Letz
- Shariff Ello

External Sponsors/Mentors:

- The American Society for Engineering Education

Internal Sponsors/Mentors:

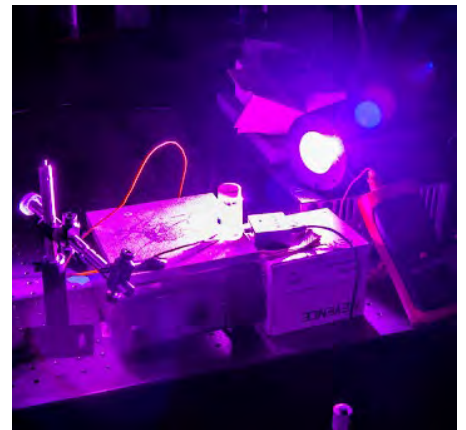
- Dr. Maurizio Manzo

Abstract:

The objective of this project is to determine how accurate a spectrometer is when compared to more conventional techniques regarding measuring pressure and temperature. Utilizing a spectrometer can potentially save companies money and precious time, in order to measure temperature and pressure differentials, while also showing a real time view for change in readings. The approach for this project will be to create an easy-to-follow lab manual in order to successfully complete experiments in the classroom, utilizing the Ocean Vue Spectroscopy Education Kit.

The team will be utilizing Rhodamine 6G Dye in conjunction with a portable spectrometer, and 2 light sources with known wavelength intensities. The readings measured by the spectrometer will be compared with data collected with a thermocouple (a more accurate thermometer).

The team will also be creating a 3D printed material and utilizing Pressure Sensitive Paint (PSP) in conjunction with the Ocean Vue Spectrometer to measure pressure differentials among different parts of the material. The data collected through using the PSP and Spectrometer will be compared to CAD simulation in the SolidWorks Program to ensure accuracy in measurement.



Modular DAQ Training System for Thermo-Fluids Applications

Team Members:

- Tomi Arenyeka
- Gabino Bencomo
- Joshua Dorsey
- Austin Watson
- Joshua White
- Aiman Khan

External Sponsors/Mentors:

Internal Sponsors/Mentors:

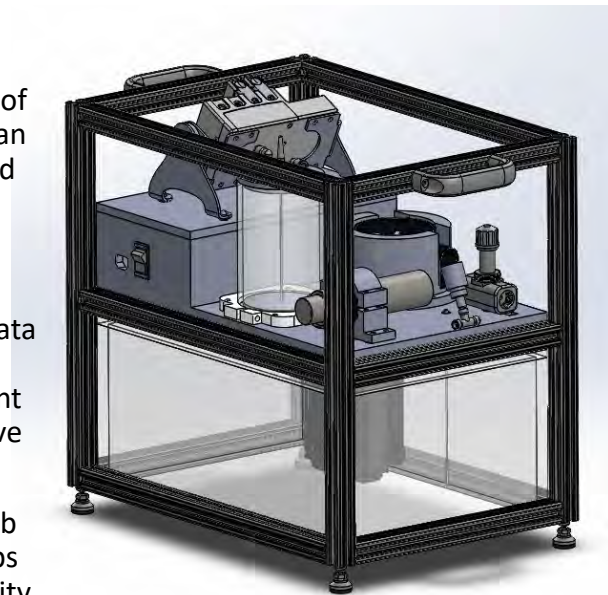
- UNT ETEC Department
- Dr. Huseyin Bostanci

Abstract:

The goal of the project is to build six modular, multi-functional data acquisition (DAQ) training sets for thermo-fluids applications. By applying the principles of thermodynamics, fluid mechanics, and heat transfer, an experiment thermo-fluid systems setup will be created to be integrated with the virtual simulation program, LabVIEW.

Currently in the senior level course Experimental Thermal Science (MEET 4360), the fundamentals of data acquisition and LabVIEW are briefly covered with no physical apparatus to work with. This limits the student hands-on experience with the experiments that involve data acquisition and important measurements.

With the creation of the DAQ training modules, the lab facilities will be enhanced and students in small groups of five or six together can have more practical capability in acquiring measured and recorded data as well as instrumentation in different thermo-fluid areas.



Hopper and Actuator for Rotary Swager



Team Members:

- Elyssa Reeves
- Bryce Bonanno
- Adam White
- James Koonce
- Adam Tollison

External Sponsors/Mentors:

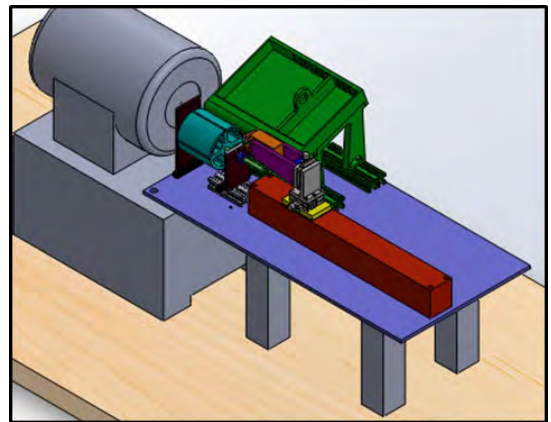
- Epimed

Internal Sponsors/Mentors:

- Dr. Seifollah Nasrazadani
- Dr. Rabah Aoufi

Abstract:

Epimed is a medical device manufacturing company located in Dallas, TX that provides high-quality specialty devices for pain management. They are designing a new product that requires a cold-forged, rounded-tip needle. Currently, Epimed is outsourcing the process of forging these needles which is costing them several thousands of dollars per lot (1000 needles). The focus of this project is to create an automated system to use with Epimed's rotary swager to bring this process in-house and reduce production costs. The needle sizes we are working with are 7-inch 16 gauge needles and 3.5-inch 18 gauge needles. Our team has created an automated system utilizing a linear actuator, provided by Epimed, to feed each needle into a barrel from a hopper, insert the needle into the swager with a gripper and the linear actuator, and dispense the swaged needles into a bin. This automated system is controlled by a PLC to allow for continued development and the addition of different size needles. With the completion of this project, Epimed will save over \$3000 after just the first lot.



We would like to thank Epimed and Dr. Seifollah Nasrazadani for supporting us throughout this project and giving us the opportunity to take on this challenge. We would also like to thank Scott Courtney, process engineer from Epimed, and Dr. Rabah Aoufi for assisting us with the electrical components.

Microgravity Gas-Liquid Separator for the Liquid Amine CO₂ Removal System

Team Members:

- Alyssa Sarvadi
- Balmore Giron
- Nick Frease
- Fernando Primo
- Hannah Whitehead

External Sponsors/Mentors:

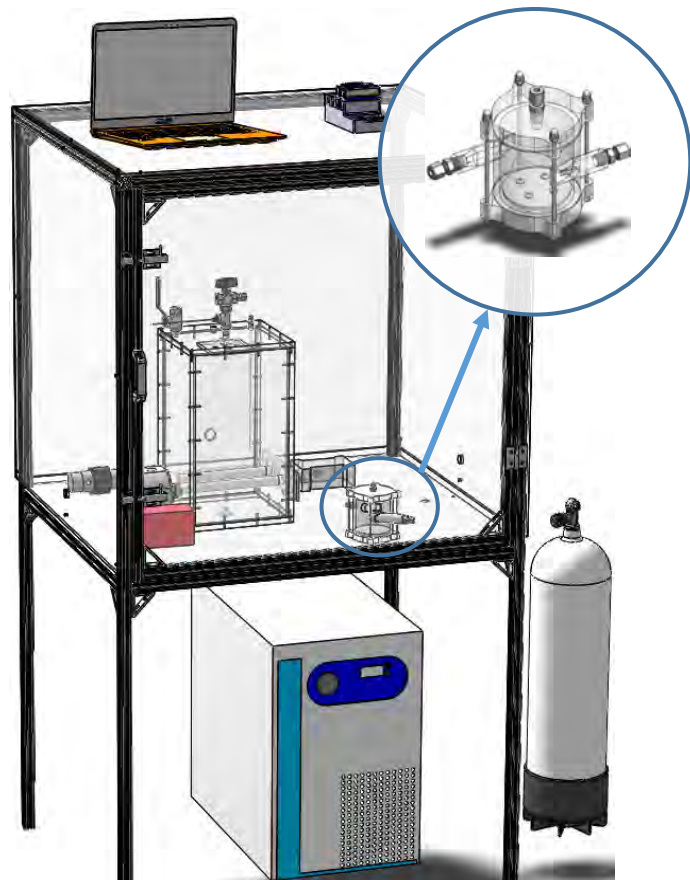
- National Aeronautics and Space Administration
- Dr. Darrell Jan, NASA Ames
- Dr. Cable Kurwitz, Texas A&M

Internal Sponsors/Mentors:

- Dr. Huseyin Bostanci

Abstract:

The X-Hab 2020 Academic Innovation Challenge has selected eleven senior design teams from colleges across the US to demonstrate working prototypes for exploration systems and habitation. UNT has been working on the creation of a gas-liquid separator for an air revitalization system. Air revitalization technology is used to support spaceflight by removing CO₂ from enclosed systems to maintain breathable air. Separating CO₂ from enclosed environments in space application is extremely important because if the CO₂ levels in an enclosed cabin exceed certain levels, death by hypercapnia can occur. The ISS currently uses solid sorbents in their air revitalization system to aid in CO₂ removal from the enclosed cabin, however solid sorbents are difficult to handle in microgravity environments and the system in which they are used with requires a large amount of energy. This project demonstrates vortex phase separator technology for removing H₂O from a CO₂ stream, which is a vital subsystem to NASA's current air revitalization system and could replace the need for use of solid sorbents. This would ensure an innovative, reliable, compact, and energy efficient air revitalization system for gravity independent manned exploration.



The X-Hab Team would like to thank Mr. Bobby Grimes, graduate student Sania Shaik, and undergraduate student Charlie Wang for their hard work and dedication to the X-Hab project

Adjustable Rotor Blade Pitch for Unmanned Aerial Systems (UAS) Operations

Team Members:

- Freddy, Huerta
- Joseph, Oladapo
- Henry, Enemuoh

External Sponsors/Mentors:

- Army Research Laboratory (ARL)

Internal Sponsors/Mentors:

- Dr. Hector Siller

Abstract:

This Senior Design Project consists of a multi-departmental collaboration at the University of North Texas College of Engineering in joint research with the Army Research Laboratory VTD Vehicle Applied Research Division. The College of Engineering students in Mechanical and Energy Engineering, Electrical Engineering, Materials Science and Engineering, and Mechanical Engineering Technology created a joint project initiation involved in the research in Unmanned Aerial Systems (UAS). The departments had initially built prototypes of the CRC 20 drone named CRC10 (Now CRC3). ARL wanted us to design blades that could be used in an adjustable pitch system integrated in the drone. This adjustable pitch was to increase forward flight, and vertical take off and landing (VTOL) performance. Almost all drones commercially available are equipped with fixed variable pitch blades, achieving adjustable pitch with Shape Memory Alloys was where the innovation started. With this came the need for a highly productive manufacturing process to be developed by ETEC students. Rapid prototyping using additive manufacturing machines with carbon fiber reinforced filaments came to use as well as CNC machined molds to be used for polyurethane casting resins.



We would like to thank ARL for providing us this great opportunity to gain hands on experience and show the innovation that drives UNT College of Engineering. Lastly, we would like to thank the professors and staff that helped us through our project especially our adv



Design and Manufacturing Concepts of UAS Morphing Structural Elements- Project Aquila

Team Members:

- Jadon Morris
- Ali Alfayez
- Braylon McCarty
- Adam Greig

External Sponsors/Mentors:

- CCDC Army Research Laboratory

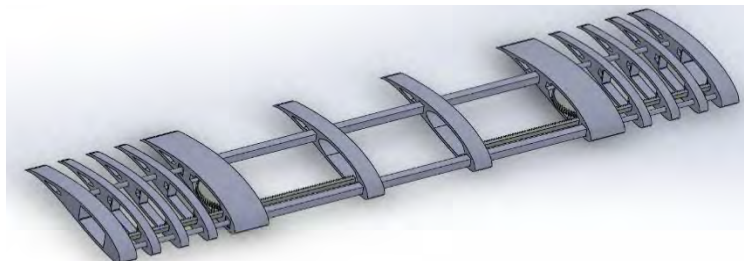
Internal Sponsors/Mentors:

- Dr. Hector Siller
- Dr. Nandika D'Souza

Abstract:

In order to more effectively use the limited battery power of an Unmanned Aerial System, this team has been tasked with developing an airfoil for a hybrid system with both multirotor and fixed-wing flight capabilities. This system was developed as a modern method for small payload delivery over moderate ranges, and as such required the reliability and maneuverability of a multirotor vehicle – which allows vertical take-off and landing – as well as the more robust flight-range capabilities of a fixed-wing system.

This team has been specifically assigned to create an airfoil for this system that not only can be rapidly reproduced, ideally using additive manufacturing, but also has mechanical components allowing for in-flight control of the airfoil's physical properties. The primary property the team hopes to effectively control is the airfoil's length. By extending and contracting the airfoil in a linear fashion from each end, the team hopes to provide a variable surface area which will allow finer control over the amount of lift and drag provided by the airfoil. In order to minimize drag caused by mechanical components, the airfoil's extension mechanism is completely internal, and all components with the exception of motors can be 3D printed and assembled by hand.



Project Aquila thanks Dr. Hector Siller for his guidance and assistance in the development of this system.

Versatile Platform for Measuring Aerodynamic and Aeroacoustics Characteristics of UAS

Team Members:

- Austin Ciervo
- Mostafa Alqamr

External Sponsors/Mentors:

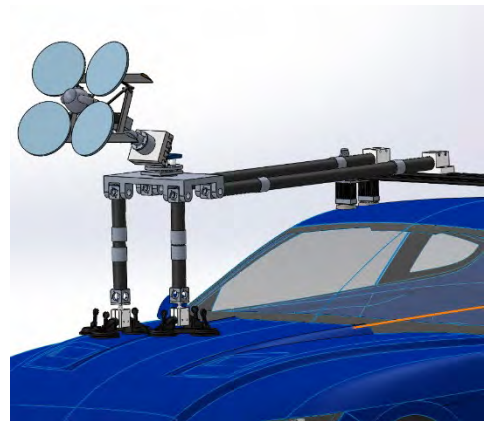
- Army Research Laboratory

Internal Sponsors/Mentors:

- UNT ETEC
- Dr. Hector Siller

Abstract:

Hybrid unmanned aircraft systems (UAS) that incorporate the design features of fixed wing vehicles and rotorcraft do not require additional control systems to enter and exit the transition flight. Such control systems require more attention as the interaction of rotor jets and wings can change the generated lift force during the transition, which might cause loss of altitude. Unmanned Intelligences' design project is to develop and manufacture a test platform to evaluate the aerodynamics and aeroacoustics of UASs. The UAS will transition from a vertical takeoff to horizontal flight by manipulating motor RPMs and pitch angles of the rotor blades and wings. In order to perform tests, the aircraft must be fixed in place on a platform which will then have the capability to mount on various automotive vehicles. The vehicle will then accelerate to approximately 40 mph to simulate airflow over the UAS. A load cell will collect data from the forces acting on the wings. Such data will be used to calculate the required parameters to perform a successful flight transition.



We would like to give a special thanks to Dr. Hector Siller, Dr. Hamid Sadat, Dr. Xinrong Li, Dr. Kamesh Namuduri, Dr. Diana Berman, Dr. Huseyin Bostanci, Ph.D. student Cesar Chavez and the Army Research Laboratory for the continuous support and guidance throughout this project.



Portable Handheld Antimicrobial Treatment Device

Team Members:

- Christopher Gibson
- Nicholas Greene
- Dalton Richey
- Jonathan Lopez
- Elijah Nisar

External Sponsors/Mentors:

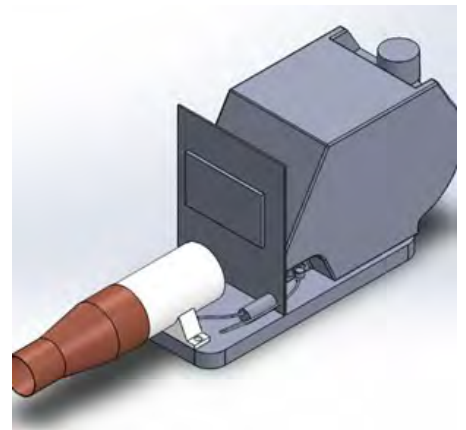
- Dis.In.Fx Inc.

Internal Sponsors/Mentors:

- Dr. Hector Siller
- Dr. Maurizio Manzo

Abstract:

Portable handheld antimicrobial treatment devices are manufactured in many different ways with multiple application methods. Currently, Dis.In.Fx is operating with the use of multiple sprayers depending on the type of application needed. Some devices are needed for extended use such as treating gymnasiums, work-out facilities, while other applications require intermittent use with high portability. As of now, there is no portable handheld antimicrobial device on the market that utilizes both wall power and/or a rechargeable battery. In addition, Dis.in.fx wants to manufacture the portable device for itself and future retail sales. With this new design, application of the antimicrobial solution will result in less time at jobsite which increases the companies profits as well.





UNT FSAE Rear Spool Differential

Team Members:

- Zachary Cline
- Matthew Peralez
- Daniel Duncan
- Ali Al Kadem
- Monty Grabner

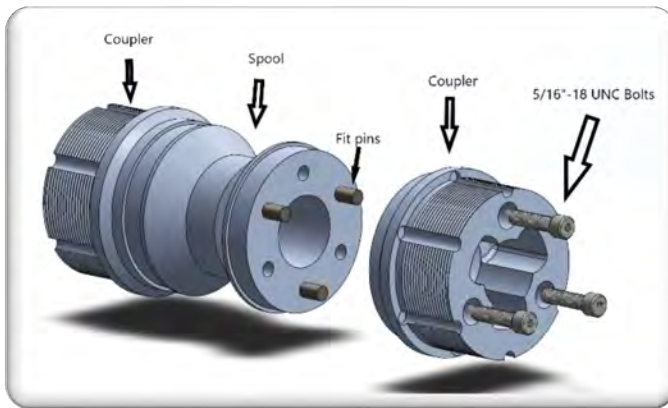


Abstract:

The differential is a key mechanism for providing vehicular stability and mobility in any drivetrain. The purpose of this project was to design a lightweight, cost efficient rear spool differential for UNT Mean Green Racing to use during the Formula SAE Lincoln national competition in summer 2020. This project investigates the transitioning process from limited slip differential (LSD) to a lightweight rear spool differential. Doing this it will decrease the weight, cost and component count of the racecar. By reengineering the rear differential this produces a more efficient energy transfer to the wheels, preventing any loses that may occur when taking turns at high speeds. The dynamics of the limited slip differential (LSD) is quite simple, the LSD design loses power around turns because the outer most wheel lifts off the ground, which transitions all the power from the inside to the outside wheel. Implementing the rear spool differential allows the UNT Mean Green racing team to not only evenly distribute power between the wheels but will put them across the finish line faster earning more points for competition.

Internal Sponsors/Mentors:

- UNT ETEC
- Professor Ali Nouri
- Mr. Rick Pierson
- Mr. Bobby Grimes





Easy-to-use Bluetooth System

Easy-to-Use Bluetooth Music System for Senior Center

Team Members:

- Hassan Alnasser
- Egue Essoh Desire Romero
- Sharon Arowolo

External Sponsors/Mentors:

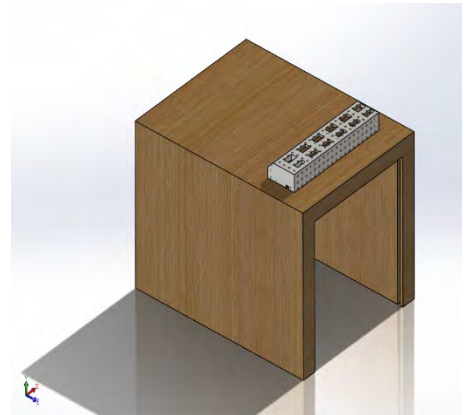
- Dr. Mitty Plummer

Internal Sponsors/Mentors:

- University of North Texas
- Dr. Mitty Plummer

Abstract:

This project deals with the development of the senior boom box for chair aerobics exercise class. Initially cassette tapes were being used to play songs during exercise class. There are many problems with this device, one being that it was producing a static sound. Additionally, the client wasted time changing in between songs, as they could not be stored in a specific order in that device. Therefore, the idea to design a Boom Box was developed, which contained multiple USB ports with switches to play the songs, along with a stop button. Songs could be arranged in order on multiple USB sticks, and a specific song could be played by pressing a single button, which has the capability to reduce the efforts made by senior citizens to turn on the music system. Not only the box is easy to use but also it will have its own speaker, which will allow the client to play music from it directly. In addition to that, with the use of the Raspberry Pi's Bluetooth system, the box can be connected to the Senior Center's sound system allowing the client to play songs through it as well.





HVAC System Design at 1401 Elm St

Team Members:

- Abdulmuin Alanazi
- Chukwuemeka Uzor
- Fredi Sanchez
- Mohammed Alzayer

External Sponsors/Mentors:

- H & G system

Internal Sponsors/Mentors:

- Dr. Maurizio Manzo

Abstract:

Heating, ventilation and air conditioning(HVAC) technology are among the modern solutions developed for the purpose of achieving indoor and vehicular environmental comfort. The air-conditioning units achieve this by offering thermal comfort for all building occupants by ensuring warmth and the air quality are within the acceptable limits while improving productivity, reducing the amount of energy usage and thus cutting on the cost of the bills..

In this project, HVAC system for Drever building, Downtown Texas was redesigned by employing a type of HVAC technology known as Variable Refrigerant Flow(VRF). The software used for obtaining project specifications of the components for this project was the AutoCAD software. Daikin system helped with the fabrication of VRF HVAC unit while the H&G helped in installation of the unit at Drever building.



Special thanks to Mr. Grant Yaney, President of H&G Systems, for his constant guidance throughout the process of bringing the project to life.



UNT #13

Mobile Stand for Trap Machine

Team Members:

- Floyd, Johnathan
- Almajed, Mohammed
- Albahrani, Kamel
- Almmarri, Abdulhadi

External Sponsors/Mentors:

- Dr. Mitty Plummer

Internal Sponsors/Mentors:

- Dr. Hector Siller
- Mr. Bobby Grimes

Abstract:

Nearby gun ranges are being flooded by fast rising water causing the ranges trap launchers to be water logged, leading to expensive repairs or replacement of the launcher. The ranges gave design requirements of lifting the launcher six feet off the ground, be mobile enough that the stand can be moved around easily to give verity to the locations that the targets come from when costumers come to shoot and with a budget of \$600. Attempts by previous design teams were not able to properly address the problem, being too short or not mobile enough to fulfill the needs of the range. Our teams design will fix the root of the problem cheaply and effectively, with our scissor lift that can hold the weight of a fully loaded launcher at the required six foot height to prevent the launchers from being water logged. While the wheels that have been chosen will give it enough mobility to be moved around easily by the employees of the ranges.



Fire Hose Auto-Roller



Team Members:

- David S. James
- Jomique Johnson
- Luis Martinez
- Olawunmi Olasoju

External Sponsors/Mentors:

- Denton Fire Department
- Battalion Chief David Boots

Internal Sponsors/Mentors:

- UNT ETEC
- Prof. Ali Nouri

Abstract:

The Fire Hose Auto-Roller is a device custom-built to serve the needs of our Denton community by improving the working efficiency and conditions of the Denton Fire Department. Fire hoses of 5-inch diameter, used for bringing water from a fire hydrant to a pump truck, are very heavy (up to 1000 pounds per 100 feet when full) and time-consuming to drain, roll, and store by manual labor, and the weight poses a safety risk for the fire fighters who have to handle them. The Fire Hose Auto-Roller will be capable of rolling, draining, and brushing clean the outside surface of hoses at the push of a button. The rolled hose can then be retrieved easily for storage on a truck or at the fire station. The device will be made of as few custom components (that is, as many off-the-shelf components) as possible to allow for easy maintenance and parts replacement by its end users. Its winch motor may be powered by either a battery or the electrical outlets on-board fire trucks. Other designers have made devices which can reel in any size of hose but are mounted to trucks, or which are portable but can only reel in 2.5-inch-diameter hoses and must be walked along the length of larger-diameter hoses, but the Fire Hose Auto-Roller will have the power to reel in any size hose up to 5 inches in diameter while being portable enough to move around training sites or be used at the scene of a fire fight independently of fire trucks.



Our sincere thanks go to UNT ETEC, Prof. Ali Nouri, Dr. Huseyin Bostanci, Mr. Rick Pierson, the Denton Fire Department, Battalion Chief David Boots, and our community and loved ones for all the input and support which have made this project possible.

EtherCAT CNC Plasma

Team Members:

- Austin Wilson
- Scott Crum
- Ryle Jersey Mercado

External Sponsors/Mentors:

- ExtraTech
- MultiCam
- Engr. Andy Cordell

Internal Sponsors/Mentors:

- Prof. Rabah Aoufi

Abstract:

Ethernet for Control Automation Technology (EtherCAT) is an Ethernet-based fieldbus system supporting both hard and soft real-time computing requirements in automation technology. The project team's objective was to upgrade MultiCam's Computer Numerical Control (CNC) Plasma Cutting Machine system's software and incorporate EtherCAT technology to produce a faster and modernized system. The projected plan consists of analyzing of the machine's performance with applied modifications via code, conducted through testing and debugging. Many benefits will be produced once the upgraded system is fully implemented, including higher performance, easier access, a reduction of cost for hardware, short data update times with low communication jitter and remote debugging configuration issues will be available.



SAE Formula Design Parts



Team Members:

- Saleh Alatwah
- Majed Aljuhani
- Belal Baamour
- Ali Almarzooq

External Sponsors/Mentors:

Internal Sponsors/Mentors:

- UNT ETEC
- Dr. Nourredine Boubekri
- Dr. Reza Mirshams

Abstract:

The objective of this project is to build a pedal box , firewall, and floor panel for University of North Texas formula car to participate in the Formula SAE competition.

SAE is the Society of Automotive Engineers. It is a US-based organization and has international events. SAE has been founding since 1905. The SAE formal race is a big event that happens every year. It is an opportunity to allow graduate students to show off their engineering skills. The senior design project formula SAE car is a project to design a formula car according to the SAE competition rules.

