IF YOU WANT SOMETHING NEW YOU HAVE TO STOP DOING SOMETHING OLD

- Peter Drucker

FROM THE DEAN

The Allen School of Engineering & Technology expresses its gratitude to the many individuals, companies and organizations who have contributed so much of their time, talent, materials and support to make the 2016 Engineering Design Expo an outstanding success.

Special gratitude goes to those individuals who served as industrial consultants. These busy people play an important part in the development of the projects by sharing their knowledge and experience. We also are grateful for the generosity of the many organizations that have sponsored or contributed materially and financially to the projects.

Although each student group has a faculty advisor, it is not uncommon for students to seek advice from other members of the Trine University family. Their interest and concern in helping students is also greatly appreciated.

We sincerely appreciate the area companies that are exhibiting their engineered products as part of today's activities. We are indebted to their support of Trine University academic programs throughout the year.

In addition to Deb Strong, who has been instrumental in assembling this booklet, I wish to personally thank the following members of the Trine administration, faculty and staff who have helped to make this year's expo a success:

Bill Barry, Ph.D., Chair, Reiners Department of Civil & Environmental Engineering
Sean Carroll, Ph.D., Chair, Department of Electrical & Computer Engineering
Maria Gerschutz, Ph.D., Chair, Biomedical Engineering
Amanda Malefyt, Ph.D., Chair, McKetta Dept. of Chemical & Bioprocess Engineering
Tom Trusty, Chair, Department of Design Engineering Technology
Darryl Webber, Ph.D., Chair, Wade Department of Mechanical & Aerospace Engineering
Engineering staff: Sue Radtke, Sheri Thomson, Bethany Repp, Jeff Raymond and Joe Thompson

And most importantly, the professors in charge of all of the design classes, whose work is on display today.

Finally, special thanks to all of the people in the offices of admission, brand and integrated marketing, and campus operations, as well as Bon Appetit Management Company, who helped to make this day a success.

Sincerely,

Timothy N. Tyler

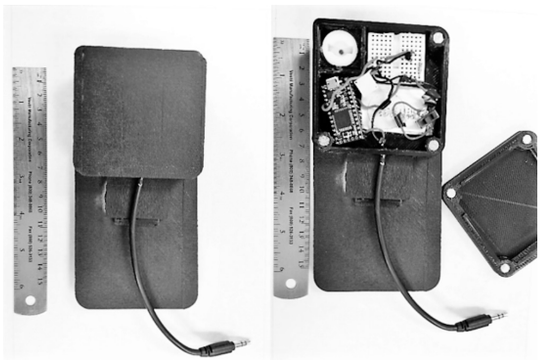
Tim Tyler, Ph.D., P.E.
Associate Dean, Allen School of Engineering & Technology

DEPARTMENT OF BIOMEDICAL ENGINEERING

SmartMed Case Product Development Team

Members: **Jordan Backer, Garrett Benedict, Paul Carlquist, Scott Evans, Sarah Fowler, Sam Ginsburg, Kathleen Seeley, Evan VanBelle and Sarah Wells**
Advisor: **Melanie G. Watson, Ph.D.**
Sponsor: **HandHeld Medical Technologies, LLC**

Current methods of blood testing require large, expensive equipment and costly visits to hospitals, which are often inconvenient and time consuming. These tests may also leave patients waiting for hours to receive results. Moreover, blood testing may require considerable amounts of blood for hemanalysis testing. HandHeld Medical Technologies, LLC of Kendallville, Indiana, aims to alleviate this issue with the collaboration of the 2015-2016 Biomedical Engineering Senior Design and Development Team at Trine University. We are designing a product to provide the resources of an entire blood lab in the palm of a patient's hand via investigation and utilization of biomimetic microfluidic technology involving blood component separation, cellular tagging, process imaging and data collection. Our research team has constructed the SmartMed Case, an innovative, hand-held medical device empowering patients to safely and conveniently perform blood tests in the comfort of their own homes, providing real-time, accurate results. This technology is capable of providing diagnostic information about a patient's overall health, potentially leading to the discernment of specific illnesses and/or diseases. The device works similarly to a standard blood glucose meter with test strips; only a single drop of blood is required for the device to analyze biological parameters. The device attaches to an iPhone, similar to a typical cell phone case. With this device, results from the blood tests can be relayed back to the patient in real time through an iOS phone application. Once the blood is applied to the test strip, the blood is transported through a series of microchannels to aid in the separation of the blood components. The strip is inserted within a cell cytometer, which generates an electric field around these microchannels to allow specific components of the blood to be manipulated and sorted into separate microchannels. These cells absorb fluorescent quantum dots, which allows them to be imaged for analysis by proprietary application software. Further development of the SmartMed Case will result in a larger variety of hematological tests and the development of additional cell phone platforms, allowing for a larger patient base.



SmartMed Case Prototype for iPhone 6 Plus

MCKETTA DEPARTMENT OF CHEMICAL & BIO-PROCESS ENGINEERING

PADNOS Polypropylene Project

Member: **Jacob Nantz**
Advisor: **Majid Salim, Ph.D.**

The project's objective was to determine if a trend exists between the number of recycle stages and the deterioration of the polypropylene's properties. Ten injection molds were taken for testing the melt index, strength, flexibility and glass percentage by using notched izod, melt index instrument and tensile tester.

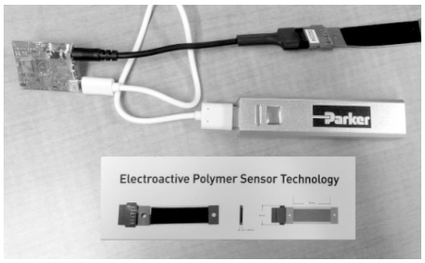
In conclusion the experiment showed a change in physical properties for glass-filled polypropylene after the first recycle. Both the impact strength and flexibility decreased, while the melt index increased. The results conclude that if the original physical properties are required, additional virgin material/impact modifier would need to be added.

Chemical Engineering Design Minor Design Projects

Advisor: **John Wagner, Ph.D.**

Each year the Chemical Engineering class participates in the AIChE National Student Design Contest. Unfortunately, contest rules prohibit publicly presenting the results until after June 1. In addition to this contest, however, the seniors complete a minor design project. The 2016 Chemical Engineering Minor Design Projects are as follows:

ELECTROACTIVE POLYMERS



Members: **Mike Mwenya, Jacob Nantz and Michael Sheperd**

Electroactive polymer components have recently been developed for biometric and other applications. These polymers change their electrical properties when subjected to physical stress or in response to their chemical or physical environment. Parker Hannifin has sponsored a contest on the novel use of these electro active polymers. A novel application involving the Parker Hannifin product has been developed by our group as an entry for this contest.

SOLAR DISTILLATION

Members: **Jenny Jackemeyer, Amanda Kempher, Caleb Knust and Lucas Krupp**

Solar distillation is a form of water purification in which solar energy is used to evaporate the water while the condensate is collected within the same closed system. A solar still was designed and built for the production of fresh drinking water. This still purifies water using an energy-efficient design and is constructed from easily accessible materials. The efficiency of the still was quantitated, and the product water was analyzed for purity. The advantages and disadvantages of solar distillation compared to alternatives were investigated.

ARCHIMEDES FOOT WASHING STATION

Members: **Josh Chapman and Ethan Maust**

At Camp Chief Little Turtle in Pleasant Lake, Indiana, safety rules state that people must wear shoes at all places except the waterfront, thus creating a requirement of campers having to put shoes on sandy feet every time they exit the waterfront. The current foot washing station is inconvenient and is a major source of camper complaints.

A new foot washing station was built that involves a human-powered Archimedes screw 4 inches in diameter and 7 feet long. The screw pumps water from the lake to a new multi-user foot washing station. This new foot washing station makes the act of transitioning from beach activities to land-based activities much more efficient and enjoyable.

PROPYLENE GLYCOL COOLING SYSTEM FOR LOCAL WINERY

Members: Shelby Frailey and Stephanie Radandt

A local winery is considering adding fermentation capacity. To maintain the flavor of the wine, it is essential that the fermentation and conditioning temperature be maintained to within a degree or two of specification. To accomplish this, a circulating cooling system was designed.

Propylene glycol is the standard coolant used in wineries because of its low toxicity, miscibility with water and low freezing point. A circulating glycol cooling system was designed for this winery to provide the cooling capacity for their anticipated increased capacity. The design parameters included the heat transfer area in the fermentation and conditioning vessels, the temperature and flow of the circulating glycol, the power requirements of the system, as well as estimates of capital costs. The control system and a process flow diagram were also included in the design.

ACETONITRILE IS A COMMON SOLVENT USED IN CHEMICAL ANALYSIS

Members: Mohammed Alajaji and Saud Almingash

Acetonitrile is a common solvent used in chemical analysis. In particular, the chemistry department generates several liters of aqueous solutions of acetonitrile waste. The recovery and purification of acetonitrile from this waste is complicated by the fact that it forms a minimum boiling azeotrope with water. A method was developed involving an entrainer to effectively recover the acetonitrile and eliminate this as a waste stream. This will lessen the future environmental footprint of the university and save on solvent and disposal costs.

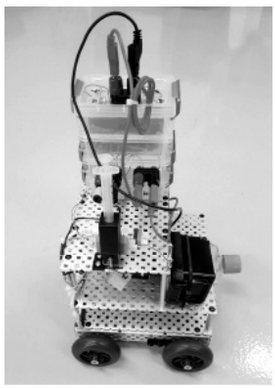
PASTEURIZATION

Members: Brian Alexander, Michael Becker and Zach Richardson

Pasteurization is a heat treatment process used to stabilize beverages while minimizing flavor alterations. A local microbrewery is interested in this process to create a product that is stable for longer periods of time at room temperature. A small-scale continuous pasteurizer was built using common components to evaluate the heat treatment effects on beverage products and better understand the method of pasteurization. This pasteurizer can then be used to optimize process parameters. The pasteurizer consists of three separate heat exchangers. The first exchanger utilizes the heated material and acts as a pre-warmer. The second exchanger heats the fluid up to the desired pasteurization temperature using boiling water. The third exchanger cools the fluid quickly with cooling water.

AICHE CHEM-E-CAR

Members: Brad Auld, Nick Cassidy, Michael Greenwell and Matthias Phillips



A small car that is powered and stopped using chemical reactions was designed and will be taken to the AIChE Chem-E-Car competition to compete with other schools. At this competition, teams will be given a distance and load requirement the car needs to achieve.
A magnesium-air battery was used as the power source and an iodine clock reaction was used as the stopping mechanism. The battery was built from magnesium metal, activated carbon cloth, copper metal and a salt solution. This combination provides around 9 V and 2 A (18 W). The iodine clock reaction was used in combination with a laser and photosensor. By using the magnesium-air battery and the iodine clock reaction, the car is able to move and stop autonomously.

INTERACTIVE EXCEL FILES

Members: Alicia Eavey and Doug Jakubowicz

Interactive Excel files were developed for students and professors. The files allow professors to create example problems with randomly generated variables. This allows each student to have their own problem.

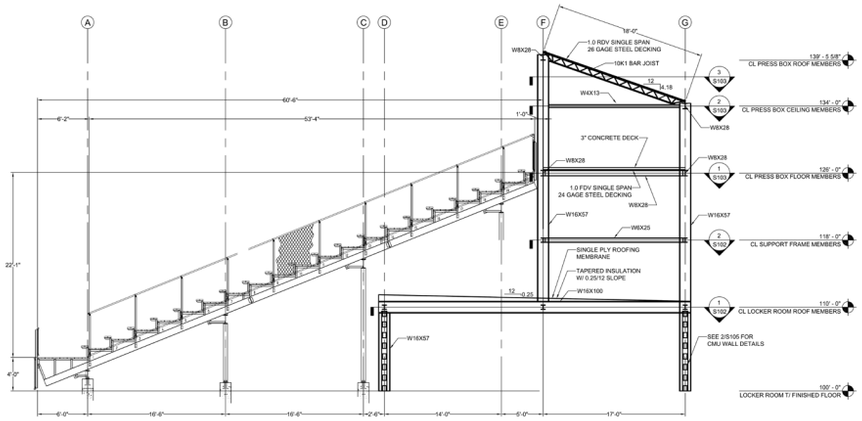
The files developed for the students provide feedback to the students if they provided the correct answer. If the student does not provide the correct answer after multiple attempts, the file will direct the student to an online video resource that will go through a similar problem step by step. The problem will be reset, and the student will be given the opportunity to attempt the problem again. This will ensure that all of the students demonstrate a level of competence and are provided with on-demand context-sensitive help.

REINERS DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

DeKalb High School Football Stadium Renovation

Members: **Zachary Bower, Ethan Maust, Jacob Ullom and Blake Warner**
Advisor: **Prof. T. J. Murphy**
Sponsors: **DeKalb Central Foundation, Inc., John McDermott and DeKalb High School**

DeKalb High School has requested several improvements to its current football facility including: a new football field turf, new bleachers, a new locker room, a new press box and a new entryway/ticket booth. The design team specified field turf and bleacher models to be used at the high school, evaluated the drainage effects of the new field turf and designed the framework of the new structures. The main feature of this project is the locker room, press box and bleacher layout and design. The locker room will be placed below both the press box and bleachers, with the press box directly behind the bleachers, so the locker room and press box will each be part of a single framework tying the structures together and also supporting a portion of the bleachers.



Decatur Wetland/Detention Basin Flood Mitigation Project

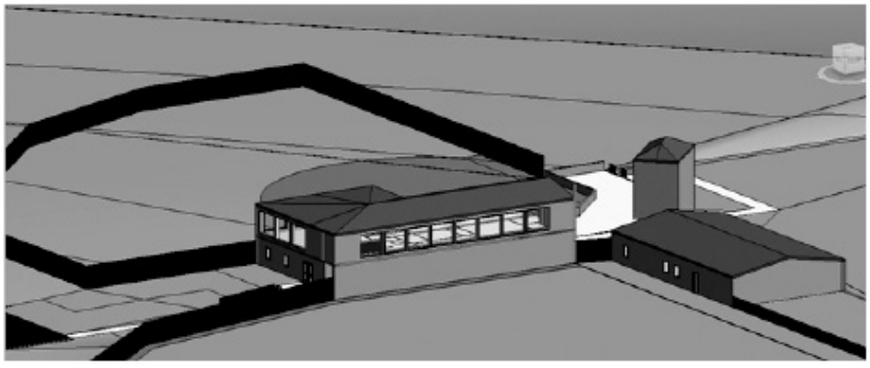
Members: Nicole Garrison, Katlin Kershner, Joe Schroeder and Charles Stewart
Advisor: Prof. T. J. Murphy
Sponsor: City of Decatur Engineering and Stormwater Department, Nate Rumschlag

The City of Decatur requested a proposed solution to severe flooding of the St. Mary's River at Keekionga Park and the surrounding neighborhood during large storm events. The existing stormwater collection system does not have sufficient capacity to convey stormwater from the 400-acre watershed. The flooding is damaging nearby homes, playgrounds and parks. The city and residents are burdened with repair costs. This project is a planning-level design for a wetland detention basin to handle the influx of water during a 2-year, 50-year and 100-year storm event. This will reduce the volume of water that enters the river and mitigate the flooding problem for the City of Decatur.

Trine University Baseball/Softball Clubhouse, Alumni Suite and Underground Practice Facility

Members: Jeremy Colson, Jake Kendall, Colin O'Keefe, Alivia Recker and Spencer Sutton
Advisor: Prof. T. J. Murphy

This project was for the design of a new complex for Trine University's baseball and softball programs. The complex will have two separate buildings connected by an underground batting facility. One building will be a clubhouse for the baseball team and the other a clubhouse for the softball team. The softball clubhouse will be connected to the back of the softball dugout, while the baseball clubhouse will be along the right field line of the baseball field. The softball clubhouse will be two stories with the top floor having an alumni suite. The suite will be surrounded with glass windows so the fans can either watch a softball or baseball game. The batting facility will be located under right field of the baseball field, with entrances into both of the clubhouses. Each building will have lockers, a trainer's room, coach's office and a classroom that will allow the buildings to be used for academic purposes.



Albion Indiana Hidden Diamonds Park Pavilion and Basketball Court

Members: Mike Anderson, Nathan N. Miller, Andrew Plough and Tanner Vannieuwenhoven
Advisor: Prof. T. J. Murphy
Sponsor: Albion Department of Parks and Recreation, Casey Myers

This project included the design for additions to be made to Hidden Diamonds Park for the Town of Albion Parks Department on behalf of Casey Myers. The project includes designing a full-size basketball court, pavilion, handicap accessibility and site grading. The pavilion was designed with roof trusses, masonry walls and bathrooms. The basketball court was designed to be an asphalt surface with subgrade. Grading and stormwater controls were designed to minimize any impact due to increased stormwater runoff.

Lake Minifenokee Earthen Dam Evaluation and Design

Members: Corey Bremigan, Alex DePoy, Alison Lang, Corey Ng, Mitch Pratt and Matt Silver
Advisor: Prof. T.J. Murphy
Sponsor: Lake Minifenokee Homeowners Association

The homeowners of Lake Minifenokee in Fremont, Indiana, have noticed the level in the lake has been decreasing over several years and are worried about the long-term impact of a falling lake level. The homeowners believed that the earthen dam might be leaking, causing the loss of water. The dam required many upgrades based on state inspection. For this project, the dam was evaluated by taking soil borings through the dam, evaluating seepage through the dam, and performing hydrologic routing of a 100-year storm through the lake. Although the group determined leaking from the dam was not the likely cause of the problem, but rather falling groundwater levels, a new dam was designed to meet the specification for the state.

ASCE Steel Bridge Competition

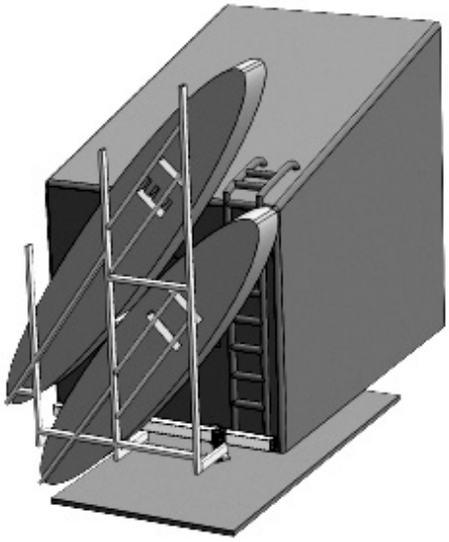
Members: Wynn Bishop, Nathan Miller and Jimmy Radabaugh
Advisor: Prof. T.J. Murphy
Sponsors: AISC and ProFab, Jay Stevens

A steel bridge was designed to compete at the 2016 American Society of Civil Engineers Great Lakes Student Conference on April 15, 2016. A warren deck truss spanning 20 feet, 4 inches was selected for design based on its stiffness, constructability and overall appearance. Individual members less than 3 feet long made of hollow structural sections (HSS) varying in sizes make up the bridge. HSS was chosen as a steel type based on its high strength-to-weight ratio. The two decking support surfaces are spaced 2 feet, 8 inches apart and are braced by cross bracing at the ends and every 4 feet to resist lateral-torsional buckling. Also a bracing system that inhibits side sway during lateral loading can be found at two locations. The bridge is designed to simultaneously support a vertical load of 1500 pounds at the center and a varying vertical load of 1100 pounds. Using the HSS and warren deck truss configuration allows us to meet competition regulations while being highly competitive in the categories of lightness, stiffness and construction speed.

DEPARTMENT OF DESIGN ENGINEERING TECHNOLOGY

Kayak Transportation System Project

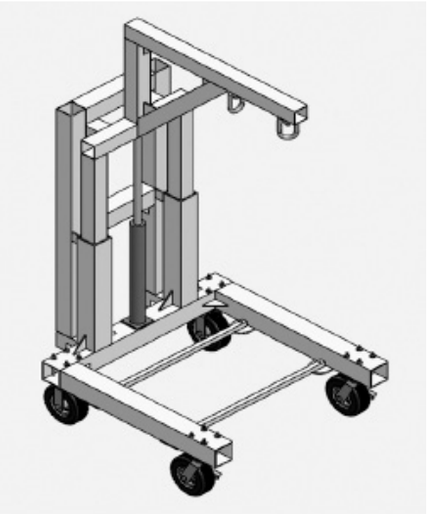
Members: Patrick Butler, Luke Henley, Ross Jones and Nathanial Scroggins
Advisors: Timothy Jenkins, Ph.D., and Jason Blume (Innovation 1)
Sponsor: Mike Bock, Senior Vice President – Trine University
Other Partners: TK Steel, Inc. (steel donation), Innovation 1 and Aluminum Alliance Products (aluminum donation)



One issue for kayakers when towing a fifth-wheel trailer is that the user no longer has the option of transporting the kayaks in the bed of the tow vehicle. The proposed Kayak Transportation Rack is a solution for any individual towing a fifth-wheel camper trailer who also wants to transport up to two longer kayaks with the same tow vehicle and fifth-wheel camper setup. As part of this solution, a 13 foot, 5 inch kayak was used, since this is the size of one of the sponsor's kayaks.

Unfortunately, this is only 1 inch shorter than the 13 foot, 6 inch DOT regulation for allowed vehicle height. This eliminates most transportation solutions on the rear of the fifth-wheel camper or over-the-cab designs. Based on these issues, the team designed and fabricated a rack that allows the user to easily load, transport and unload two kayaks without damage to the tow vehicle, fifth-wheel camper trailer and kayaks. The design abides by all DOT regulations for height, width and length when the tow vehicle and fifth-wheel camper are connected. The device is connected to the hitch of the fifth-wheel camper and lifts the kayaks up and down using an electric winch.

Remote Operated Small Arms Mount (ROSAM) Lift



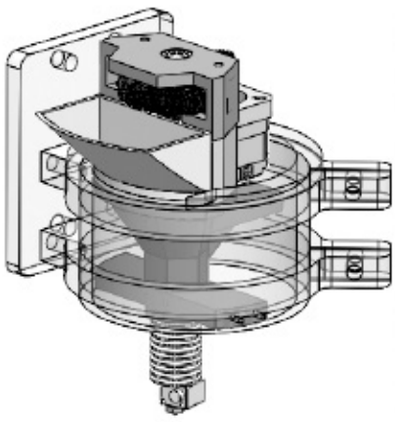
Members: **Kyle Auernhamer, Buddy Denman, Seth Lloyd and Brandon Wilson**
Advisors: **Timothy Jenkins, Ph.D. and James Ernest (Crane)**
Sponsor: **NSWC Crane and Innovation 1**

The Navy uses a Remote Operated Small Arms Mount (ROSAM) to test various weapons systems on firing ranges around the world. Currently, to move the ROSAM requires multiple people or heavy lifting equipment (fork lift) not suited for the task. Due to the top-heavy, 600-pound construction, moving the ROSAM is a cumbersome operation. With the use of a lift made especially for transporting the ROSAM over daily obstacles such as rough terrain and a three-inch vertical level change from the loading dock to the truck bed, the ROSAM can be transported with fewer people and equipment. After being reviewed by the team's sponsor, the concept that was pursued was a combination of the modified engine lift as the base concept, the I-beam cart system's cart idea and the U-shaped dual rail lift design. This final concept uses dual rails to raise the lift with a single hydraulic jack, the modified engine hoist frame, wheels, boom and strap designs, two swinging bars to act as a cart to set the ROSAM down during transport and a new roller system design that keeps the dual rails from pinching with the weight of the ROSAM. This design will allow for the lift to move over multiple terrains and safely raise, lower and transport the weight required by this project.

ShopBot CNC Router to 3-D Printer Conversion

Members: **Warren Burkhart, Russell Cooper, Kegan Crafton and Sam Margulis**
Advisors: **Timothy Jenkins, Ph.D., and Vic Makximenko (Crane)**
Sponsor: **NSWC Crane and Innovation 1**

Three dimensional (3-D) printing is a process where material is added a layer at a time. CNC is a process in which a cutter is programmed to remove material. Both processes are programmed with G-Code and have the same concept of axis movement. The objective of the CNC/3-D printer project is to convert a standard 4-by-8-foot ShopBot CNC router table to a functional 3-D printer platform. This includes developing processes for exchanging different heads such as extruder heads and router heads for laboratory prototype purposes and exploring different types of materials that can be implemented on the integrated 3-D printer/router application. Several concepts were developed that could be well-suited for the platform conversion, including a standard filament, feed gear and an auger extruder. An auger- and pellet-based 3-D printer extruder was selected to meet the design requirements for this conversion based on material choice, platform size and sponsor interest. Using pellets gives a larger variety of available materials and also reduces print material cost, which helps when printing on a large scale. The extruder will be interchangeable with the router head using a custom fabricated mounting adapter, Figure 1, allowing the two systems to use the same mounting bracket.



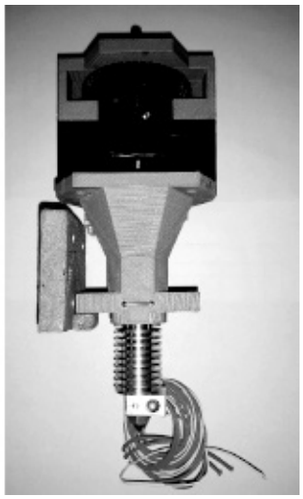


Figure 1: Complete Assembly Figure 2: Prototype Assembled

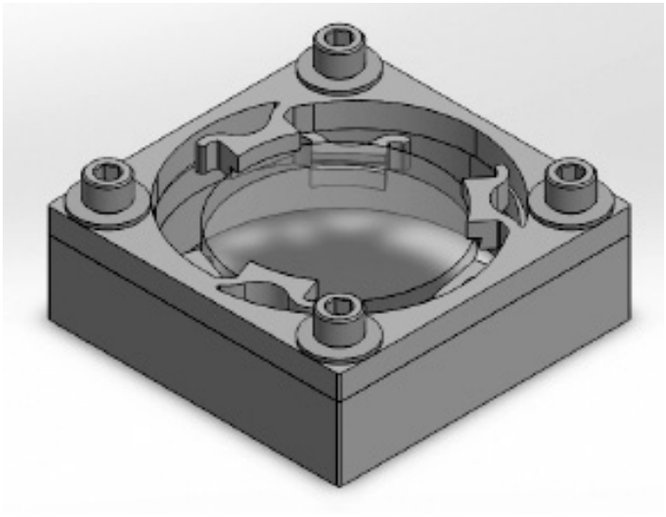
Pet Cleaning Station

Members: Ben Gaddy, Mark O'Neill, Steffan Slick and Devon Stout
Advisors: Timothy Jenkins, Ph.D., and George Hunter (Hudson Aquatic)
Sponsor: Hudson Aquatic Systems, LLC and Innovation 1

The project called for the design team to work with Hudson Aquatic Systems LLC in designing a polymer-based grooming table or tub to be used with pets. The expected result was a better alternative to current stainless steel tub models in use for pet grooming and cleaning. The polymer-based design should be lighter and less expensive than current models. It will also be able to open up opportunities for smaller shops. Interviews at several locations in the town of Angola that use pet cleaning stations daily were conducted and resulted in learning the true needs of the customers. These needs included adjustable height, ease of access for pets, and a surface that prevents pets from sliding. Based on the acquired needs and specification requirements, some concepts were generated that lead to a final design solution. The cleaning station uses a scissor lift to account for adjustable height. It features a marine-grade polymer base with an aluminum frame for rigidity. It holds pets of every size, big and small, and is versatile for the user as well. The design that the team came up with encompasses everything that the sponsor and the customers would like to see.

Satellite Optic Mount

Members: Jake Ahearn, Alec Burchard, Tyler Harding and Drew Rowe
Advisors: Timothy Jenkins, Ph.D, and David Lund (Harris Corp)
Sponsor: Harris Corporation Space and Intelligence Systems and Innovation 1

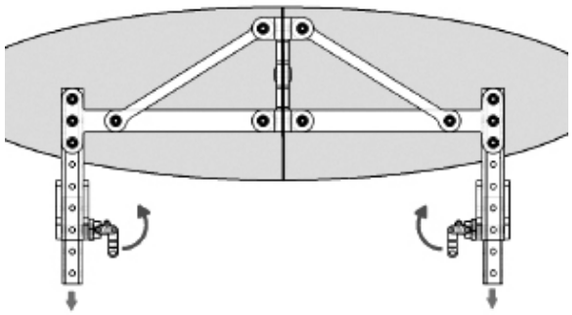


Optics provide a vital role in the functionality of satellites and have a wide variety of applications on space crafts. These optics allow precision gathering of data and require a high level of precision and stability. This demands secure mounting in order for the optic to survive launch, be cryogenically cooled in orbit, and remain undamaged for 10-15 years in space. An optic mount is to be designed for Harris Corporation of Fort Wayne, Indiana, the sponsor for the optic mount project. The proposed design balances strength, stiffness and kinematics over a wide range of dynamics and temperatures. The mount accurately holds an optic lens in place without causing body distortion and must fit within a restricted size envelope (small cube). The design cannot exceed three pounds total weight. The mount will operate in a temperature range of 80K to 300K (-315°F - 80°F). The design team extensively researched space-capable materials since all materials used have to meet NASA out gassing standards. The design chosen incorporated finger flexures. The flexures were intended to apply a minimal load to prevent the optic from rattling under launch vibrations. The flexures could also flex to avoid overloading the lens due to thermal contraction. The design shown was tested using finite element software, in SolidWorks Simulation, for robustness against temperature shock and mechanical vibration on a vibration table at room temperature.

Wing Pod Mount

Members: **Britney Browning, Tyler Hodson, Zach Rilett and Wes Shirley**
Advisor: **Timothy Jenkins, Ph.D.**
Sponsor: **Brian Thomas, Ph.D.**
Other Partners: **Airframe Components by Williams, Inc. (donated consulting and air frame parts)**

Imagine going on a trip for two in a private plane, like a Zenith CH 750. A plane of this size really does not have much room for luggage. This problem is an ongoing dilemma for private plane owners who want to take more personal items on trips. The team's sponsor has come across this problem while traveling in other planes and has thought about some key things needed for his plane due to limited cabin storage space. Thus a decision was made that a system needs to be mounted under one wing of the airplane to hold items like a cargo pod, a bicycle and/or a camera mount. The mounting system needs to be able to hold these items one at a time or in combination under the wing safely, while remaining lightweight. Along with creating the mount, the team needs to have a way to quickly disconnect the item(s) being carried during flight. This quick release system would allow the pilot to pull a lever in the cockpit to quickly disconnect whatever is under the wing. The entire mounting system along with the device being carried needs to weigh no more than 50 pounds. The team designed a final system made of aluminum and steel components that will be bolted to the wing framing and allow for interchangeability of carried items.

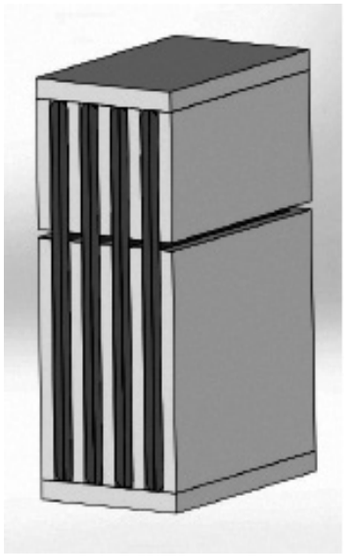


NASA Human Exploration Challenge

Members: **Jacob Boswell, Charlie Dreessen, Jarred Finnerman, Melissa Grahovac, Cydney Huey, Dustin Johnson, Cody Mart, David Roach and Zach Sylvester**
Advisors: **Brian Thomas, Ph.D., and Timothy Jenkins, Ph.D.**
Sponsor: **Design Engineering Technology Department**
Other Partners: **Vestil Manufacturing (donated aluminum), Finnerman Custom Services (donated material and fabrication) RRFabwerks (frame fabrication)**

The purpose of the NASA Human Exploration Challenge is to engage student teams to design and test new technologies and concepts that could possibly be used on future exploratory missions in outer space. The task was to design a vehicle that can traverse terrains similar to those of other planets, moons, asteroids and comets. The vehicle is designed to be carried and operated by the two people. In addition, the vehicle is designed to collapse and fit inside a 5-foot cube. One key change for the 2016 competition was the complete design of wheels except for the hub. Thus the team avoided using prefabricated commercially available products as much as possible during the design phase. In addition, the team wanted to create a novel concept for the rover as a whole, including using independent suspension and a rack-and-pinion steering system. The team was able to travel to Huntsville, Alabama, to compete in the annual NASA Human Exploration Rover Challenge, where schools from around the world attended. This gave students a unique experience and a chance to compare the work on this project to the work done by hundreds of other students. This was great exposure to what can be expected after graduation when it comes to managing a project from start to finish.

iPad Shipping Container



Members: Kyle Barber, Blake Hochstetler, Kamden Plonka and Megan Smart
Advisors: Timothy Jenkins, Ph.D., and Rick Gibbons (Tech Defenders)
Sponsor: Tech Defenders and Innovation 1
Other Partners: Plastifoam Company

The use of hand-held technology in the educational process for today's youth has increased dramatically in the last decade. With this new integration of devices, like tablets and laptops, comes an assortment of issues. For instance, when a hand-held device breaks, someone has to fix that problem. That person is not always in the same location in which the damage occurred. This usually requires devices to be shipped to outside companies and then returned when the product has been refurbished. As of now, there has not been a cost-effective and efficient way of shipping electronic devices to and from the repair facility. A company called Tech Defenders is looking for a solution to this problem and has partnered with Innovation One at Trine University to develop a shipping design concept. A senior design group came up with several concept designs that were then broken down into components. The sponsor chose the design shown here to best meet current needs and cost. This design, using shaped endcaps that hold the devices in place inside the shipping container, will allow multiple devices to be shipped safely for repair and repaired devices returned to the user. This design proved to be both efficient and effective in handling multiple devices for shipment to and from the sponsor's repair facility.

Direct Digital Manufacturing Competition

Members: Matthew Frane, Codie Horan and Hallie Roof-Hildreth
Advisors: R. Thomas Trusty and Timothy Jenkins, Ph.D.
Sponsor: Department of Design Engineering Technology
Other Partners: Innovation 1

Each year the Society for Manufacturing Engineers (SME) presents a Direct Digital Manufacturing (DDM) competition. The design competition is sponsored by the Direct Digital Manufacturing Tech Group, which is a part of SME's Additive Manufacturing Community. There are currently seven recognized additive manufacturing processes that optimize the form, fit and function of designs that might otherwise not be possible to create. The competition for the 2015-2016 academic year is to take an unmanned aerial vehicle (UAV) design and improve upon it using additive manufacturing. The submissions will be scored based on criteria provided by the sponsor. The hexacopter sits at about 5 feet wide and 1 foot in height when it is fully assembled. The team determined that the arms of the hexacopter were the ideal part to modify. The team chose to alter the design of the hexacopter to allow the arms to be folded on a hinge and locked into place. The redesigned parts are required to be created using additive manufacturing methods to allow for modifications and end user repair. This concept design is intended to be a quick, versatile, and sturdy solution for consumers to be able to transport and store the large hexacopter with ease.

Figure 1: Hexacopter Current Design with Fixed Arms

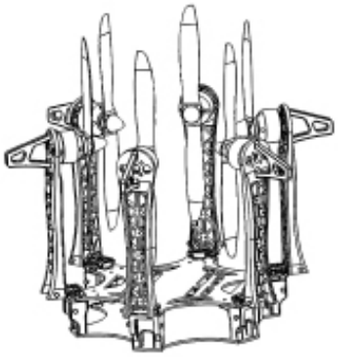


Figure 2: Hexacopter Redesign with Folded Arms

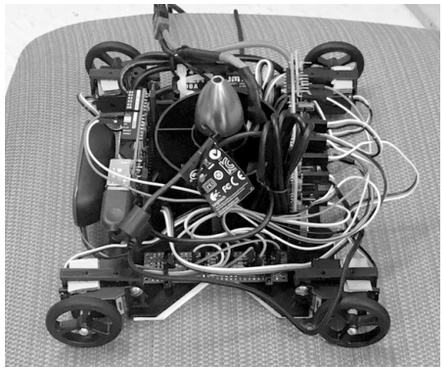
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Burr Oak Tool Triumph Bender Buckle Detection System

Members: **Andrew Cameron, Sean Galloway and Joe Gest**
Advisor: **Steve Carr, Ph.D.**
Sponsor: **Burr Oak Tool, Michigan Rebuild and Automation**

This project is a collaborative effort between Burr Oak Tool, a Sturgis, Michigan, company specializing in the manufacturing of tube processing machinery; and Trine University students. One of their premier lines, the Triumph Tube Bender, unrolls and bends coils of copper, aluminum and steel tubing into cooling coils. An issue that can occur during this process is jamming and consequently buckling of the tube; that is where our design comes into play. Their current system, utilizing wheels that detect motion in the tube, was giving false buckle readings because the sensors monitoring wheel rotation were sending signals too quickly for their PLC to register. By replacing the PLC input cards with more advanced high-speed counter modules, the bottleneck in their control system was eliminated. Another solution that we devised was the use of logarithmic suppression laser sensors, to detect when the tube deviates from its intended path, to denote a buckle. This technique eliminates the need for the tubes to be in contact with the wheels, eliminating the wear associated with moving parts and creating a more robust machine. However, due to the industrial environments that these cells will be located in, sensors that require an unobstructed and relatively clean environment will suffer from poor performance. For this reason, implementing changes to their controls infrastructure is the more effective solution and the path we chose to pursue.

Ceiling Climbing Robot



Members: **Jonmarc Hewett, Brok Sailor and Ryan Willmann**
Advisor: **Sameer Sharma, Ph.D.**

The purpose of this project is to design a robot that has the ability to climb up a wall and transition to the ceiling without falling. While the robot is suctioned to the wall and ceiling, it has to be able to move freely up and down, and it has to be able to make left and right turns. The final step of the project will be for the robot to navigate through a maze on the ceiling. We have provided a first-person view from the robot itself so the operator can view firsthand each obstacle as the robot moves throughout the maze. All controls for the robot, including the livestream video, are handled via a portable touchscreen controller. The portable controller consists of a Raspberry Pi 2 with a mounted touchscreen display. The display shows the images from the camera with button controls overlaid on the video feed. Using the controller, the operator can control the movement of the robot and avoid any obstacles.

Guitar Hero Robot

Members: **Kyle McClellan, Zach Thorn and Matt Toy**
Advisor: **Andrea Mitofsky, Ph.D.**

We have built a robot that plays the game Guitar Hero. We use a standard web camera to watch the screen. In place of one's fingers, solenoids press the buttons and strum the guitar. We wrote code in National Instruments' LabVIEW to control the robot as it plays the game.

Road Monitor

Members: **Jayson Brennan, Kyle Livingstone and Ray Secondo**
Advisor: **Andrea Mitofsky, Ph.D.**

Our device detects potholes through various sensors and plots them on a map via an app. The project uses hardware that can be mounted on a vehicle and is a combination of proximity sensors and accelerometers that feed into an Arduino microcontroller. This system is powered by a combination of a solar panel and batteries. The user interface is an Android app that displays a map powered by Google Maps. On the map, pothole placements and severities are recorded and sent off to Google's App Engine in the cloud. The user interface and hardware are connected using Bluetooth communication. This system provides real-time data on road conditions affected by potholes.

Network Connected Speakers

Members: **Steven Bradford and Aaron Ceckowski**
Advisor: **Steve Carr, Ph.D.**

This project is to create a speaker system that can operate in all rooms of a house simultaneously. Each speaker is independent and has an amplifier incorporated into it. The system utilizes a pre-existing WiFi network to handle communication between the speakers and the app. The system allows the user to place speakers around their home and then select music to play and adjust the volume remotely from the app.

Battleship

Members: **Kyle Brown, Casey DeMonia, Nathaniel Harrison, Caleb Reed and Colin Thompson**
Advisor: **Sameer Sharma, Ph.D.**

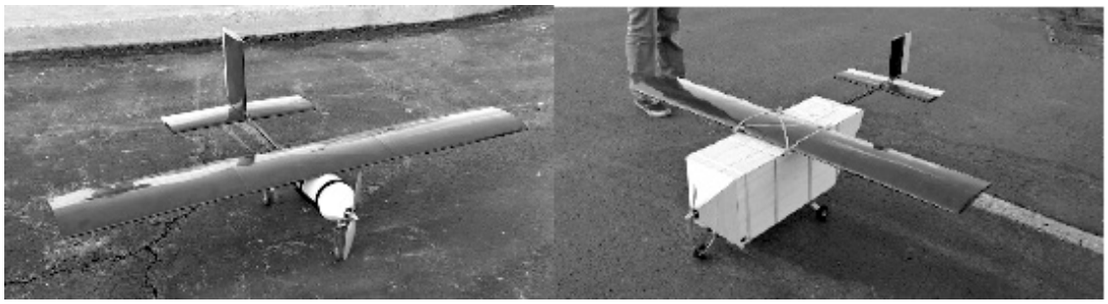
For our project, we designed two battleships that are each controlled by an Android app. The battleships fire at each other by lighting up an infrared LED, and the other ship gets hit when the infrared receiver detects the LED signal. After getting hit, the ship will make a sound so the user can tell their ship was hit. Also, the app will update a score, tallying the number of hits by each ship, and will later display a winner at the end of a round.

WADE DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING

AIAA Design-Build-Fly Competition

Members: **Westin Becker, Kevin Berry, Aaron Bruner, Mike Chernoff, Mark Haydock, Jonathon Lantz and Chris Short**
Advisor: **Jamie Canino, Ph.D.**
Competition Sponsor: **American Institute of Aeronautics and Astronautics (AIAA)**
Sponsor: **Indiana Space Grant Consortium**

Seven MAE seniors entered the American Institute of Aeronautics and Astronautics (AIAA) Design-Build-Fly (DBF) competition in Wichita, Kansas. This competition required the seniors to design, build and fly a remote-controlled aircraft to learn about aircraft fundamentals and airplane structures. The competition required the group to build two separate aircrafts. The first airplane would need to be able to internally carry an unopened Gatorade bottle. The second aircraft was required to carry the first airplane broken down into sub-components. The competition gave a prescribed course layout with prescribed missions for each airplane. During the fall semester, the team sized the aircraft based on power calculations and used XFLR5 to ensure stability. The team also explored wing manufacturing techniques. During the spring, the team manufactured the planes and tested them to prepare for the competition.

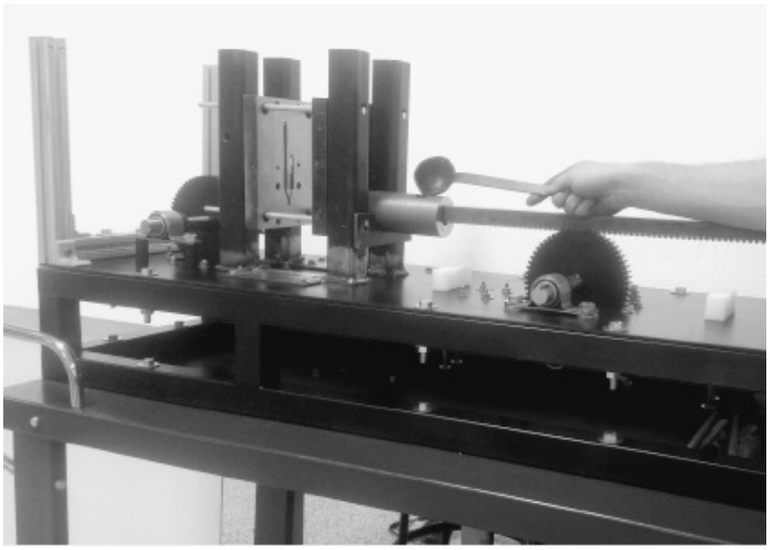


Basic Utility Vehicle (BUV)

Members: **Devin Copple, Courtney Forsythe, Jaime McCarrell and Taylor Rabel**
Advisor: **Jamie Canino, Ph.D.**
Sponsors: **Advantage Driveline, Hydra-Gear, Indiana Fluid Power, Parker, Sherwin-Williams, Tek-Hackett and Vestil**

Basic Utility Vehicles (BUVs) are simple rugged vehicles made by the Institute for Affordable Transportation. The vehicles are designed to be used in Third World countries, where they aid in everyday tasks such as gathering and transporting water. The BUV Competition is put forth in an effort to generate new ideas for the vehicle's design. The requirements for this competition note the vehicle must be durable, easy to manufacture, made of readily-available automotive parts, and capable of operating in extreme conditions. In addition, it must carry three 55-gallon drums of water with the capability of emptying and refilling said drums. The inclusion of a hydraulic drivetrain provided the team with new challenges and learning opportunities when designing the BUV. The project offered real-world engineering practice through design, analysis, production, assembly, budget and time management. The team traveled to the 16th Annual Basic Utility Vehicle Competition in Batavia, Ohio, on April 23, 2016.

Die Casting Machine



Members: Ryan Gerber, Christie Hasbrouck, Kevin Lincoln and Joshua Peters
Advisors: Jamie Canino, Ph.D. and Darryl Webber, Ph.D.

Dr. Darryl Webber, chair of the Wade Department of Mechanical and Aerospace Engineering and Foundry Educational Foundation Key Professor, expressed a desire for a laboratory-scale cold chamber die casting machine for Trine University's foundry. He wanted a machine that could serve dual purposes – the first, to teach students about the die casting process, including how thin of a section it could create; and the second, to produce metallic tensile specimens to be pulled in lab to teach students about material properties. A cost-effective, mobile, laboratory-scale die casting machine was designed and built by a group of three senior mechanical engineering majors: Ryan Gerber, Christie Hasbrouck and Kevin Lincoln; and one senior electrical and mechanical engineering double major: Joshua Peters. The machine casts both a tensile specimen and a step block from each shot of molten tin, which is melted in a crucible separate from the machine. Thermocouples and pressure sensors display a variety of data from the machine on a liquid crystal display (LCD).

GPS Delivery Robot

Members: Jedi Colinco, Mitchell Herber, Alex Payne and Craig Wiggins
Advisor: Jamie Canino, Ph.D.

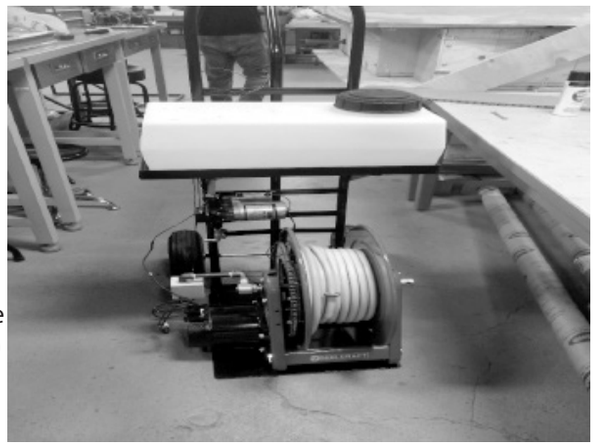
The purpose of our project is to design a robot that uses GPS to autonomously deliver mail from the east door of the University Center to the northeast door of Fawick Hall. Requirements were placed on speed, navigation, collision avoidance, cargo weight and volume, weatherproofing, safety and cost.

Like most land-based vehicles, our robot has a frame, body and wheels. The frame of the robot is made from square aluminum tubing. We chose aluminum mostly because of its strength-to-weight ratio. The body is made from plywood because it is light, workable and cheap.

The brain of our robot is an Arduino microcontroller, which is basically a tiny computer. The microcontroller receives information from its inputs. In this case, the inputs are ultrasonic sensors and a GPS antenna. The GPS antenna tells the microcontroller where our vehicle is located and the ultrasonic sensors act like eyes to tell the microcontroller if any obstacles are in the way. All of the input information is run through our computer program in order for the microcontroller to output the correct information to drive the motors.

The computer-controlled motors are what drive our robot. We used a chain and sprocket system to transfer power from the motors to the drive shafts. The motors get their electrical power from two car batteries. The vehicle is front-wheel drive and contains two independent drivetrains (motor, axle, wheel etc.). The two drivetrains allow the robot to be steered by adjusting the speed and direction of each motor independently.

HVAC Duct Coating Group



Members: Nick Flint, Braden Knight and Patrick Schlamb
Advisor: Jamie Canino, Ph.D

This project is designed to help seal corroded HVAC air ducts and help prevent further water corrosion to ducts buried in a slab. A pumping system was designed to complete the need of the project. However, due to financial constraints, a prototype to spray the selected material could not be made. Instead, it was decided that a system spraying water could test the functionality of the system effectively. In order to test the system, the group will spray water inside a 40-foot-long HVAC duct. A successful test will be inserting the nozzle the length of the duct, retracting the nozzle as it sprays evenly in the duct, and stopping the system once spraying has completed.

Crane NSWC In-Bore Projectile Velocity Team

Members: Wesley Hocker, Nikolai Miller, Joseph Savage and Christopher Strauch
Advisor: Jamie Canino, Ph.D. and Jon Koch, Ph.D.
Sponsor: Crane NSWC

This project is a combined effort between Crane NSWC and students at Trine University. Crane is a Naval Research base located in southern Indiana. Crane tasked the students with developing a method of accurately measuring the speed of a bullet at multiple points within the barrel of a gun. Through discussion and research, the team from Trine narrowed down a list of roughly 20 concepts down to five. The team picked a method from this list which used strain gauges in conjunction with high-speed data acquisition to correlate bullet position with increased hoop stress within the barrel itself. Through the use of a high-speed camera and measurement system, the team was able to correlate bullet position with strain increase in the barrel. The team then used a chronograph to verify that the speeds calculated using the strain gauges was reasonable when compared to the open-air velocity of the bullet.

iPad Case Design Team

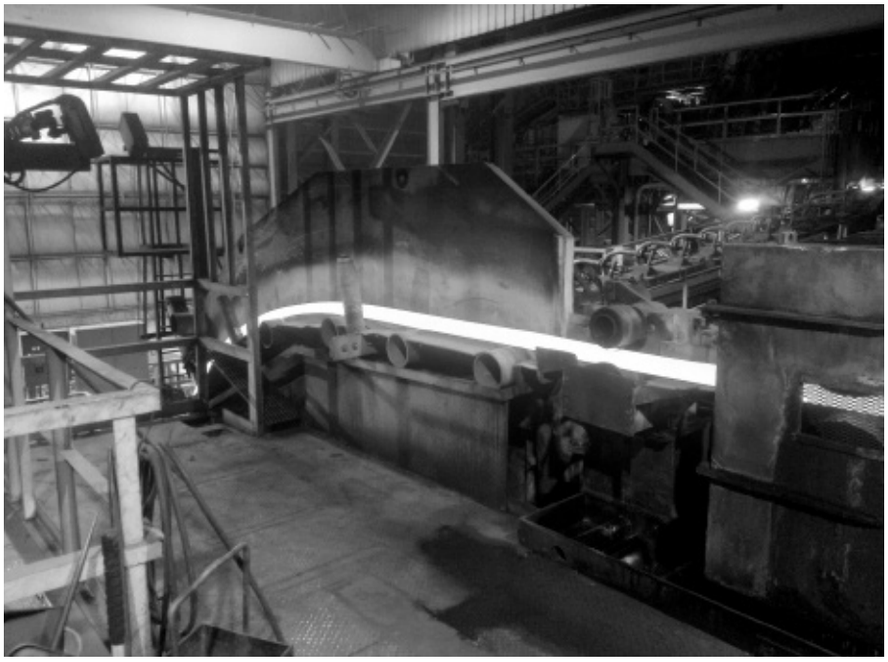
Members: Dylan Dyar, Tyler Grimm, Nicholas Harrison and Mitchell Schmucker
Advisor: Jamie Canino, Ph.D.

The project objective was to design and create an iPad case that can protect an iPad Air from breaking, as well as make a dropping machine to test the iPad case. Students were asked to design an iPad case that had a handle, a kickstand, a stylus holder and a clear area on the back in case serial codes need to be read. The team was also asked to make the dropping machine able to drop an iPad from multiple orientations, while also being able to perform tests repeatedly from a height of 5 feet. The team was to make a 3-D printed iPad case that was modeled after an iPad case that is currently on the market, and then use the dropping machine to test how well the printed case protects an iPad. Afterward, the team had to 3-D print their own design for an iPad case and drop test it to see if the team's designed case held up as well as the current market case. The iPad Case Design project helped increase awareness of how material properties, manufacturing processes, time management, safety and cost factor into real-world engineering issues.

Steel Dynamics, La Farga Oxygen Control

Members: Dustin Arvola, Jordan Bontrager and Jacob Haller
Advisor: Jamie Canino, Ph.D. and Darryl Webber, Ph.D.
Sponsor: Steel Dynamics, La Farga

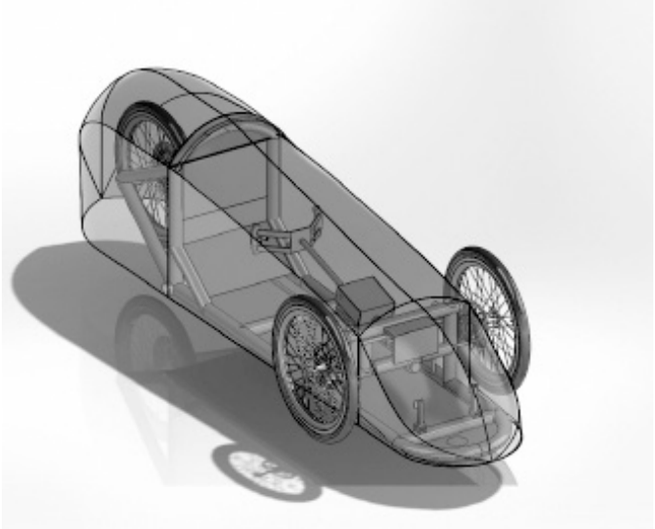
This project took place at the Steel Dynamics, La Farga copper mill. The goal of the project was to reduce the variation in the oxygen levels of copper wire produced in the facility. Sampling procedures were redesigned based on an understanding of oxygen to copper diffusion models, and conclusions drawn from statistical analysis. After these changes had been implemented, a dynamic model was created to make real-time predictions, given attainable input variables.



Shell Eco Marathon 2016 – Battery Electric Category

Members: Johnston Baird, Sam Baker, Victoria DiFranco, James Dougherty, Tyler Finup, Joshua Jones, Adam Lehman, Gage McGrath and DJ Miller
Advisor: Jamie Canino, Ph.D.
Sponsors: Shell, Benteler, S&T Auto Body, CE Electronics and Holland Custom Signs

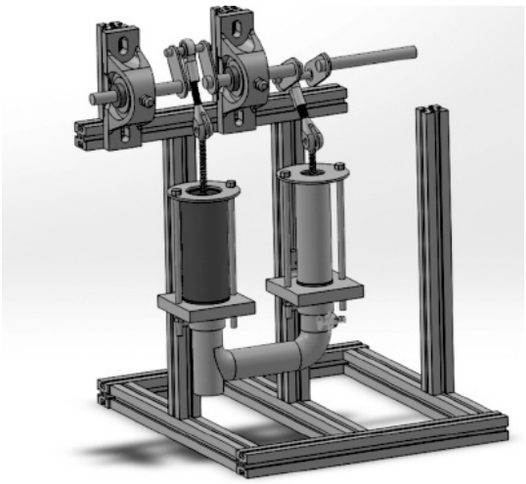
This project is a competition-based project created by Shell to test students' ability to design, build and test an ultra-efficient vehicle in the propulsion category of their choice. Our team has entered into the battery electric category. Our design consists of a three-wheeled vehicle with an aluminum frame and a fiberglass shell. The front wheels are mounted outside the shell and the rear wheel is mounted inside the shell behind the bulkhead. The steering of these wheels is done through a rack and pinion design. The vehicle is driven by a brushless DC hub motor mounted inside the rear wheel. This wheel is powered by a 48V lithium manganese battery and is driven by an Arduino Mega development board. Information from the Arduino Mega will be sent to a display to assist the driver during the race. The vehicle was designed in AutoCAD, keeping in mind all requirements set by Shell. It will be taken to competition in Detroit, Michigan, where we will be aiming to achieve at least 62 mi/kWh during a single run on the track.



Stirling Engine

Members: Brian Ertl, Austin Helm and Justin Trigg
Advisor: Jamie Canino, Ph.D.

The project consisted of the design, analysis and construction of a Stirling engine for Dr. Koch as a teaching aid. The Stirling Engine consists of two pistons attached to a crankshaft, with a pipe between them. A Stirling engine runs off of the thermal energy difference between the pistons. The project consisted of theoretical analysis, along with physical testing to determine the efficiency of the engine. The theoretical analysis was completed with Matlab software, and designed utilizing Solid Works. The engine was designed to incorporate a cartridge heater as a power input source and an electric motor to help measure the power output.



PROFESSIONAL SOCIETY – STUDENT CHAPTERS

American Institute of Aeronautics and Astronautics (AIAA)

Advisor: **James Canino, Ph.D.**
President: **Adam Boles**

The American Institute of Aeronautics and Astronautics (AIAA) is dedicated to the advancement of the aerospace sciences. Membership is open to all engineers, scientists and other professionals who have an interest in aerospace. The Trine University Student Branch of AIAA has been continuously active since 1940, when Dr. James Doolittle and Maj. Leslie Green visited campus to approve the aeronautical program for membership to the Institute of Aeronautical Sciences (IAS).

American Institute of Chemical Engineers (AIChE)

Advisor: **Majid Salim, Ph.D.**
President: **Skye Nguyen**
Vice President: **Nicole Walters**
Secretary: **Jordan Tinkle**
Treasurer: **Sam Hunt**
Student Gov't Rep: **Stuart Gillig**
Jr Class Rep: **Madison Fain**
Soph Class Rep: **Roger Chase**

AIChE is a professional association of more than 40,000 members that provides leadership in advancing the chemical engineering profession. Its members are creative problem-solvers who use their scientific and technical knowledge to develop processes and design and operate plants to make useful products at a reasonable cost. AIChE fosters and disseminates chemical engineering knowledge, supports the professional and personal growth of its members and applies the expertise of its members to address societal needs throughout the world. In addition to organizing plant tours and hosting guest speakers on campus, the Trine student chapter hosted a fall picnic, a departmental Christmas party and a spring banquet to honor graduating seniors.

American Society of Civil Engineers (ASCE)

Advisor: **Professor TJ Murphy**
President: **Brad Whitehead**
Vice President: **David Norris**
Treasurer: **Nicole Garrison**
Corresponding Secretary: **David Gaff**
Recording Secretary: **Rick Perry**

The American Society of Civil Engineers is America's oldest national engineering society, having been chartered in 1852. Trine University's chapter has been in existence since 1965, supporting the aims of the national organization – to "develop leadership, advance technology, advocate lifelong learning, and promote the profession." In the pursuit of these goals, ASCE student members participate in a wide range of activities. Signature projects include the steel bridge and concrete canoe competitions and the Canstruction project. Additionally, service projects such as our fifth grade engineering outreach allow the organization to promote civil engineering while giving back to the community. ASCE also strives for professional development via guest speakers, an annual banquet for students and local professionals, and field trips such as the Ohio Contractor for a Day event and the yearly ASCE Indiana Section meeting. As an organization committed to excellence, new chapter leaders attend ASCE's annual Workshop for Student Chapter Leaders. This conference equips Trine's chapter officers with the tools and motivation to effectively lead the organization's varied programs and to maintain a venue for personal and professional development.

American Society of Mechanical Engineers (ASME)

Advisor: **Kevin Molyet, Ph.D.**

With 120,000 mechanical engineers and mechanical engineering students as members, ASME offers quality programs and activities in mechanical engineering, enabling its practitioners to contribute to the well-being of humankind. Originally chartered by the national governing body in 1971, the Trine University section has a current membership of approximately 50 students. The section usually meets once a month and attends two regional conferences per year. In addition, the section sponsors miscellaneous activities such as design competitions, special speakers and plant tours throughout the year.

Biomedical Engineering Society (BMES)

Advisors: **Maria Gerschutz, Ph.D., and Melanie G. Watson, Ph.D.**
President: **Scott Evans**
Vice President: **Michael Forthofer**
Secretary: **Anna Kersey**
Treasurer: **Madison Hatkevich**

The vision of the Biomedical Engineering Society (BMES) is to serve as the world's leading society of professionals devoted to developing and using engineering and technology to advance human health and well-being.

The mission of the BMES is to build and support the biomedical engineering community, locally, nationally and internationally, with activities designed to communicate recent advances, discoveries and inventions; promote education and professional development; and integrate the perspectives of the academic, medical, governmental and business sectors.

Chi Epsilon (Civil Engineering Honor Society)

Advisor: **Tim Tyler, Ph.D., P.E.**
President: **Wynn Bishop**
Vice President: **Seth Gressley**
Treasurer: **Michael Anderson**
Secretary: **Ethan Maust**
Associate Editor: **Alivia Recker**
Marshal: **Blake Warner**

Chi Epsilon is the national civil engineering honor society for the top civil engineering juniors and seniors in the department. The Trine chapter has been involved in community service projects including Plank-a-Palooza, Canstruction and a surveying project for Pokagon State Park.

Engineers Without Borders (EWB-USA)

Advisor: **Tim Tyler, Ph.D., P.E.**
President: **Jasper Jameson**
VP of Projects: **Tyler Carpenter**
VP of Membership: **Joshua Carmichael**
VP of Finance: **Colten Webber**
Secretary: **Aaron Lawrence**
Treasurer: **Evan Poole**

Our vision is a world in which the communities we serve have the capacity to sustainably meet their basic human needs, and that our members have enriched global perspectives through the innovative professional educational opportunities that the EWB-USA program provides. Our mission supports community-driven development programs worldwide by collaborating with local partners to design and implement sustainable engineering projects, while creating transformative experiences and responsible leaders.

Institute of Electrical and Electronics Engineering (IEEE)

Advisor: Sean Carroll, Ph.D.
President: Devin Gingerich
Vice-President: Zachary Morgan
Secretary: Peter Howland
Treasurer: Gage McGrath

The IEEE promotes the engineering process of creating, developing, integrating, sharing and applying knowledge about electronic and information technologies and sciences for the benefit of humanity and the profession. The student branch tutors, travels, listens and competes to sharpen the interests and skills of Trine electrical and computer engineering students through interaction with industry and between more and less experienced students.

Institute of Transportation Engineers (ITE)

Advisor: Ryan Overton, Ph.D.
President: Nathan N. Miller
Vice President: Bradley Whitehead
Treasurer: Austin Gurley
Secretary: James Beck-Powers
Student Rep: David Austin

The Institute of Transportation Engineers is an international educational and scientific association of transportation professionals who are responsible for meeting mobility and safety needs. ITE facilitates the application of technology and scientific principles to research, planning, functional design, implementation, operation, policy development and management for any mode of ground transportation. Trine University's ITE student chapter was established in 2013 and aims to draw attention to the importance and excitement of the transportation engineering field. Every spring the ITE members compete in the annual Traffic Bowl competition in which they answer transportation "Jeopardy"-style questions against students from Indiana, Michigan and Ohio. The student chapter attends several conferences each year including the Purdue University Road School and the ITE Great Lakes District Annual meeting, in which they attend technical sessions and collaborate with professional engineers.

Omega Chi Epsilon (Chemical Engineering Honor Society)

Advisor: John Wagner, Ph.D.
President: Jennifer Jackemeyer
Vice President: Brian Alexander
Treasurer: Michael Becker
Secretary: Shelby Frailey

Omega Chi Epsilon is the national chemical engineering honor society for the top chemical engineering juniors and seniors in the department. The Trine chapter (Alpha Nu) hosts the McKetta birthday celebration and department homecoming activities.

Society of Automotive Engineers (SAE)

Advisors: **Pavan Karra, Ph.D., and Prof. John Eiler**
President: **Devin Anderson**
Secretary: **Kendall Miller**
Treasurer: **Clay DuVal**
Student Senate Rep: **Austin Baker**
Crew Chief (VP): **Allen Oeung**

SAE International is "the premier society dedicated to advancing mobility engineering worldwide." SAE provides many student competitions including Aero Design, Clean Snowmobile Challenge, Formula SAE Series, Mini Baja Series, Supermileage, Robot Systems Challenge and the Micro-Truck Baja. SAE's magazines, such as Automotive Engineering International, Aerospace Engineering and SAE Off-Highway Engineering, are other terrific opportunities to keep up-to-date with the latest in vehicle technology and breakthroughs.

Society of Manufacturing Engineers (SME)

Advisor: **Dr. Tim Jenkins**
President: **Donald Shockley**
VP/Student Gov't Rep: **Brandon Heath**
Treasurer: **Allyson Ross**
Secretary: **Ali Algethmi**

The Society of Manufacturing Engineers (SME) is the world's leading resource where "manufacturing comes together — both people and information — to advance manufacturing knowledge." Since its inception in 1932, SME has worked to make engineers, companies, educators and others successful in their quest to advance manufacturing industries in the United States.
As the manufacturing engineering profession has evolved over the years, SME has helped North American colleges and universities transform their curriculum to meet the changing needs. By infusing more than $90 million into colleges, universities and technical schools since the 1980s (more than any other professional engineering society), SME has helped prepare engineers for the challenges they face in the competitive manufacturing environment. By identifying education competency gaps and targeting its Education Foundation's funds to institutions and programs that fill those gaps, SME is helping prepare our future workforce.
The Trine University SME student chapter, S280, currently has 13 student members. Chapter members attend student and local senior chapter (Fort Wayne 56) meetings that include plant tours and expert presentations from local manufacturing companies. Some of the field trips have included visits to GM Powertrain (Defiance, OH), Steel Dynamics (Butler, IN) and Caterpillar (Lafayette, IN). Guest speakers include Trine alumni now working in industry. These events allow students to see real-world applications of design and manufacturing processes and equipment, and provide a means to interact with fellow engineers in the field. Student chapter members also have attended the North American International Auto Show, the Chicago International Auto Show and the Chicago International Machine Tool Show.

Society of Women Engineers (SWE)

Advisor: **Andrea Mitofsky, Ph.D.**
President: **Kaethe Henke**
Vice President: **Montana Hermann**
Secretary: **Kathleen Seeley**
Treasurer: **Robin Furnish**
Student Senate Rep: **Haley Reed**

The Society of Women Engineers (SWE), founded in 1950, is a not-for-profit educational and service organization. SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance, and be recognized for their contributions and achievements as engineers and leaders. The Trine University student section of SWE provides networking opportunities for students pursuing degrees in engineering, technology and science. Activities include guest speakers, attending career fairs, plant trips and outreach activities to encourage K-12 students to pursue technical degrees.

Tau Beta Pi – The Engineering Honor Society (TBP)

Advisor: Ryan Overton, Ph.D.
President: Skye Nguyen
Vice President: Josh Marty
Corresponding Secretary: Jonathon Lantz
Recording Secretary: Ethan Price
Treasurer: Ben Miller

Tau Beta Pi is the only engineering honor society representing the entire engineering profession. It is the nation's second-oldest honor society, founded at Lehigh University in 1885 to mark in a fitting manner those who have conferred honor upon their alma mater by distinguished scholarship and exemplary character as students in engineering, or by their attainments as alumni in the field of engineering, and to foster a spirit of liberal culture in engineering colleges. In order to be eligible for membership, one must be in the top one-eighth of the junior engineering class or the top one-fifth of the senior engineering class at his or her university. There are now collegiate chapters at 241 US colleges and universities, 32 active alumni chapters in 15 districts across the country, and a total initiated membership of approximately 545,000. Trine University's Indiana Epsilon chapter was founded on Feb. 22, 1975. Each year, the student chapter hosts Engineering Futures sessions — professional seminars focusing on the "soft" skills that engineers need to succeed in their career. As a community service, TBP also organizes a series of fundraising events called Creating Christmas where all proceeds go to purchasing hats, gloves and candies for local elementary students. Additionally, the students are encouraged to travel to regional and national conferences to expand their professional networks as well as polishing their leadership skills.

Trine University Materials Society

Advisor: Darryl Webber, Ph.D.
President: Dustin Arvola
Vice President: Christie Hasbrouck

The Trine University Materials Society is a combined student chapter of the American Foundry Society and Material Advantage, which incorporates membership in the Materials Information Society (ASM); the Minerals, Metals, and Materials Society (TMS); American Ceramic Society; and the Association for Iron and Steel Technology (AIST). These professional organizations seek to promote research and knowledge in the area of material science and engineering design. Student members actively participate in meetings with their professional counterparts, host technical presentations from working engineers and scientists, as well as open the foundry laboratory to the Trine community for foundry nights. Many students in the Materials Society are also involved in Foundry Educational Foundation, which was established to assure a continuing supply of engineers for the metal casting industry through scholarship programs. FEF acts as an interface between students and industry to promote internships, cooperative educational opportunities and full-time employment and provides funding for laboratory equipment; travel to professional meetings and for industrial tours.